2025 Chemistry

CAIE iGCSE 0620

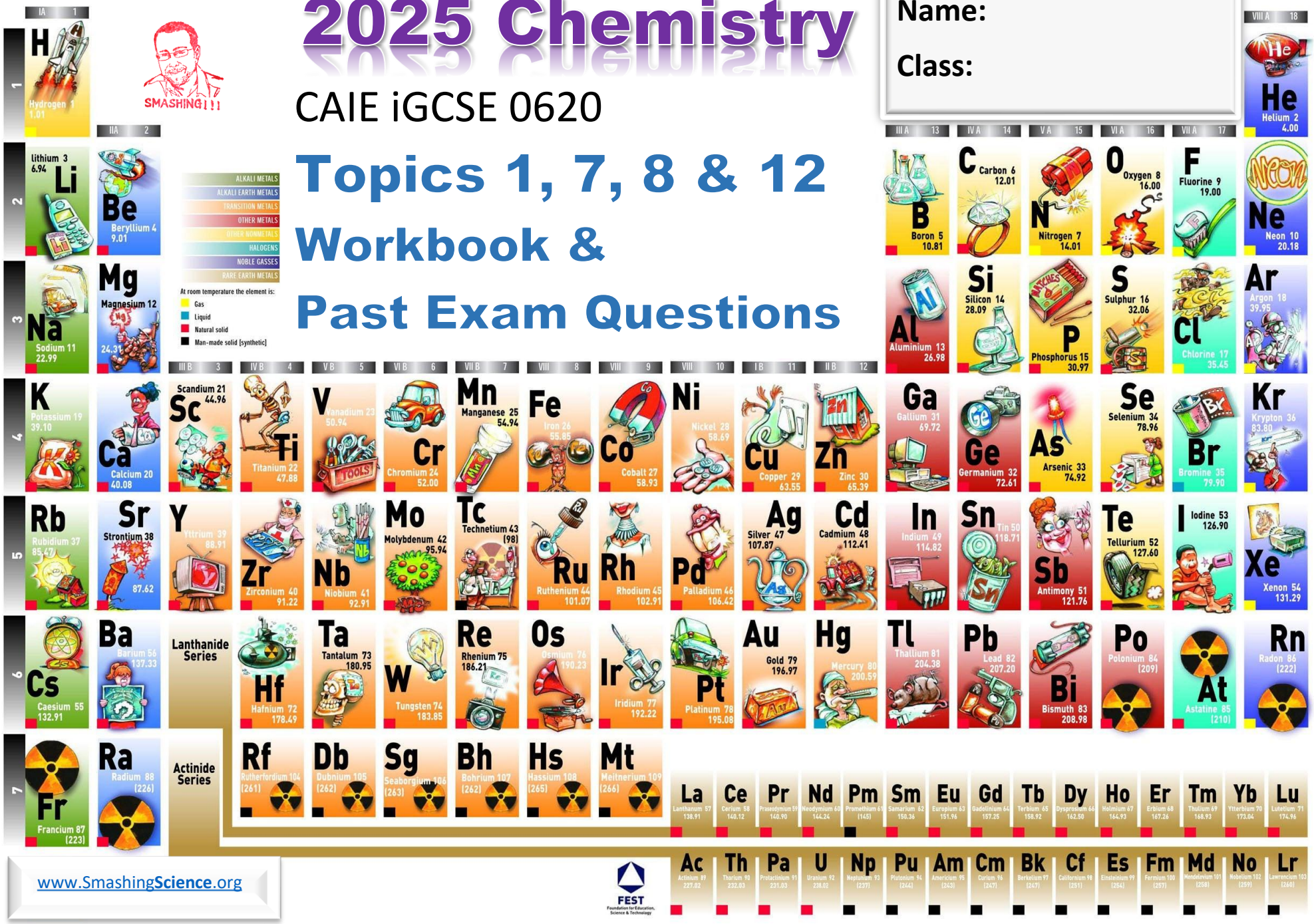
Topics 1, 7, 8 & 12

Workbook &

Past Exam Questions

Name:

Class:



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Target iGCSE grade :____ **Target** Assessment Average Score: _____% **Target** Score for End of Year EXAM____%

Test name	Topic #	Mark (out of)	% Score
		/	%
		/	%
		/	%
		/	%
		/	%
		/	%
		/	%
		/	%
		/	%
		/	%
Average of the first 10 assessed activities		/	%
		/	%
		/	%
		/	%
		/	%
		/	%
		/	%
		/	%
		/	%
		/	%
		/	%
Average of the first 20 assessed activities		/	%
		/	%
		/	%
		/	%
		/	%
		/	%
		/	%
		/	%
		/	%
		/	%
		/	%
Average of the first 30 assessed activities		/	%
		/	%
		/	%
		/	%
		/	%
		/	%
		/	%

	Topic #	Mark (out of)	% Score
		/	%
Average of the first 40 assessed activities		/	%
		/	%
		/	%
		/	%
		/	%
		/	%
		/	%
		/	%
		/	%
		/	%
		/	%
		/	%
Average of the first 50 assessed activities		/	%
		/	%
		/	%
		/	%
		/	%
		/	%
		/	%
		/	%
		/	%
		/	%
		/	%
Average of the first 60 assessed activities		/	%
		/	%
		/	%
		/	%
		/	%
		/	%
		/	%
		/	%
		/	%
		/	%
		/	%
		/	%

For an electronic version of this Workbook

And for a variety of complete selection of booklets and workbooks for all iGCSE Chemistry exam papers broken down into iGCSE topics, go to this website or scan this code:

https://www.smashingscience.org/igcse-chemistry

Contents

Calendars and time management

Organising your months in 2025

January							
Wk	Mo	Tu	We	Th	Fr	Sa	Su
1			1	2	3	4	5
2	6	7	8	9	10	11	12
3	13	14	15	16	17	18	19
4	20	21	22	23	24	25	26
5	27	28	29	30	31		

Your notes:

February							
Wk	Mo	Tu	We	Th	Fr	Sa	Su
5						1	2
6	3	4	5	6	7	8	9
7	10	11	12	13	14	15	16
8	17	18	19	20	21	22	23
9	24	25	26	27	28		

Your notes:

March							
Wk	Mo	Tu	We	Th	Fr	Sa	Su
9						1	2
10	3	4	5	6	7	8	9
11	10	11	12	13	14	15	16
12	17	18	19	20	21	22	23
13	24	25	26	27	28	29	30
14	31						

Your notes:

April							
Wk	Mo	Tu	We	Th	Fr	Sa	Su
14		1	2	3	4	5	6
15	7	8	9	10	11	12	13
16	14	15	16	17	18	19	20
17	21	22	23	24	25	26	27
18	28	29	30				

Your notes:

May							
Wk	Mo	Tu	We	Th	Fr	Sa	Su
18				1	2	3	4
19	5	6	7	8	9	10	11
20	12	13	14	15	16	17	18
21	19	20	21	22	23	24	25
22	26	27	28	29	30	31	

Your notes:

June							
Wk	Mo	Tu	We	Th	Fr	Sa	Su
22							1
23	2	3	4	5	6	7	8
24	9	10	11	12	13	14	15
25	16	17	18	19	20	21	22
26	23	24	25	26	27	28	29
27	30						

Your notes:

July							
Wk	Mo	Tu	We	Th	Fr	Sa	Su
27		1	2	3	4	5	6
28	7	8	9	10	11	12	13
29	14	15	16	17	18	19	20
30	21	22	23	24	25	26	27
31	28	29	30	31			

Your notes:

August							
Wk	Mo	Tu	We	Th	Fr	Sa	Su
31					1	2	3
32	4	5	6	7	8	9	10
33	11	12	13	14	15	16	17
34	18	19	20	21	22	23	24
35	25	26	27	28	29	30	31

Your notes:

September							
Wk	Mo	Tu	We	Th	Fr	Sa	Su
36	1	2	3	4	5	6	7
37	8	9	10	11	12	13	14
38	15	16	17	18	19	20	21
39	22	23	24	25	26	27	28
40	29	30					

Your notes:

Organising your weeks towards your exams

Week Starting	Wk #	Events	Topic Focus
14-Apr	1		
21-Apr	2		
28-Apr	3		
05-May	4		
12-May	5		
19-May	6		
26-May	7		
02-Jun	8		
09-Jun	9		
16-Jun	10		
23-Jun	11		
30-Jun	12		
07-Jul	13		
14-Jul	14		
21-Jul	15		
28-Jul	16		
04-Aug	17		

Week Starting	Wk #	Events	Topic Focus
11-Aug	18		
18-Aug	19		
25-Aug	20		
01-Sep	21		
08-Sep	22		
15-Sep	23		
22-Sep	24		
29-Sep	25		
06-Oct	26		
13-Oct	27		
20-Oct	28		
27-Oct	29		
03-Nov	30		
10-Nov	31		
17-Nov	32		
24-Nov	33		
01-Dec	34		

CAMBRIDGE
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Cambridge IGCSE™
Cambridge O Level
Cambridge International AS & A Level

Cambridge Final Exam Timetable June 2025

Administrative zone 5

Cambridge IGCSE

Syllabus/Component	Code	Duration	Date	Session
Biology (Multiple Choice - Extended)	0610/22	45m	Wednesday 11 June 2025	PM
Biology (Core)	0610/32	1h 15m	Tuesday 06 May 2025	PM
Biology (Extended)	0610/42	1h 15m	Tuesday 06 May 2025	PM
Biology (Practical)	0610/52	1h 15m	Tuesday 13 May 2025	PM
Biology (Alternative to Practical)	0610/62	1h	Tuesday 13 May 2025	PM
Business Studies	0450/12	1h 30m	Friday 16 May 2025	PM
Business Studies	0450/22	1h 30m	Monday 19 May 2025	PM
C				
Cambridge International Mathematics (Core)	0607/12	1h 15m	Tuesday 29 April 2025	PM
Cambridge International Mathematics (Extended)	0607/22	1h 30m	Tuesday 29 April 2025	PM
Cambridge International Mathematics (Core)	0607/32	1h 15m	Monday 05 May 2025	PM
Cambridge International Mathematics (Extended)	0607/42	1h 30m	Monday 05 May 2025	PM
Cambridge International Mathematics (Core)	0607/52	1h 15m	Wednesday 07 May 2025	PM
Cambridge International Mathematics (Extended)	0607/62	1h 30m	Wednesday 07 May 2025	PM
Chemistry (Multiple Choice - Core)	0620/12	45m	Tuesday 10 June 2025	PM
Chemistry (Multiple Choice - Extended)	0620/22	45m	Tuesday 10 June 2025	PM
Chemistry (Core)	0620/32	1h 15m	Wednesday 30 April 2025	PM
Chemistry (Extended)	0620/42	1h 15m	Wednesday 30 April 2025	PM
Chemistry (Practical)	0620/52	1h 15m	Thursday 15 May 2025	PM
Chemistry (Alternative to Practical)	0620/62	1h	Thursday 15 May 2025	PM
Physics (Multiple Choice - Core)	0625/12	45m	Wednesday 04 June 2025	PM
Physics (Multiple Choice - Extended)	0625/22	45m	Wednesday 04 June 2025	PM
Physics (Core)	0625/32	1h 15m	Friday 09 May 2025	PM
Physics (Extended)	0625/42	1h 15m	Friday 09 May 2025	PM
Physics (Practical)	0625/52	1h 15m	Tuesday 20 May 2025	PM
Physics (Alternative to Practical)	0625/62	1h	Tuesday 20 May 2025	PM

Longer term planning for 2026 – 2027

2026

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
Sep	Tu	We	Th	Fr	**Sa**	**Su**	Mo 37	Tu	We	Th	Fr	**Sa**	**Su**	Mo 38	Tu	We	Th	Fr	**Sa**	**Su**	Mo 39	Tu	We	Th	Fr	**Sa**	**Su**	Mo 40	Tu	We	
Oct	Th	Fr	**Sa**	**Su**	Mo 41	Tu	We	Th	Fr	**Sa**	**Su**	Mo 42	Tu	We	Th	Fr	**Sa**	**Su**	Mo 43	Tu	We	Th	Fr	**Sa**	**Su**	Mo 44	Tu	We	Th	Fr	**Sa**
Nov	**Su**	Mo 45	Tu	We	Th	Fr	**Sa**	**Su**	Mo 46	Tu	We	Th	Fr	**Sa**	**Su**	Mo 47	Tu	We	Th	Fr	**Sa**	**Su**	Mo 48	Tu	We	Th	Fr	**Sa**	**Su**	Mo 49	
Dec	Tu	We	Th	Fr	**Sa**	**Su**	Mo 50	Tu	We	Th	Fr	**Sa**	**Su**	Mo 51	Tu	We	Th	Fr	**Sa**	**Su**	Mo 52	Tu	We	Th	**Fr**	**Sa**	**Su**	**Mo** 53	Tu	We	Th

2027

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
Jan	**Fr**	**Sa**	**Su**	Mo 1	Tu	We	Th	Fr	**Sa**	**Su**	Mo 2	Tu	We	Th	Fr	**Sa**	**Su**	Mo 3	Tu	We	Th	Fr	**Sa**	**Su**	Mo 4	Tu	We	Th	Fr	**Sa**	**Su**
Feb	Mo 5	Tu	We	Th	Fr	**Sa**	**Su**	Mo 6	Tu	We	Th	Fr	**Sa**	**Su**	Mo 7	Tu	We	Th	Fr	**Sa**	**Su**	Mo 8	Tu	We	Th	Fr	**Sa**	**Su**			
Mar	Mo 9	Tu	We	Th	Fr	**Sa**	**Su**	Mo 10	Tu	We	Th	Fr	**Sa**	**Su**	Mo 11	Tu	We	Th	Fr	**Sa**	**Su**	Mo 12	Tu	We	Th	**Fr**	**Sa**	**Su**	**Mo** 13	Tu	We
Apr	Th	Fr	**Sa**	**Su**	Mo 14	Tu	We	Th	Fr	**Sa**	**Su**	Mo 15	Tu	We	Th	Fr	**Sa**	**Su**	Mo 16	Tu	We	Th	Fr	**Sa**	**Su**	Mo 17	Tu	We	Th	Fr		
May	**Sa**	**Su**	**Mo** 18	Tu	We	Th	Fr	**Sa**	**Su**	Mo 19	Tu	We	Th	Fr	**Sa**	**Su**	Mo 20	Tu	We	Th	Fr	**Sa**	**Su**	Mo 21	Tu	We	Th	Fr	**Sa**	**Su**	**Mo** 22
Jun	Tu	We	Th	Fr	**Sa**	**Su**	Mo 23	Tu	We	Th	Fr	**Sa**	**Su**	Mo 24	Tu	We	Th	Fr	**Sa**	**Su**	Mo 25	Tu	We	Th	Fr	**Sa**	**Su**	Mo 26	Tu	We	
Jul	Th	Fr	**Sa**	**Su**	Mo 27	Tu	We	Th	Fr	**Sa**	**Su**	Mo 28	Tu	We	Th	Fr	**Sa**	**Su**	Mo 29	Tu	We	Th	Fr	**Sa**	**Su**	Mo 30	Tu	We	Th	Fr	**Sa**
Aug	**Su**	Mo 31	Tu	We	Th	Fr	**Sa**	**Su**	Mo 32	Tu	We	Th	Fr	**Sa**	**Su**	Mo 33	Tu	We	Th	Fr	**Sa**	**Su**	Mo 34	Tu	We	Th	Fr	**Sa**	**Su**	**Mo** 35	Tu
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31

V1.0 – Continue to refine these to find and RECORD times you study best (and when you never study)

Period	Time	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
	5:00 am							
	5:30 am							
	6:00 am							
	6:30 am							
	7:00 am							
Regstn	7:25 am							
1	7:50 am							
2	8:40 am							
3	9:30 am							
4	10:20 am							
5	11:00 am							
Lunch	11:50 pm							
6	1:10 pm							
7	2:00pm							
8	2:50 pm							
9	3:40 pm							
	4:20 pm							
	5:00 pm							
	5:30 pm							
	6:00 pm							
	6:30 pm							
	7:00 pm							
	7:30 pm							
	8:00 pm							
	8:30 pm							
	9:00 pm							
	9:30 pm							
	10:00 pm							
	10:30 pm							

Planning your days – v2.0

Period	Time	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
	5:00 am							
	5:30 am							
	6:00 am							
	6:30 am							
	7:00 am							
Regstn	7:25 am							
1	7:50 am							
2	8:40 am							
3	9:30 am							
4	10:20 am							
5	11:00 am							
Lunch	11:50 pm							
6	1:10 pm							
7	2:00pm							
8	2:50 pm							
9	3:40 pm							
	4:20 pm							
	5:00 pm							
	5:30 pm							
	6:00 pm							
	6:30 pm							
	7:00 pm							
	7:30 pm							
	8:00 pm							
	8:30 pm							
	9:00 pm							
	9:30 pm							
	10:00 pm							
	10:30 pm							

Period	Time	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
	5:00 am							
	5:30 am							
	6:00 am							
	6:30 am							
	7:00 am							
Regstn	7:25 am							
1	7:50 am							
2	8:40 am							
3	9:30 am							
4	10:20 am							
5	11:00 am							
Lunch	11:50 pm							
6	1:10 pm							
7	2:00pm							
8	2:50 pm							
9	3:40 pm							
	4:20 pm							
	5:00 pm							
	5:30 pm							
	6:00 pm							
	6:30 pm							
	7:00 pm							
	7:30 pm							
	8:00 pm							
	8:30 pm							
	9:00 pm							
	9:30 pm							
	10:00 pm							
	10:30 pm							

Planning your days – v4.0

Period	Time	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
	5:00 am							
	5:30 am							
	6:00 am							
	6:30 am							
	7:00 am							
Regstn	7:25 am							
1	7:50 am							
2	8:40 am							
3	9:30 am							
4	10:20 am							
5	11:00 am							
Lunch	11:50 pm							
6	1:10 pm							
7	2:00pm							
8	2:50 pm							
9	3:40 pm							
	4:20 pm							
	5:00 pm							
	5:30 pm							
	6:00 pm							
	6:30 pm							
	7:00 pm							
	7:30 pm							
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	8:30 pm							
	9:00 pm							
	9:30 pm							
	10:00 pm							
	10:30 pm							

Exercise: Long term revision planning

A bad academic outcome is not evidence of being a bad student, or bad person, it is just a lack of the skills needed to be more organised to make effective use of your time. **The more organised you become, the more successful you will be, regardless of what you want to do**. Some chaotic study habits will allow some students with strong memories to succeed even without a lot of apparent organisation, but it will almost always be a more stressful and less successful journey, and while it might sometimes deliver a similar academic outcome, the person at the other end has developed far fewer life skills.

The tables here will allow you to organise your revision and see your plan using a logical process. This will allow you to break down a project into smaller steps that is otherwise so large, so difficult to define and so complex that it a human brain cannot fully grasp it all at once. This will give you simple, straightforward steps that will turn this important task into an achievable goal. To be successful you do not need to always learn all of chemistry right now, or even most of the time learn all of AS chemistry soon, you just need next to do 50 minutes of past exam questions from Paper 3 this Tuesday at 7pm to win, for instance. And each slot you complete is a separate, distinct win.

Like a scientific experiment, a systematic revision plan will enable you to record and describe to your future self what you did and when so you can reproduce the successful parts of your revision method and have hard data you can use to see what went wrong in a detailed and objective way.

When a human brain encounters what it thinks is a substantial failure its capacity for higher order thinking (to think logically, creatively and analytically) is massively downregulated; it is adapted by natural selection instead to retreat and remove itself from the source of the failure. This is lifesaving when dealing with hungry lions and serious injury, but less helpful for figuring out how to improve next time on a chemistry exam. The work you do here recording what you did, and the updates and changes you made to your revision plan along the way may be far more valuable than you can imagine in learning to think about exam performance more like a logical, abstract puzzle. It will help you to remove some of the feelings associated with perceived lower performance. And like any puzzle, improved exam performance's best solution is found fastest in the gradual and **incremental growth** from the reasoned application of organisational skills.

Overview planning for: Next BIG Test	Subject Chemistry				
Date of exam or test					
Weeks until test					
Revision slots per subject per week					
Total revision slots per subject					

Overview planning for: **AS Mock exam**	Subject Chemistry				
Date of exam or test					
Weeks until test					
Revision slots per subject per week					
Total revision slots per subject					

Overview planning for: **AS CAIE exams**	Subject Chemistry				
Date of exam or test					
Weeks until test					
Revision slots per subject per week					
Total revision slots per subject					

Other tests:

Overview planning for: **Title:** ______________________	Subject Chemistry				
Date of exam or test					
Weeks until test					
Revision slots per subject per week					
Total revision slots per subject					

Overview planning for: **Title:** ______________________	Subject Chemistry				
Date of exam or test					
Weeks until test					
Revision slots per subject per week					
Total revision slots per subject					

Overview planning for: **Title:** ______________________	Subject Chemistry				
Date of exam or test					
Weeks until test					
Revision slots per subject per week					
Total revision slots per subject					

Planning your revisions slots

Using the tables found in this section ("*Exercise: Long term revision planning*") to work out how many revision slots you have for each subject based on the number of weeks left.

Add your other subjects into the headings. You can **map out the slots first in rough**, by adding the topic number. **Later** you can add **one- or two-word titles** and other details like which **exam paper** you would like to focus on and the **subtopic number** (check the syllabus for this detail, this will also help you ground your revision in the what the syllabus describes, helping eliminate misunderstandings).

You should allocate more overall revision time on topics:

- That you found most difficult from previous tests.
- That tend to be more common in the exams using the analysis found in the tables and graphs in this Workbook.
- By remember to break up your revision time to introduce a variety of revision tasks, types of exam questions, or chemistry topics, but especially create a blend of subjects. Making substantial changes regularly and often with your revision program is an example of a highly effective learning strategy called "**interleaving**"[1].

You can even split single sessions into two or more smaller topics or subtopics, either by splitting one cell in the table, or taking up two or more cells. If you study for longer than you have planned on a topic, make sure you still record it on the table. This table not only helps you plan your work, but also helps you display your work which helps deliver feelings of accomplishment which are really important to getting big jobs done. After the exam, this extra work should also be visible so you can see what you did better, in part to celebrate the work you actually did, but also so that when you look back on your revision plan you do not have unknown amounts of work not recorded. You are trying to control and detail the variables in your revision method.

- Neatly put a line through the cell and tick each revision block you have finished so you can still read what you did.
- As your splendid revision plan contacts with reality, you are likely to find that some slots do not get done. Put 2 lines through and add a cross.

After you have finished a specific test, you can draw a strong line in the table and use the remaining unused parts for the next test. Or use the same tables in a workbook for a different exam paper. Or you can get the editable Word file of these Workbook exercises at: https://www.smashingscience.org/a-level-chemistry-caie

Date	Slot #	Subject and Revision Focus				
		Chemistry				
31/08	**:o)**	~~T2.4: Titrations calculations P3~~ ✓				
25/12	**:o(**	~~T19.1: Primary amines P2~~ ✗				
	1					
	2					
	3					
	4					
	5					
	6					
	7					

[1] https://www.coursera.org/articles/interleaving

Date	Slot #	Chemistry	Subject and Revision Focus			
	8					
	9					
	10					
	11					
	12					
	13					
	14					
	15					
	16					
	17					
	18					
	19					
	20					
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	35					
	36					
	37					
	38					

Date	Slot #	Chemistry	Subject and Revision Focus			
	39					
	40					
	41					
	42					
	43					
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	45					
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	69					

Learning to Learn

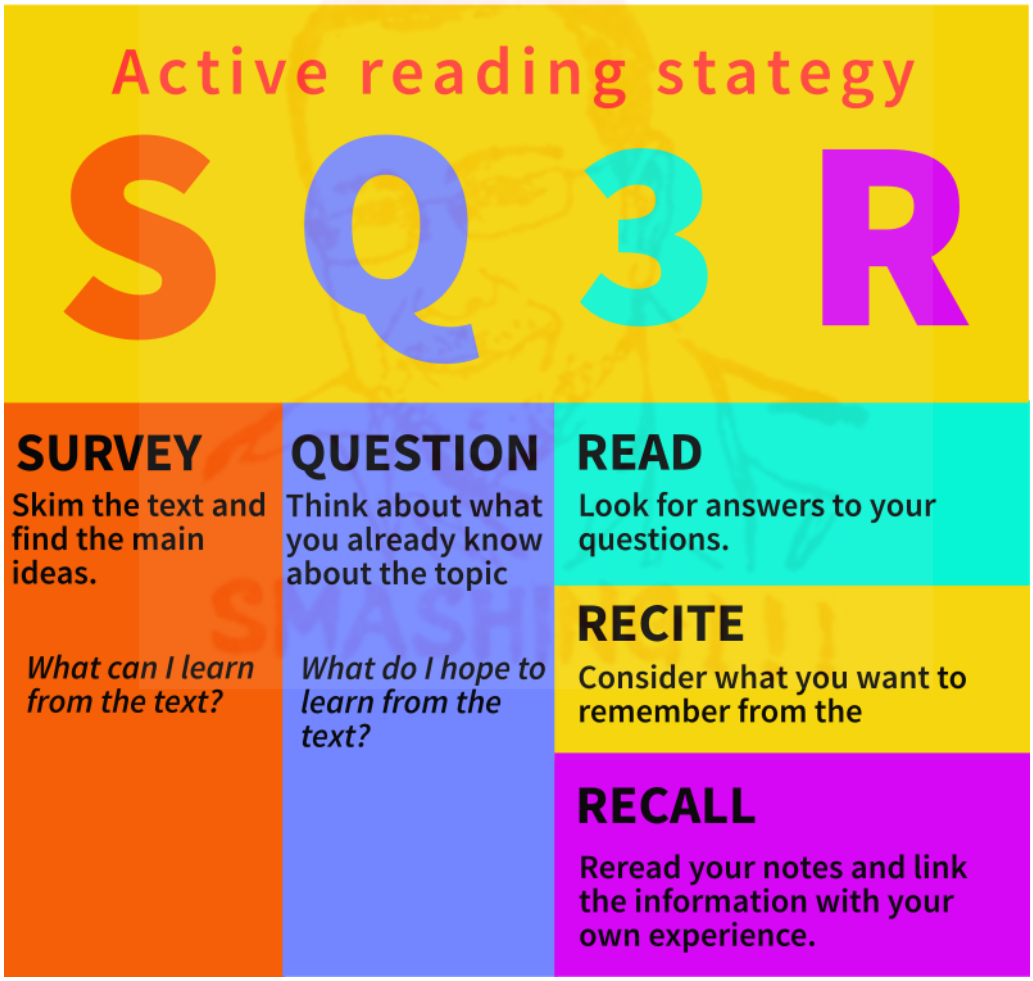
Reading to Learn Effectively

Critical Reading Techniques

Active reading simply means reading something with a determination to understand and evaluate it for its relevance to your needs.

Only reading and re-reading the material isn't an effective way to understand and learn. Actively and critically engaging with the content can save you time. Most OU study books and websites include in-text questions and self-assessed questions. Use these as built-in cues to make your study active.[2]

Active Reading Advice –Core ideas



[2] https://help.open.ac.uk/active-reading

Active Reading Advice - Extension

From: https://mcgraw.princeton.edu/sites/mcgraw/files/media/active-reading-strategies.pdf

THE McGRAW CENTER for TEACHING & LEARNING
328 Frist Campus Center
Princeton University, Princeton, NJ

Active Reading Strategies

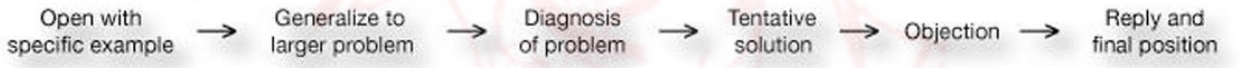
Choose the strategies that work best for you or that best suit your purpose.

- **Ask yourself pre-reading questions.** For example: What is the topic, and what do you already know about it? Why has the instructor assigned this reading at this point in the semester?
- **Identify and define any unfamiliar terms.**
- **Bracket the main idea or thesis of the reading, and put an asterisk next to it.** Pay particular attention to the introduction or opening paragraphs to locate this information.
- **Put down your highlighter. Make marginal notes or comments instead.** Every time you feel the urge to highlight something, write instead. You can summarize the text, ask questions, give assent, protest vehemently. You can also write down key words to help you recall where important points are discussed. Above all, strive to enter into a dialogue with the author.
- **Write questions in the margins, and then answer the questions in a reading journal or on a separate piece of paper.** If you're reading a textbook, try changing all the titles, subtitles, sections and paragraph headings into questions. For example, the section heading "The Gas Laws of Boyle, Charles, and Avogadro" might become "What are the gas laws of Boyle, Charles, and Avogadro?"
- **Make outlines, flow charts, or diagrams that help you to map and to understand ideas visually.** See the reverse side for examples.
- **Read each paragraph carefully and then determine "what it says" and "what it does." Answer "what it says" in only one sentence.** Represent the main idea of the paragraph in your own words. To answer "what it does," describe the paragraph's purpose within the text, such as "provides evidence for the author's first main reason" or "introduces an opposing view."
- **Write a summary of an essay or chapter in your own words.** Do this in less than a page. Capture the essential ideas and perhaps one or two key examples. This approach offers a great way to be sure that you know what the reading really says or is about.
- **Write your own exam question based on the reading.**
- **Teach what you have learned to someone else!** Research clearly shows that teaching is one of the most effective ways to learn. If you try to explain aloud what you have been studying, (1) you'll transfer the information from short-term to long-term memory, and (2) you'll quickly discover what you understand — and what you don't.

See other side of page for sample diagrams →

Sample diagrams:

Sketch of a reading's argumentative structure:



Learning with your **Textbook** using **Active Learning** and **Active Reading**

The easiest to recommend textbook regardless of format is https://www.chemguideforcie.co.uk/

It is free and delivers enough content even for even a quite good A*, which is more than most A Level Chemistry textbooks for the CAIE syllabus offer. However, it is not that easy to print it out, so whatever **printed textbook** that CAIE recommends that is for the 2016 syllabus or later would be the way to go (newer would be better, but not by much).

Hopefully you have already started to notice certain patterns in all textbooks, like the way they are set out and structured. Normally one idea or concept (which are defined by the syllabus points) is covered in a section which gets its own heading, and these sections usually follow the order of the syllabus. In this way a larger syllabus topic is broken down into smaller parts

Usually there are also **questions to test your understanding of the content**, either after the section, or at the end of the chapter. These questions are not at all as carefully thought out or complex as exam questions but writing out the answers to them is still an effective way to get a longer lasting learning impact (more efficient) from the time invested. They are better than exam questions in the respect that they are answerable with just the information from that section you have just finished. Exam questions have been mapped to the syllabus topic in this and other workbooks, and to a Smashing!!! standard, but it is not always clear for Paper 2 and 3 which parts you should be able to answer when there are still important ideas within the topic that you have not yet started. You can however use Paper 1 questions, but this is less straightforward so not for all students.

Working through these questions in the textbook and making systematic notes is a part of a process known as Active Learning[3]. Solving past exam questions is another way to learn by activity. Also effective is teaching another student who is struggling with a particular part of the course.

Active Reading[4] requires you to really think about what you are reading and make notes, underline and reflect on the ideas in front of you. It is highly effective at making what you read understandable later on (part of the reading for meaning skill). The instructions in the next table will help you learn how to actively read, some or many will be things you already do, so concentrate on trying out the things you are not yet doing.

A common misconception, especially in lower levels of academic success, that the faster you read, the smart you are. Scanning for key information across pages is a vital skill that gets more useful at university. But by the far the strongest way to read the most complex types of literature is systematically with a deeply intellectually engaged process and by being profoundly open and vulnerable to changing your mind in the biggest and best ways. All of this takes care and especially time. It is also a skill, so you can get better at it. If you really like reading, or big ideas, or would like to spend more time with either or both check out:
https://www.smashingscience.org/periodic-table-of-literature

Important points to note about the textbook

Sometimes there are differences between details in a textbook and in an exam mark scheme. Usually, the mark scheme would be the best version to learn (textbooks often have several mistakes in them, mark schemes almost never have any errors of any kind; so if there is a conflict, always assume the mark scheme is correct). The very best version would be one that includes details of both the mark scheme, which should be prioritised and then add whatever details the textbook also thinks is important.

[3] https://teachingcommons.stanford.edu/resources/learning-resources/promoting-active-learning &
https://www.smartsparrow.com/what-is-active-learning/
[4] https://help.open.ac.uk/active-reading

Activity	What you should do	Why it helps	When you should do it
1. Translation (If English is an additional language)	Translate **ALL** new words, especially the ones in **bold**, ideally next to the text. Use the glossary at the back to help you. If English is an additional language, instead of translating a word into your first language, explain the word in English in a way that you understand.	The most important words to translate are the non-scientific words you already know in your first language. If you sat the English as a Second Language iGCSE prioritising your English language learning earlier will benefit all aspects all of your AS Levels.	As you are reading.
2. Underlining	Underline, **bold**, CAPPITAL LETTERS, highlight circle , put a *star or symbol 😊 next to the biggest new ideas. But remember, if you highlight everything, you've actually highlighted nothing ☹.	**This is where Active Reading and Active Learning begins, but it should not be where it ends**. Students who are more capable sometimes do less well because they chose to annotate the textbook instead of their notes. Whatever you do in the textbook is building on work your brain knows is not its own, so it is less interested in it. That also makes it easier and therefore more appealing, but it is much less effective use of time.	As you are reading.
3. Answers to **questions** in the textbook	Write the title of the section, date, textbook page number, then answer the question in a way that allows you to use these answers as notes months or even years from now. Therefore, use complete sentences, include as much detail as is needed in your answer for it to make sense. Include all of the working for the calculation. Answer all of these questions either with your main class notes, or a specific notebook.	Remember you are aiming to learn the idea, not just reproduce mark scheme, so your work should reflect that intention. For each question's answer you are essentially summarising the question and the idea in your answer, which is a creative, analytical and reflective process; all of these higher order thinking skills in one activity is a very powerful way to systematically actively learn using the textbook.	As you are reading.
4. Answers to **worked examples**	Answer the worked examples whenever you get to them. Cover up the explanation with a piece of paper so you can only see the question. Include your working, with clearly labelled numbers and equations. After you have written out your answer then check to see if you understood the calculation.	You are building not only the skill to get the right answer, but also the skill to deliver an answer in an exam that gets all of the marks, including the hardest marks for details that most students who know the answer lack the exam technique to include.	As you are reading.
5. Create an **introduction mind map** of key points and essential aspects	Create a mind map of the topic as you learn it. Include essential diagrams, equations, keywords and connections as you come across them. Try to be creative, visual and colourful. Make sure whatever you write is in your own words. You can tape securely sticky notes to add to areas that need more space. This can be the first page in your notes. It will grow as you are encounter new ideas.	You will be using, exploring and growing your creativity, analysis skills, your visual understanding of the topic as well as your ability to summarise large amounts of information into a small space. You are unlikely to do this well for Topic 1. But by Topic 37 you will be an expert at this highly specialised and efficient way to study using a written source.	As you are reading.
6. Create **summary sentences** of textbook sections	You can create condensed sentences with the essential points as you go for each section. You could write all of them for a chapter together on the same page, clearly indicating the pages each sentence relates to (and the date).	Another way of thinking about it is: what's the least useful or least important 90% content in a section?	As you are reading.

Activity	What you should do	Why it helps	When you should do it
7. Read ahead and **write out questions to ask** in class	Read ahead in the topic you are studying in class and write out questions about the material you have encountered that it's not well or fully explained by the textbook. Ask these questions at the end of class, or after class if the lesson has not answered them.	Asking good, insightful questions is an important skill to improve. Don't ask these questions before the content has been taught – the best value of the activity lies in your carefully listening throughout the whole lesson to make sure the question was not answered; often it will have been. You are aiming to learn better in the scheduled time. This is a highly effective way give yourself extra incentive to pay extra attention.	As you are reading.
8. Read and practice past exam questions	Carefully select parts of exam questions you can answer from what you have already learnt about the topic. Paper 1 questions usually are the most compartmentalised and focus on individual syllabus points, so they tend to be the best questions to try when you are still studying the topic. You might be able to answer some questions on the topic you are currently learning in Papers 2 and 3, or at least can read through them and look for the parts that you can do.	Learning a topic with and knowledge of they kinds of questions you will be asked can help you understand the relevance of what you are learning and centre it on practical skills and understanding that will soon be essentially to gaining a good grade. It can also help you to create questions in your mind about things you have yet to see, so that you are curious to find out the answer.	As you are reading.
9. Add to your Cornell Notetaking Notes from class	Add any details you are missing in your class notes on a section in a way that allows you to see what came from a textbook (e.g. by highlighting that text, or different colour only used for content from the textbook).	You will have to read and understand all of your notes and the textbook content before you decide to add and write out these additional details. You are far more likely to check if this content really isn't in your notes, making you compare and contrast the content of both much more thoughtfully, again using and growing your thinking skills for this topic.	After you have studied the textbook's section in class.
10. Add to your **Cornell Notetaking Cue** column	Cover up you Cornell cue column for a section you have studied both in class and from the textbook. Does this cue column have everything it should, or are there details, keywords or questions you now know that are missing? Add to your cue column in your Cornell Notes any additional details, keywords or questions that you have.	If you covered up the notes section of the page, answering these questions should allow you revise the whole page simply by answering the questions you have written out and thinking about a few core ideas (much more efficient revision, for instance before you start practicing past exam questions).	After you have studied the textbook's section in class.
11. Add to your **Cornell Notetaking Summary** sections	Read carefully what you have already written in the cue column and the summary section of your notes. What additional sentence could you add to make it better? Write it in a specific colour so you can easily and quickly see this most sophisticated and important (to you) sentence that can lead you back to your thinking when it was written after finishing your lessons and your notes of the whole topic.	Another way of thinking about it is: what's the least useful or least important 80-90% content here?	After you have studied the textbook's section in class.

Activity	What you should do	Why it helps	When you should do it
12. Create a **summary mind map**	Using the introductory mind map create a summary map that summarises everything in a logical and well presented and well set out ways.	A great quick revision strategy is to write out a mind map for the entire topic on a blank piece of paper, from memory. Then to check it with a mind map like this one, and look for the things you missed out, you now know what to concentrate on.	After you have finished the textbook chapter in class**, but before the topic test.**
13. Practice Paper 2 past exam questions	Concentrate on answering Paper 2 exam questions. Use these questions to explore how the knowledge you have encountered is examined, and what parts of the syllabus are important enough to be worth creating exam questions and marks for.	These are the most important exam question to get good at. If you can answer them well, then usually Paper 1 questions on the same topic will also be answered to at least the same stander, often slightly higher. But if you cannot answer Paper 2 questions then it doesn't matter if you are good at Paper 1 questions.	**After you have finished the textbook** chapter in class**, but before the topic test.**
14. Practice Paper 3 past exam questions	Most topics are not covered in Paper 3, but those that are it is particularly important to try out the questions that have **Sample Data** answers from SmashingScience. Explore whatever content is included about experiments from the textbook for these questions.	By far the best practice for this practical exam paper will be done in the lab, actually doing similar experiments. But when you do not have lab access, for instance outside of lesson time, you can still revise Paper 3 questions and include the information from the textbook to help.	After you have finished the textbook chapter in class**, but before the topic test.**
15. Add to your Cornell Notes any **final essential textbook details** you missed	Add whatever details into your notes that your past exam question practice highlights that was in the textbook but that you missed, both when you were studying it in class and when you were reading it. Try to think about how you could in the next Topic spot and learn these kinds of subtle and easy to miss ideas that deliver the harder marks earlier. This is the highest level of reflection, using data and systems to deliver the easiest to miss improvements that only the best students can make.	The tricky marks and the slippery explanations (especially that 2nd or 3rd mark) often follow patterns that can make it much easier to spot once you have thought not about the answer, or even the question, but those underlying patterns examiners use to make content more complex (so that it is an AS question instead of an iGCSE question). Sometimes those patterns are addressed in a textbook, when you miss them in one textbook chapter, you should try to be more deliberate and thoughtful to see them in the next topic.	As you are practicing the past exam questions.
16. Write out **your own Top Tips**	Write out any new tough marks or details that you have overlooked and try to think of a rule or piece of advice, to yourself and others, about how to effectively build an exam habit so you don't drop a mark from that kind of problem or puzzle again.	Ultimately, you are not aiming to deliver into your life a library of facts, but an active and growing library of learning systems. You are building a way of incrementally grow your problem solving ability to achieve important life goals through pattern recognition, diligent perseverance and creative reflection.	Any time after you've finished the topic, but before the CAIE exam.

Exercise: Exam Technique Top Tips for Smashing!!! your Exams

Actively read through these top tips. **Task:** What order are they in?

Task: Rank them, with 1 as most important to exam success (doing it correctly will deliver the most marks, failing to do it well will result in the most amount of marks last) and 25 as the least important.

For exercises like this one, it is often best to start at both ends, with the most and least important ideas, and then work into the middle where it is harder to differentiate.

Task: Add these ideas to your "Exercise: My Notes about the Paper 1 To-Do Checklist"

ID/ rank	Idea	Why it matters
TT 1	**Adding to your answers at the end**	**For most students.** The harder explain questions, or other multi-mark questions often will require details that may not be the first ones you include. After you have given the question roughly the right amount of time per mark, MOVE ON to the next part of the exam. Return later if you have made the time to do so, after you have checked through the exam and add whatever else you can think might be relevant AND correct. If you are not sure if it's relevant, but you are sure that it is correct, then add it anyways, **but only if you have the time!**
TT 2	**Annotating your multiple-choice questions**	**For ALL students!** Although the examiner will not see you question paper for multiple choice questions, you should still make notes on the question paper itself. This will help you break the question down, which will often require you to have one idea that follows another, if this is written down inside the question you are more likely to see these other steps. Also important, at the end you can see your own thinking when you check through your exam at the end, which will make checking your work easier and more effective
TT 3	**Annotating your questions**	**For ALL students!** You should be writing out what you know about the compounds and ideas as you are reading the question. Underline numbers, these are usually only ever given to you because they are necessary in a calculation. For questions involving unknowns, try to write what substance X is if that is possible (e.g. if X has 3 protons, it is a form of Li). This way you break down a larger problem in to more manageable parts helping you see more clearly the answer.
TT 4	**Checking your exam paper**	**For most students** try to allow at least 10% of the exam time to check your exam paper at the end. As you move through the paper, you should have already marked the hardest questions with a star or other symbol, these should be checked the most carefully. **For the most able students** who are aiming for a good A* you ought to have about 20 to 30% of the time left at the end for checking which will allow you to thoroughly check all of the exam and locate every mark. This is especially important for the hardest multi-mark questions, identify where in your answer do you think you have delivered enough details for each mark. **For students who struggle** you may need to ignore the later parts of a tough topic (spend least time on the hardest marks) so you can spend most time checking the easier questions to make sure that you catch and correct the silly mistakes which could deny you the higher grade.
TT 5	**Chemical equations**	**For most students**. **Always try to include at least one balanced chemical equation with state symbols**, even if you feel you have just explained the same thing in words, because you may have missed something out or not explained properly the idea that you had in your mind which the chemical equation will provide evidence to the examiner that will allow you to get the mark. It is an example of **REDUNDENCY** (or a **FAIL-SAFE).**
TT 6	**Crossing out answers**	Never cross out an answer until you have provided an alternative. So draw a box around what you intend to replace, then write your new answer, THEN write a neat cross through that box. **Your crossed-out work should always be readable to the examiner**. If it contradicts your new work, it will not be considered, but if it helps to clarify your new answer, than it ought to be considered by the examiner. For instance, in a recent exam students were expected to describe a difference and explain it; many students simply explained the difference, without saying if the value would be larger or smaller, one student suggested that it would be smaller in their crossed out work, but only different in their final answer, but they had shown they understood how it would be different and got the mark.
TT 7	**Diagrams**	**For ALL students!** A picture is worth a 1000 words. A good **LABELLED** diagram, even if there is no blank space for a diagram, can sometimes be acceptable and can help give a fuller answer to allow you to pick up the hardest marks or prevent silly mistakes where you have accidentally not included enough information. Another example of **REDUNDENCY.**
TT 8	**Drawing graphs**	**In pencil!!!** If you make a mistake in the real exam in pen it your answer may not be clear enough for you to be awarded really easy marks, you cannot ask for another exam paper, so mistakes that are made in pen are permanent! **For ALL students!**

ID/ rank	Idea	Why it matters
TT 9	**Eliminating the wrong answers in multiple choice questions**	**For ALL students!** Usually two of the 4 answers are more easily seen as incorrect. Finding these two will give you a 50/50 chance of getting the right answer with less understanding, so even though you don't fully understand the question, you have at least managed to increase your odds of guessing correctly. If you can't easily and quickly find these 2 answers, mark the question, make a guess IN PENCIL, then move on, this question is obviously a difficult question therefore.
TT 10	**Exam Questions**	**For ALL students!** Almost none of the marks are awarded for answering actual questions (you will almost never see a question mark?!?!). What are commonly referred to as exam questions, are in fact commands: **calculate** this, or **explain** that or **state** how etc. This is to reduce confusion so that you know exactly what is expected from the language of the command (which is why the **command terms** exist and why they are so important to properly understand!!!).
TT 11	**FAIL SAFE** or **REDUNDENCY**	**For most students.** If you really want to make sure you pick up every single mark you should be aiming to include additional information in a slightly different format, including labelled diagrams and balanced chemical equations with state symbols. This level of attention to detail means that if your first attempt at the hardest marks in the exam paper fails to deliver the complete answer, it fails into a safe position, because you have a backup plan. This is an essential idea in engineering and research science.
TT 12	**Give *some* properties/ etc.**	**For the most able students.** Give about 40 to 100% more properties or conditions than there are marks: irrelevant answers, or incomplete answers will not go against you, so to ensure you include all of the details that the examiner requires you need to be very cautious. Answers acceptable one year may not be acceptable in another exam session, they are not incorrect, just not enough to get a mark. **This is essential for a candidate to hope for a good A*!!!** **For the least able students.** Make sure that you are at least giving as many answers as there are marks, if you are not sure, give your best guess, never leave an answer blank! Remember though that an incorrect answer plus a correct answer normally will mean the correct answer does not get the mark.
TT 13	**Give x# properties/ conditions/etc.**	**For ALL Students!** Give exactly and only x number of properties, any more will either not be marked, so if one of your answers is irrelevant, and you are supposed to give 3 answers, but you give 4 and the 4th is correct, you could lose the mark. If one of the answers is wrong, then you will most likely lose the mark. They do not reward candidates who try to use ambiguity to increase their score, and in fact actively penalise it.
TT 14	**Name**	**For most students.** Give the name, in English, for the chemical compound, ion or element. Only the name is acceptable, and if you misspell it, especially if it is a negative ion, like chloride, you will not be awarded the mark. Do not give the chemical formula as well: it will not give you an extra mark, but if it is incorrect, it could negate the mark the name you gave would have gotten.
TT 15	**Plurals**	**For ALL students!** If a question requires more than one answer, it will have ALWAYS indicated this with the use of plurals. If only one answer is needed than again, the statement will indicate this grammatically. **PAY ATTENTION TO THIS!!!**
TT 16	**Showing your working in calculations**	**For ALL students!** The space given for your working for a calculation should not be considered as 'rough paper' or include incomplete numbers or ideas. The space for your response should be considered as a place for you to communicate with the examiner what you are doing, and especially thinking, in each step. Label your numbers! Write out the equation you are using, e.g. PV=nRT, even if there is never directly a mark of that, it will help the examiner award method marks. Sometimes the final answer is only worth one mark, and the other marks can only be achieved with carefully laid out working. Another important reason for good, systematic working, even for easy questions that involve more than one step is that they allow you at the end of the exam to check your thinking quickly, efficiently and effectively. **A logical, neatly and clearly presented, step-by-step approach to writing out your thinking for every question, including calculations, is also excellent exam technique.**
TT 17	**Spelling**	**For ALL students!** It is only really in the naming of a specific process or a species (atom, ion, radical, compound, element etc) that spelling is vital. Otherwise, anything that is spelt well enough for the word to be clear and the meaning to be understood is acceptable. Your written response is the usual evidence the exam board uses to award you credit for correct and complete scientific ideas, but they have ways to give credit to students with conditions that limit their writing ability. This includes dyslexia is used by the exam board to measure your level of understanding, but there are other ways to show you understand. Some students with certain disabilities may not be able to write, but they could still get an A* in this subject if they could shown, e.g. through speech, that they are able to understand the ideas in the mark scheme.

ID/ rank	Idea	Why it matters
TT 18	**State or identify**	**For ALL Students!** In this case you can use either the chemical formula or the full English name of the compound, ion or element. If you give the formula and the name and one of them is incorrect, you will often lose the mark, so you are better off only identifying the substance by the way you are most confident in. For instance, if you say that it is "Bromine (Br)" when it is in fact Br_2, you could lose the mark. Or "Bromine (Br^-)" when the answer is the bromide ion.
TT 19	**State symbols**	For all students. You usually do not get an extra mark for including these, but will often lose a mark which requires other details if you have not included them. Always include these whenever you are stating or identifying a substance, so $H_2O(g)$, or $Cl_2(aq)$ include far more sometimes vital details than writing “water” or “chlorine”. This is another example of a **FAIL SAFE.**
TT 20	**The order you answer questions**	**For ALL students!** This should be organised at the start of the exam. Take 2 minutes to skim through the exam paper and find the hardest questions and the easiest ones. The hardest questions should be answered last, these are the least efficient use of your time (in terms of marks achieved versus time spent). The easiest questions are the most efficient use of your time, unless you have run out of time and are forced to leave them unanswered, or poorly answered. **DON’T’ ANSWER EXAM QUESTIONS IN THE ORDER THEY APPEAR ON THE EXAM PAPER!!!**
TT 21	**Time management in exams**	**For ALL students!** You should know how long you have for each mark (normally it is around 1 mark a minute). You should also have a watch that you are familiar with that is not a smart watch or a smart band. A simple, cheap classic Casio watch would be best, and you can use this same watch throughout your academic career making sure to replace the battery before every exam session. Some questions you should be able to make time up on, others will take considerably longer, for those harder questions, stop after about 1 minute a mark and return to them at the end to ensure the easiest marks have been answered fully and carefully.
TT 22	**Understanding the distracter answer in a multiple-choice question**	**For the most able students.** After you have eliminated the 2 easily incorrect answers there will be two very similar answers that will differ in a fundamental way, hopefully, that will allow you to find the correct answer. Sometimes, however, neither will be easily identified as correct, so you will need to find the most incorrect answer and chose the other one. These questions tend to be the hardest marks in the exam.
TT 23	**Units**	**For ALL students!** Always include units in your answer! Often, they will not be enough to allow you to get a mark, but if they are not there you will lose a mark.
TT 24	**Writing in the mathematics formula booklets**	**For ALL maths students.** Nothing to do with chemistry, but I find it really unnecessary. **DO NOT TO THIS!** At best rough work which should have been included in your answer booklet, then neatly crossed out, will not be seen by an examiner, so you could very pointlessly drop marks. At worst the handwriting is yours in this booklet, so you could be accused of writing the answers in there before the exam and therefore cheating. It is CAIE policy (and all exam boards, actually) that everything a candidate does in the exam is sent to them, which is again related to exam security which they take extremely seriously. Most likely however, the booklets are just thrown away for no good reason which is a waste of paper.
TT 25	**Wrong answer + Right Answer**	= No marks! If you are unsure go with your best guess, but don't give two answers if only one answer is acceptable. **For ALL Students!**

Background science – your brain is an organ

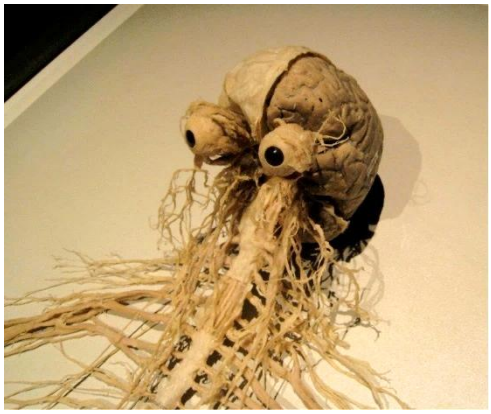


Figure 1 It's what's on the inside that counts! This organ is where almost all of your mind comes from. Other factors like adrenalin, a powerful fast-acting hormone from glands in the body, outside the brain, also shape your thinking.

As important as remembering important things is forgetting everything else. Your brain does both. Learning well is like programming a computer, using specific ways to best interact with this mysterious organ so that you can remember information and connect ideas in new ways, so you can solve new problems like an exam question you have never tried before.

Most details of most seconds, minutes and hours of anyone's life are not needed and are deleted (forgotten). But if you have ever fallen off a bike or had an accident your brain stops deleting everything and instead stores as much of the information as it is able. Time slows down and your memory feels almost photographic. **Some things are therefore more memorable than others**. The trick with learning is to present information and skills to your brain in just the right way so that it stores these memories longer term.

It is designed to only remember the things that it is programmed to think are important. It's programming comes from culture, but some is also hard-wired into the system itself, like our shared interest in learning a language when we are babies, or our ability to process visual images better or our ability to control our body temperature. This hard wiring is created by our genes, which we inherit from our parents. Our genes were created and adapted to survive and reproduce tens of thousands of years ago living lives that are totally alien to even the most extreme high school environment.

Current understanding of the human brain is extremely basic, no-one knows what the smallest part, or atom, of an idea might be in terms of brain cells. But we do know that **brain cells make connections**, and we think that those connections are where the mind, and memory, is created. We also know that the brain is more likely to make connections, and therefore memories, from events we are emotionally attached to, like an accident or a totally awesome movie. If we feel more emotions about something our brain is adding meaning to the memory, and it is much more likely to be stored longer term.

If you keep returning to the same idea over time, but you make your brain think about it differently, for instance by **taking notes using your own words**, or **making a summary**, or **writing out key questions** raised by that idea, you are making your brain to make **new connections** to make this new kind of thinking happen. Not only will the brain be better able to use new ideas in a new situation, like in an exam, but these connections also make the memory more stable. If the brain really thinks something is important, like something that hurt you or where you live, it will store these essential bits of information into what can be called long-term memory.

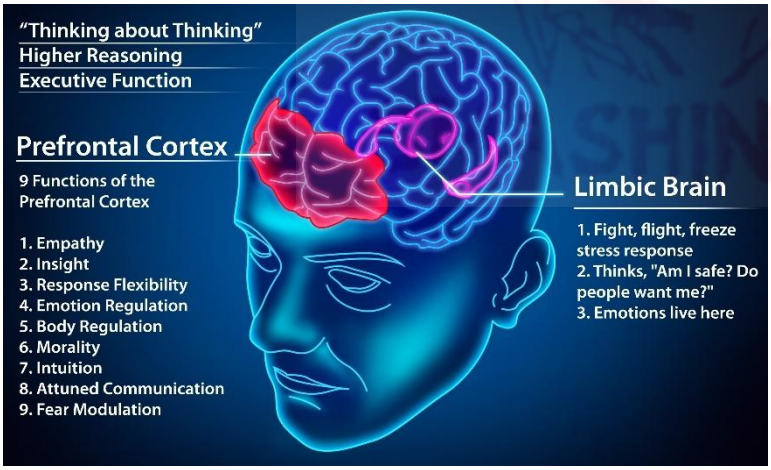


Figure 2 The business end of the organ. The human brain is special not for its size, whale brains are bigger, but for its uniquely complex **prefrontal cortex** which does much of the best thinking, it also delivers the higher order thinking skills you will need to plan and deliver the revision needed to crush your exams.

The **limbic brain** adds emotional weight to your ideas, it powerfully moderates your thinking and adds a difficult to describe property that can be simplified to as "**meaning**" to thoughts and memories.

The goal of learning is not only to make as many interesting and important connections within the brain as possible, but also to **put as much key information into the long-term storage area as possible**. The goal of education, especially in the better universities is not fill a student's brain with specific facts and ideas, or to test how

intelligent someone was born, but **to train a student's brain with valuable skills and techniques to learn faster**, better and longer.

Learning how to learn better is the most valuable and important thing you will take away from any period of education. Luckily, you are not the first person to have ever been taught. There are thousands of years of history and tens of thousands of years of culture that you can use to your advantage. Some systems of learning work better than others. The **world's best universities** have done a great deal of research into these different systems and skills involved in learning e.g.:

https://english.gse.**pku**.edu.cn/newsandevents/news/index.htm (Peeking University); https://www.**ucl**.ac.uk/ioe/research ; https://www.gse.**harvard**.edu/ideas ; https://web.edu.**hku**.hk/knowledge-exchange (Hong Kong University) ; https://**nus**.edu.sg/cfg/students (National Uni of Singapore) ; https://ed.**stanford**.edu/faculty/overview ; https://www.ioe.**tsinghua**.edu.cn/en/Education/Summer_School.htm ; https://www.educ.cam.ac.uk/research/impact/ (Cambridge); Institute Of Education What Works Clearinghouse (USA); https://as.**cornell**.edu/education/education-innovation ;

The Cornell Notetaking System

In the 1940s a professor of law at **Cornell University** called Walter Paulk realised his students, who were supposed to be some of the best of their generation, weren't that good and he wondered what they could do to learn better. He invented the Cornell Notetaking system, which is widely considered to be the best way to learn difficult things faster for almost any subject at both the High School and University level.

Notetaking is not about storing information that you need to relearn before the exams, rather it is like creating structured save points on your journey to understanding a syllabus point. The notes you have made have created connections in your brain that are reactivated when you see your notes again. Your notes are a visual key or code that transports your mind not to one part of the idea, but rather to all of the connections you had to make when the notes were created. You are retrieving the whole box of memories, skills and connections, instead of a single piece of the bigger topic.

These notes are therefore a way to neatly store away not facts, but how all of those facts interconnect (understanding) in an orderly way through an organised process that uses what we know about the brain as a biological, evolved organ.

A key feature of this system is making your brain think about priority, order and relationships that make a lessons worth of ideas at different times. Even more effective thinking about the same idea in a creative way after several nights of good sleep. The Cornell Notetaking system includes all of these most effective learning strategies.

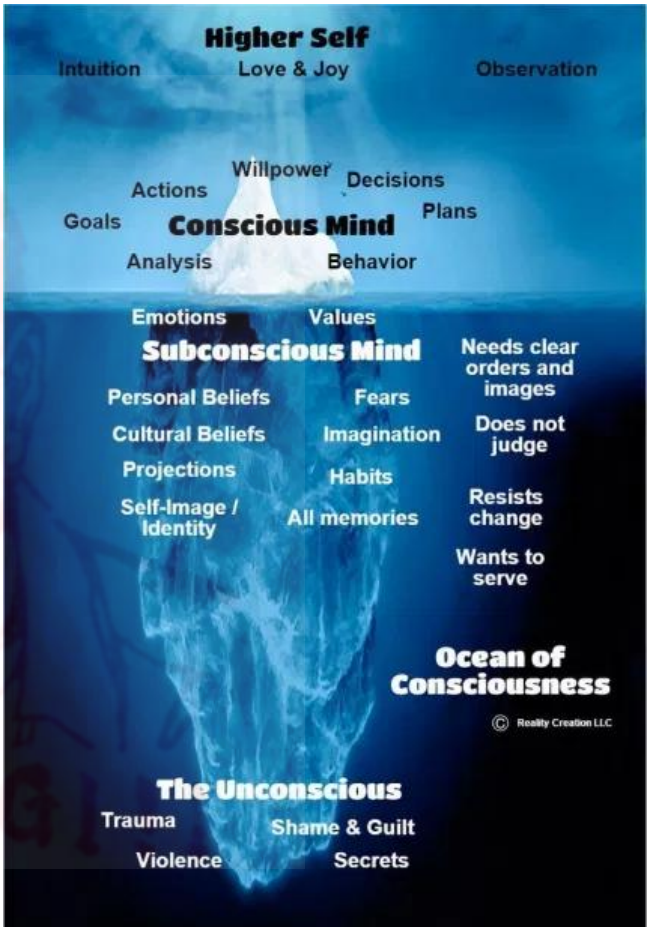
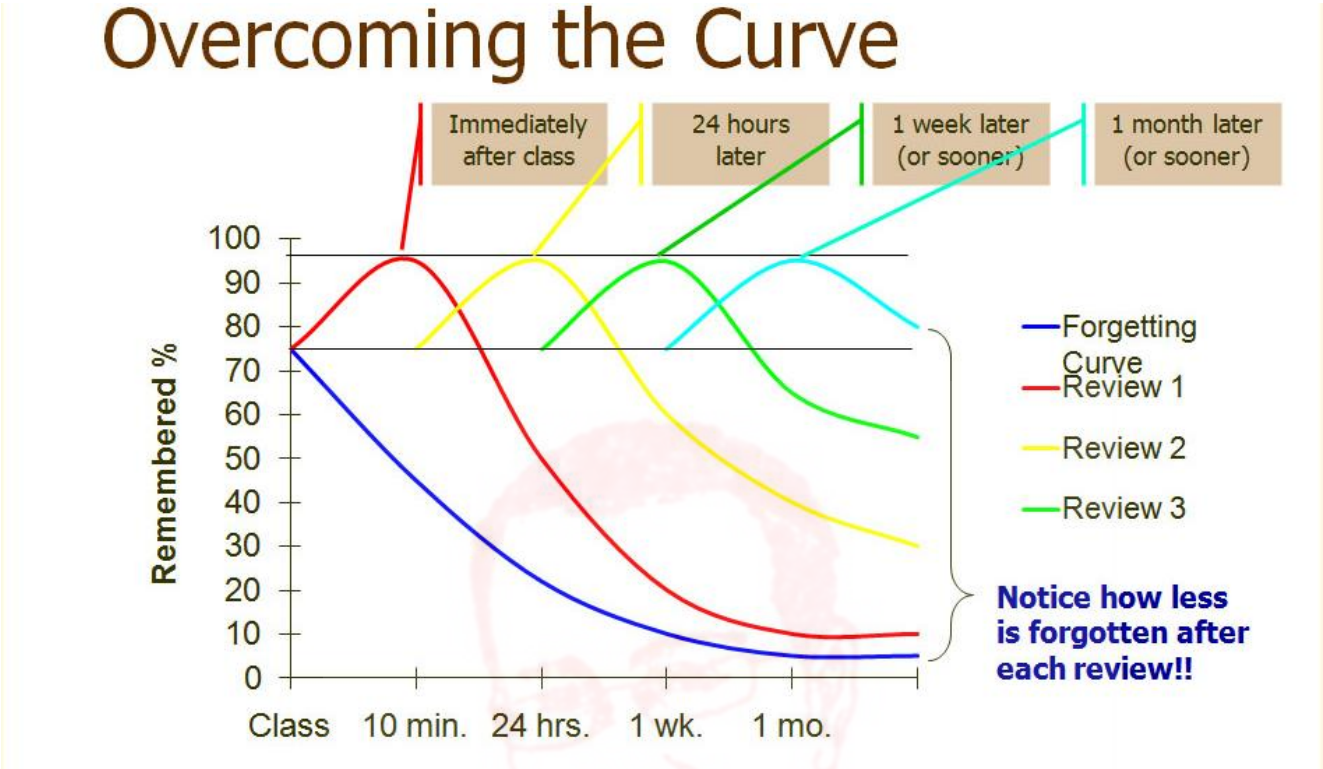


Figure 3: The mind is a small part of the brain. But the conscious mind is a smaller part of the whole mind. Most of the mind involves aspects of the self that are hard to understand and even harder to change, but with enough work it is possible for anyone to nurture and grow the habits of an outstanding student. These larger changes take time, hard work and especially a commitment to try new things.

The forgetting curve

Learning how and when the brain deletes and removes information is another essential aspect to becoming more effective at learning new things. This idea is integral to understanding the effectiveness of the Cornell Notetaking system.

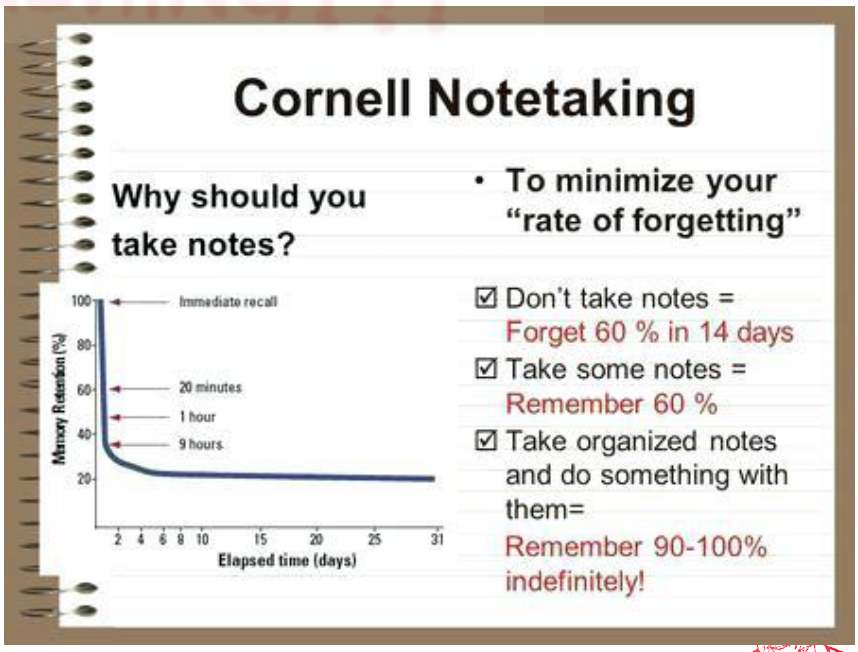


How might the data for these graphs be gathered? A physicist might say any graph without error bars ought to be classed as art rather than anything like rigours analysis. As the central science, a chemist would have a more open mind. For a more scientific perspective on the "Forgetting Curve":

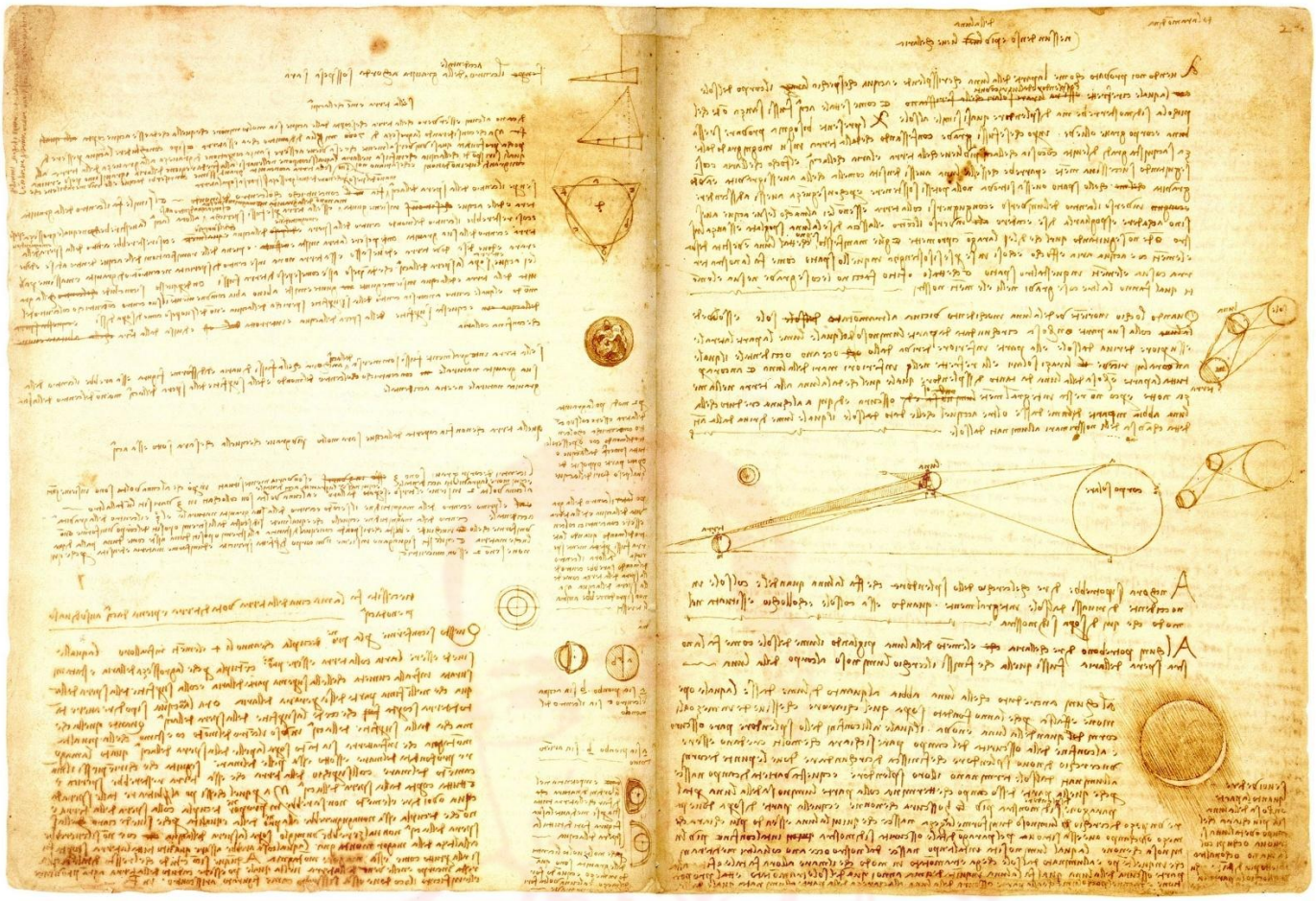
https://psychology.stackexchange.com/questions/8377/how-are-these-review-forgetting-curve-calculated

The quicker you return to a lesson to review it, the less time you will need to gently nudge it into your long-term memory, so 5 minutes of work within the first 24 hours can be as effective as an hour of study a month later. Remember, your brain does not understand what you are trying to do, but if you try to work with it, and help it along, remind it that this stuff matters to you (and it), it will be more likely respond in the way that you want and learn what you need it to.

Effective learning is essentially effective brain programing, and the Cornell Notetaking System is a highly efficient (more learning in less study time) way to insert new ideas, skills and understanding into your long term memory.

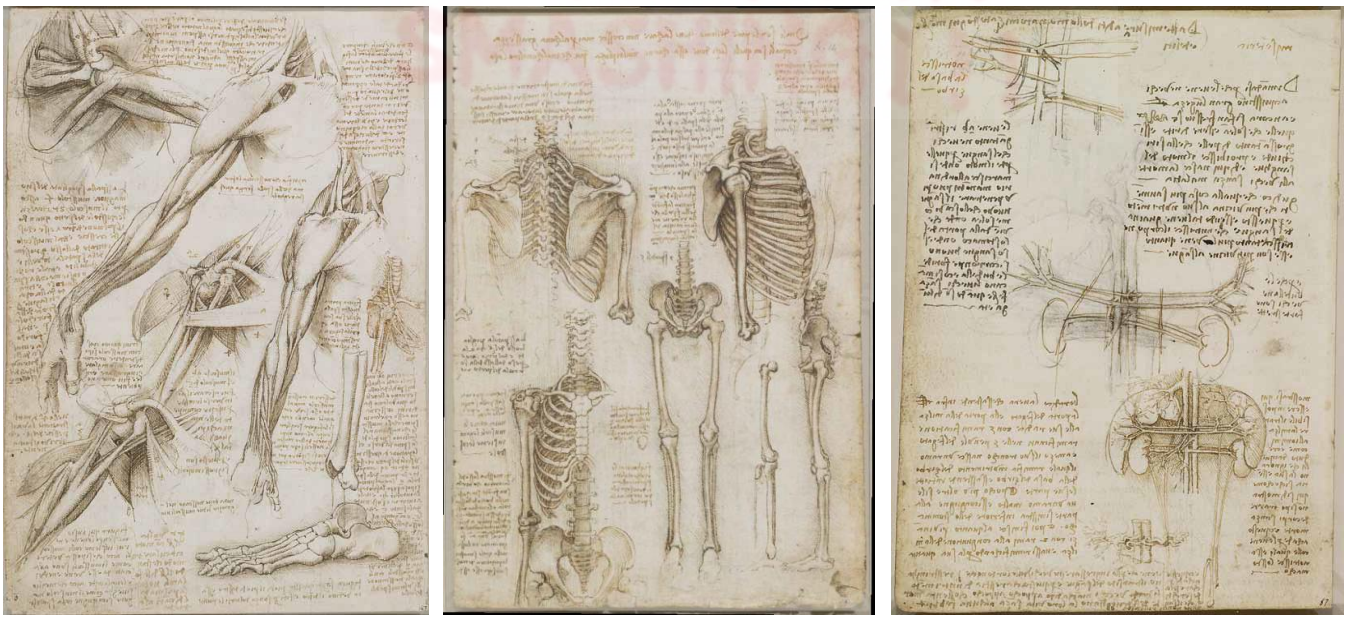


Notetaking has been an essential skill that the most important and prominent minds throughout history have used to record, explore and expand their thinking. Perhaps the most famous notes were those of Leonardo da Vinci, which shows how he interconnected his then advanced ideas on science and the human body with his mastery of visual art and profound insights into design.



Leonardo da Vinci's notes in the *Codex Leicester*, above, and sketches from his anatomical sketches, below, held in the Royal Collection. For a boss-level free book in .pdf format on DaVinci's anatomical sketches:

https://www.rct.uk/collection/publications/leonardo-da-vinci-anatomist



For more resources on notes and why they matter at iGCSE and AS/A2 levels and beyond, including exemplar notes from students and a PowerPoint presentation exploring the value of notetaking skills see www.SmashingScience.org

Cornell University
Learning Strategies Center

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Garden Ave Extension
Ithaca, New York 14853-4203
t. 607.255.6310
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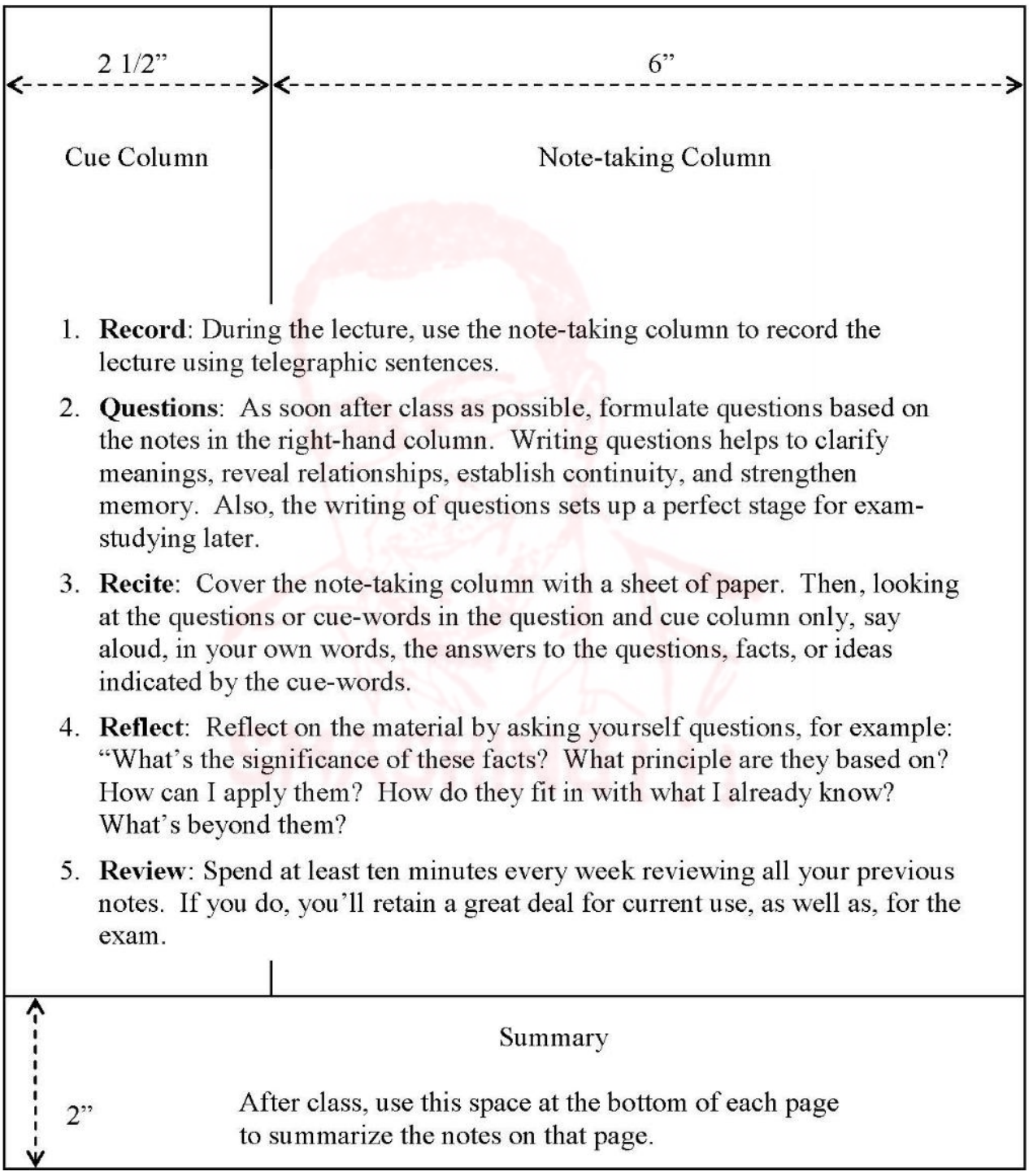
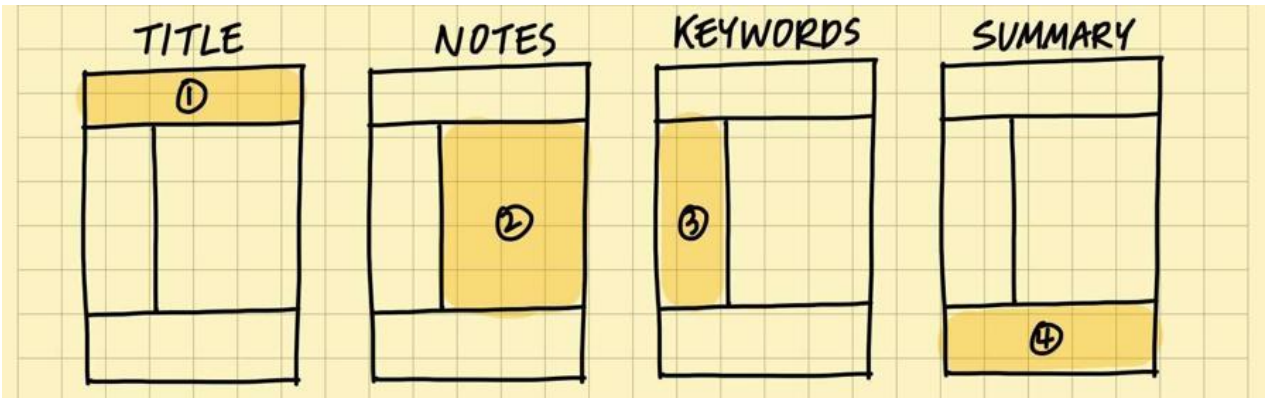
www.lsc.cornell.edu

The Cornell Note-taking System



https://lsc.cornell.edu/how-to-study/taking-notes/cornell-note-taking-system/

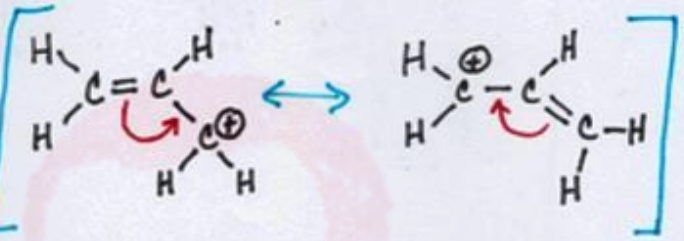


Order to complete notes, start with the title (#1). The last section (#4) is done after at least one full night's sleep.

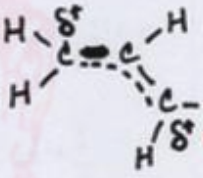
What is the difference between resonance structures & true structures?

Why does charge delocalization stabilize a molecule?

Resonance Hybrid: True structure of molecule represented by a set of resonance structures



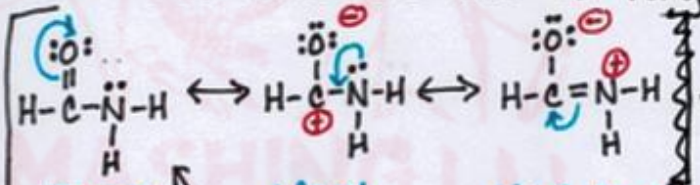
"True Structure"



Positive charge is delocalized over carbon 1 & 3

partial positive charge

Some sets of resonance structures have one structure that is very good.



BEST because no formal no charges

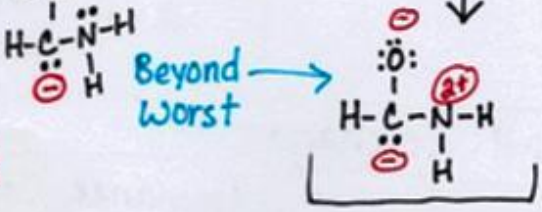
Worst

Next best

minor contributors

major contributor lowest energy most stable

Beyond Worst



Resonance structures are used to represent true structure of molecule. The more resonance structures you can draw, the more stable the molecule due to delocalization of e^-.

CUES

(reduce & recall)

AIM

reduce notes to essential ideas to practice **recall**

WRITE SOON AFTER CLASS

Step 1.

Review NOTES column + pull out:

- key words
- key concepts
- authors
- dates
- facts

Step 2.

Formulate questions based on your NOTES e.g. what are Pascale's 4 principles of complexity theory?

Step 3.

Write these cues and questions in this column alongside the corresponding NOTES

DATE MODULE/CLASS TOPIC

NOTES (record)

AIM

record as many key points as possible

TAKE DURING CLASS

What do I write here?

- key words and ideas
- important dates / people / places
- diagrams / charts
- formulas
- examples / case studies
- critique - strengths / limitations

Top tips

- use bullet points instead of full sentences
- use symbols and abbreviations
- leave a line between ideas
- don't mindlessly copy from the slides or textbook - write in your own words where possible
- use a method that works for you. Take notes in a format that you understand so you can make sense of them later.

SUMMARY (reflect & review)

AIM

review the main ideas + **reflect** on their importance

WRITTEN AFTER CLASS

Briefly summarise the main points from your notes. This section is useful when searching for info later.

Think about:

- why is this info important?
- what conclusions can I draw?

2.5"

CORNELL NOTE TAKING

CUE COLUMN

This section is to be completed after the lesson/ lecture, and should include key words or phrases as well as vocabulary, people or case studies you may need to research, and potential exam questions.

I guess you could say this column is for the

WHAT'S
WHO'S
WHEN'S and
WHERE'S

6"

Name, Date, Subject, Topic...

NOTE TAKING COLUMN

This section of your page is dedicated to lesson time and in class note taking. You might want to include:

- Main points and lesson objectives
- Diagrams, graph sketches, drawings or charts
- Bullet points/numbered processes
- Concise sentences
- Shorthand symbols/paraphrases/abbreviations

Also, try to leave lines between points so you can go back in and add any brief notes you may have missed. This extra space will also give you a sense of clarity.

You don't have to use a ruled line version- try one with a blank note taking section to experiment with mindmaps, tables or whatever takes your fancy - make it personal to you.

You might say this column is for the **WHY'S** and **HOW'S** with some of these guys thrown in.

ALSO

If you really run out of space, add a post-it, but do try to summarise on just one page!

2"

SUMMARY SECTION

This section should be written last, after class. It should also only really contain a basic, condensed summary of your notes in the Cue column, and important details of your main notes. It is used to quickly find & digest info later.

Topic:	Name:	Date:
	Class:	Period:

Step 2: Cues (Reduce)

When: During class but after the lecture, activity or discussion

What: Reduce learning to the essential facts & ideas

How (make lists):
- Facts
- Key ideas
- Important words
- Pivotal phrases
- Questions

Why: Students can not recall everything and need to filter out the most important ideas, concepts and questions.

Step 1: Notes (Record)

When: During class lecture, discussion or activity

What: Record as many facts and ideas from the lesson as possible

How:
- Bullets, phrases and pictures
- Avoid sentences and paragraphs
- develop abbreviations and symbols
- leave space between points to add information later

Why: Students need to record the learning in a method that is meaningful to them before they can do anything with it.

Step 3: Summary (Reflect & Review)

When: At the end of class, after class for homework or as a warmup at the start of the next class

What: Synthesis that reviews and summarizes the main ideas from the lesson

How (in complete sentences, answer questions such as the following):
- "Why is this information important?"
- "What conclusions can I make from this information?"
- "How can this information be applied?"

Why: Summarizing and reviewing information after it is learned is one of the best research based strategies for ensuring long term retention of any content or skill.

Exercise: Learning and Understanding the Five R's of the Cornell Notetaking

Use the table of ideas in the section "***Learning with your Textbook using Active Learning and Active Reading***" to actively read the living heck out of the descriptions of what highly effective Cornell Notetaking looks like, and the explanations about why it works so well that follow.

On a piece of paper marked out with the Cornell Notetaking sections, write out as much of these details, instructions and explanations about the Cornell Notetaking System as you can remember, write them in the most effective place, using as much details as you can remember. Then re-read these descriptions and explanations here and add to your notes the things you think are important, but that you missed.

Extension activity: You can create an A3 version (or larger) with all of the details, an A4 version with the most important, and A5 and A6 versions which progressively include stronger and more succinct summaries.

Regularly and Systematically Reflecting to Make Progress Deliberate: At the start of every term, try to recreate this page summarising and listing key points of the Cornell Notetaking from memory, then check with the one you created last term. Also, read again the notes in this workbook and think about what you tried that works best, what you could improve, either by upgrading something you are already doing, or by trying something new to you. Add these additions and changes to improve and update the working version of your own most important ideas on effective Cornell Notetaking. Keep this version with you at the start and try to implement the new ideas as early and as often as possible into you class notes.

The Five R's of the Cornell Notetaking – Summary

1. **Record** – Your notes (ideally in your own words), written in class, with as much detail as you have time to include, written in the largest, main space.
2. **Reduce** – Extract keywords, chemical symbols, structures, diagrams and equations, create questions which your notes may or may not answer, done after the main part of the lesson, or after the lesson on the same day.
3. **Recite** – Cover your notes, read out loud your que column, then your notes. Maybe even record your performance.
4. **Reflect** – Create 1 or 2 summary sentences that includes only the most essential and important ideas from that lesson.
5. **Review** – Return to your notes, build on and add to them. Reread your summaries regularly, especially before solving past exam paper questions on the topic.

The Learning and Understanding the Five R's of the Cornell Notetaking

1. **RECORD the ideas of the lesson by handwriting them in the large right-hand section.**
   a) Writing them out combines the thinking that uses the part of your brain associated with the idea, and with the part of the brain with the incredibly complex fine motor hand skills that creates handwriting; typing uses fewer muscles, so less brain action, so less effective. The best notes are those that you have created yourself, even if you have only altered the word order; the more you have to think, the deeper the idea goes into the brain.
   b) This should be done in the lesson.
   c) These notes should be as complete as possible.
   d) Try to leave large spaces, at least 30% for future notes to be added later.
   e) Use a variety of colours. A single pen with 4 colours is extremely valuable to professional notetaking. Try to think of a system to highlight increasingly important terms , e.g. black, least important, blue, green then red, most important keywords, with red CAPITALS **BOLD** **UNDERLINED** the most important you have seen this whole week. You will need to think slightly more as you are writing them, comparing new information with what you have already written on this page, and if its extremely important, other pages elsewhere. Your notes will also look much more appealing and easier to use when you are under stress preparing for an important test. Great notes are a kind gift to your future self. When you ever see your bad notes that are poorly presented, which are hard to read and all of a single colour without any formatting or attempts to help you see what matters most, is a great moment to decide to buy a 4 colour pen and start using it!
   f) If English is not your first language, include translations here.
2. **REDUCE the sentences from your notes into just a few keywords and ideas into the much smaller cue column.**
   a) This helps **crosslink the parts of your brain** that creates **handwriting** with the parts of your brain responsible for **creative, analytical and critical thought**, which helps to use and grow your higher order thinking skills on this subtopic, and in general. Your brain is required to see different ideas and rank their importance, so has to compare them with each other and the idea in general. The thinking it is required to do this actually creates new physical connections inside your brain.
   b) This should be done some time, either minutes or hours, after your notes were made and on the same day (before you sleep).
   c) If these notes are done really well you will be able to put a blank page over your main notes and from just reading the que column on the left you will be able to recall not only keywords, but the whole idea, which makes revision much more effective and faster to do.
   d) Try to leave large spaces, at least 30%, for future notes to be added later.
   e) If English is not your first language, include key translations here.
3. **RECITE, or read out loud the words in the recall column.**
   a) **Speaking out these keywords** and essential ideas combines the thinking parts of the brain needed for these ideas with another incredibly complex region of the brain involved with the throat, mouth, tongue and lips that produces spoken language and speech. It might feel like this doesn't make a difference, but it really does.
   b) This is especially useful for English as an additional language learners.
   c) Cover first your main notes and just read the que column.
   d) Describe diagrams with words.
   e) Try to record your performance, especially for the harder topics. This can improve your confidence in public speaking, which is a key life skill. You edit these together and have your own personal podcast of your voice and your notes about key topics. The process of creating these files will also introduce you to an entirely new skillset connected to content generation.
   f) This can be done really quickly and without much effort several times before your topic test or exam, but ideally only once per session, with sleep between each session, which helps consolidate and reinforce learning in extremely effective ways.

g) Your notes will be at their most advanced state and useful when you have finished the topic in class, read through the textbook and completed all of the exercises associated with the chapter suggested in this workbook and are preparing for the end of topic test or an exam. They will hopefully include a great deal of updates, and upgrades, that are also easy and quick to identify. **Reading these notes calmly and deliberately, thinking about what you are saying, just before the exam will pull together all of the hard work you have done** at different times and in different ways activating all of the memories you have worked so hard and so carefully to create.

h) Listening to your notes could be an interesting and strongly different new way to revise in the future, find out if it works for you!

4. REFLECT on the ideas and the connections needed to understand the concept by creating summary sentences.

a) By creating just 1 or 2 summary sentences you will be making your brain go through the whole lesson's worth of ideas again, but this time after it has been allowed to sleep, which causes important changes to its abilities and allows it to remember better. You will also have to think critically and logically to remove as much as possible to allow the central ideas to remain complete, and leaving out everything that might be important, but not essential. Writing interlinks these higher order thinking skills with the complex physical action of writing, helping embed these ideas even further into your long-term memory.

b) When reflecting, try to organise the information in a new way. So create a reveres time order for a process, or if your notes go from small to large in your notes, do the reverse order in your summary.

c) You need to do this after you have slept well, ideally about a week after the lesson.

d) When done well, another revision strategy would be to put a paper across the top 80% of your notes and only read these summary sections. Then on that paper write out whatever is important but missing from the summary. Check with your cue section and then your notes to see if there is anything really important that you would have liked to include and then write out as succinctly as possible onto a strip of paper. Tape those new notes to the summary section to use later.

e) Try to leave large spaces, at least 30% for future notes to be added later.

5. REVIEW your notes immediately and regularly using past exam paper questions. Add to them whenever you notice something important missing.

1. The best way to test your understanding of your notes is past exam papers, which is why this Workbook exists. Almost all of the most effective and deepest learning will be done with past exam questions, both answering them, and especially checking those answers carefully with the mark schemes. The most successful students at the most selective universities are all experts at exam technique and exam questions. They are also incredibly well organised because the kinds of things that are in this Workbook are part of their everyday high school life, in their tutor time, and their lessons. But anyone can learn these key organisation, notetaking and exam skills.
2. **Trying to answer a question on your own is the best way to really test yourself**. Guess if you have to, but the more you write, the better your guessing skills will get (which eventually, with a lot of structured growth, becomes what is known as "Professional Judgement", which is how engineers, for instance build a new kind of aeroplane). Also, the more invested you are in trying to find the answer, by writing as much as you know, the more interested you will be to know the actual correct and complete answer.
3. Finding questions that you can't quite answer on your own when you are solving past exam questions will give you the most valuable study aid there is: a practical curiosity to find out.
4. After you have got as much written down as you can using only your memory, check you notes for questions you think need more than you are able to remember. In a different colour pen, add to your answer using information in your notes.
5. After completing about 10 to 20 mark's worth of questions (or a page or two from this Workbook), check your answers with the mark scheme. You should be able to easily tell which answers you were able to remember on your own, and what parts you got from your notes because they are written in a different colour pen. In a third colour, ideally red, add additional details until your answer includes all of the points needed to get all of the marks in the mark scheme.
6. **The details you remembered without help** are least important to getting the next grade: you already know them and have shown that you can deliver them in the right context.

7. **The details you needed your notes** for are the most important for you getting the higher grade. You have already started the work to learn these and can use them effectively when they are in front of you. You just need to remember them better. These are usually the easiest but most important and most valuable details to learn for the next test. You can write these on cue cards or flashcards to help you remember them better, for instance.
8. **The details you could not remember and did not include from your notes, but were in the mark scheme** have two categories. Both of these levels represent the hardest parts of the syllabus to you.
    1. If the detail was in your notes, but you did not include it, where was it?
    2. Was it in your main notes, the cue column, or the summary section at the bottom?
    3. How can you highlight this detail?
    4. Usually given that you missed it, even with your notes in front of you, it means you should give it an increased level of priority, so either promote it by writing it out into the cue column from the main notes section or even adding it the summary section (the most important part).
9. **If the details from the mark scheme you missed were not in your notes**, where they in the textbook?
    1. Tracking down these details is your curiosity in action, and this is the most powerful way to learn.
    2. If you find these kinds of details are often in the textbook, but not your notes after you have finished learning a topic in class then you need to fill in these gaps.
    3. **The easiest way** to do this is to use a textbook find out what you are missing and add it afterwards to each topic.
    4. **The most effective way** to do this is to try to find out why you are missing out on these key facts in your notes and solve the problem, either by making better notes in class, if that is where the problem is coming from.
    5. Or, if you are getting everything written down in class, but there are still key things missing, then after each class add to your notes using the relevant sections of your textbook.
10. **After every topic test, look back on your notetaking method** and make improvements to address whatever issues you have encountered. If you need more space, miss every other or every third line out. If your notes in class are too messy to easily read, rewrite them after class but on the same day after you made them (an extremely powerful technique, but usually not as effective for most students as solving past exam questions).

Using the Cornell Notetaking System for Topics you have not Studied in Class

You can also use the Cornell Notetaking system to make notes from chapters you have not studied in class. To study well doing that you should be rewriting the ideas found in the textbook into your own words, the more you change what was written the stronger the learning effect. If you are going to cover this topic anyways in class, this kind of activity often is not a particularly effective or efficient use of study time.

Some students will race ahead and do work on topics much later in the AS syllabus, including into the A2 syllabus, sometimes without really looking into the past exam questions for the topics they already feel they have completed. This is often not the best use of time to get the highest quality A*. Vital understanding that is needed to make sense of this more advanced material is often missing, leading to silly misunderstandings which are hard to unlearn. It is far better instead to become a true expert on the topic you are studying, and any you have studied, with past exam paper questions especially, and then working on and exploring every other active learning technique presented in these workbooks.

If after running out of all things to do from these Paper 1, 2 and 3 workbooks for all topics you have so far covered in class you still have extra time to use, instead of skipping ahead in the syllabus, work towards the kinds of extracurricular activities that the best universities use to make offers to students with otherwise identical academic achievements. More information can be found here:
https://www.smashingscience.org/uni-guidance

Effective Note-Taking Tips and Examples

Develop a code system of note-marking to indicate questions, comments, important points, for example:

a) Mark unfamiliar vocabulary & unclear ideas in unique ways, such as with a star or asterisk. Highlight vocabulary terms and important people.

b) Circle ideas that are still unclear.

c) Make sure you can understand what you have written and if needed, make corrections. Use drawings, arrows or other organizers to help you see concepts and relationships between them.

d) If you don't understand an idea, leave a large blank space and ask your teacher, or investigate it in your textbook. Update your notes with what you found out.

e) Use accepted **abbreviations** and **symbols** wherever you are comfortable e.g.

i. s/ for some: s/thing, s/where

ii. Positive: +ve, +vely, Negative: -ve, -vely

iii. H^+ for proton, e^- for electron

iv. ↓ for less, smaller or decreasing; ↑ for more, increasing or bigger

v. And is & or +

vi. Equalities and relationships: ≈approx.; ≠not the same; ≡ exactly the same; x <y x is less or x>y x is more.

vii. Take particular care when writing chemical symbols and include state symbols whenever possible when you know them, so bromine is $Br_2(l)$ not Br!

viii. Always pay attention to bonding when ordering atoms in structures, so for methanol write $HO\text{-}CH_3$ instead of $OH\text{-}CH_3$ etc.

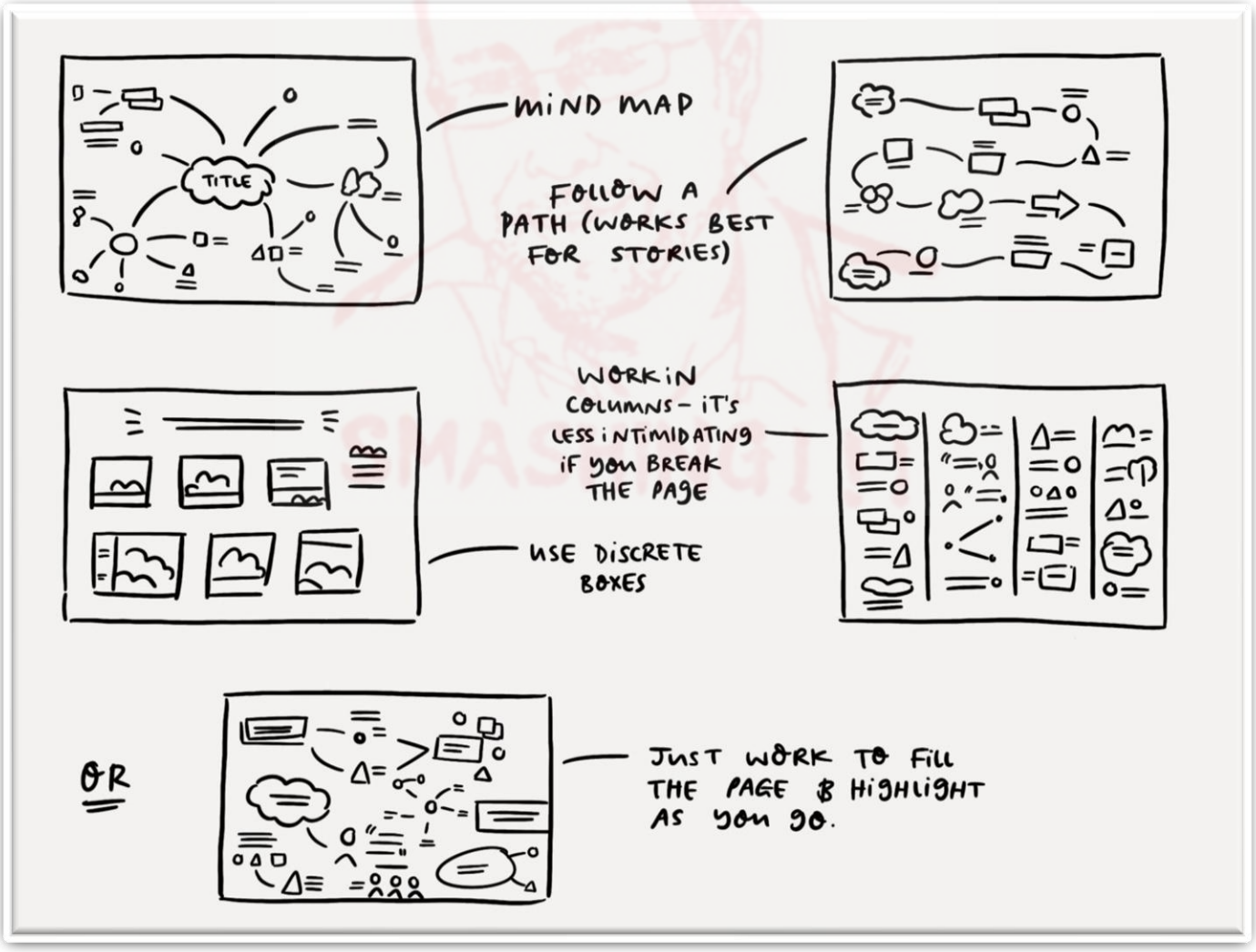
ix. If your notetaking style really favours abbreviations and you find you use a larver number, make sure that you have a key page in your notes explaining what your abbreviations mean.

x. At the start of every term, spend 15 minutes to analyse your notes only for abbreviations. Do they still make sense? Do they make it harder, easier or no impact to understand your notes? Often for most students most abbreviations usually create more problems than they solve.

xi. NEVER use any abbreviations except chemical elements in exam questions, either when you are practicing or in the exams!

For a more detailed and involved exploration and explanation of notetaking download document attached to this QR code (30 pages):


Sketchnote Basics
1. Arrows
2. Banners
Sketchnotes
3. Containers
4. Frames
5. Icons
6. People
7. Speech Bubbles
Wow!
8. Thought Bubbles
I ♥ You!


TITLE
MIND MAP
FOLLOW A PATH (WORKS BEST FOR STORIES)
WORK IN COLUMNS - IT'S LESS INTIMIDATING IF YOU BREAK THE PAGE
USE DISCRETE BOXES
OR
JUST WORK TO FILL THE PAGE & HIGHLIGHT AS YOU GO.


DRAW YOUR NOTES!
INTRO TO VISUAL NOTE-TAKING
by Ink Factory Studio
VISUAL HIERARCHY
SCALE
CONTRAST
COLOR
PATTERN
TOOLS
Pick the "CANVA" first
pens
brushes
digital
WARM UP EXERCISES
lines & circles
circles & squares
draw the TITLE & an ANCOR image
TITLE
COLORS
CONTRAST
SATURATION
One COLOR for ONE INFORMATION or SPEAKER
1 DARK
1 LIGHT
1 MEDIUM
HAND WRITING
LETTERING more elaborate Lettering
WRITE IN UPPERCASE
DRAW BLOCK LETTERS
COMPOSITION
3 TYPES: CENTER
PILLARS
TIME-LINE
VISUAL LANGUAGE
ICONS LIBRARY
SIMPLE! NOT A MASTER-PIECE
ACTIVE LISTENING
FILTER
SYNTHETISE
PRACTISE & IMPROVE
CHECKLIST to set up FOR SUCCESS
Ask FOR FEEDBACK
CONCLUSION
It takes TIME & PRACTISE
Let's GO!


Sketchnote Tips
Carol Anne McGuire
Lettering
Print (easy to read)
High Low
SKINNY FAT
ALL CAPS
Small Caps
Kinder
FANCY
Fast
REVERSE
BLOCK
3D
DASH
Script
Bullets
Scroll
Frames
HELLO!
HELLO
HELLO
WOW
ANGRY!
Scary
ELECTRONIC
Banner
Connectors
1. 2. 3.
Shadows
People

How To Illustrate Your Notes

YOU CAN DO IT!

YES. I CAN DO IT!

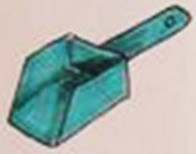
By Revise or Die

IT'S ALL ABOUT PIC N' MIX Y'KNOW

① CHOOSE YOUR 'BAG'... (TYPE OF NOTES)

MINDMAP? POSTER? THE CORNELL METHOD?
THE OUTLINING METHOD? THE CHARTING METHOD?

② CHOOSE YOUR 'SCOOP'... (FONTS/TOOLS/COLOURS)



THERE are SO MANY kinds OF FONTS TO choose FROM
to find inspo go to dafont.com!

TOOLS → PENS → BIRO → FINELINER
→ GEL → FELT TIP
→ HIGHLIGHTER
→ PENCILS

Colours - if you're feeling really snazzy, choose a colour palette for your work! Here's some suggested ones I use...

A) B) C) D) E)

③ CHOOSE YOUR 'SWEETS'... (TWIDDLY BITS)

CLOUDS

BANGS

Polaroids

PINS

FLAGS

STARS

RIBBONS

DASHED LINES

ARROWS...

LOTS OF ARROWS

STEP-BY-STEPS! HA!

LITTLE DRAWINGS OF WHO YOU'RE STUDYING

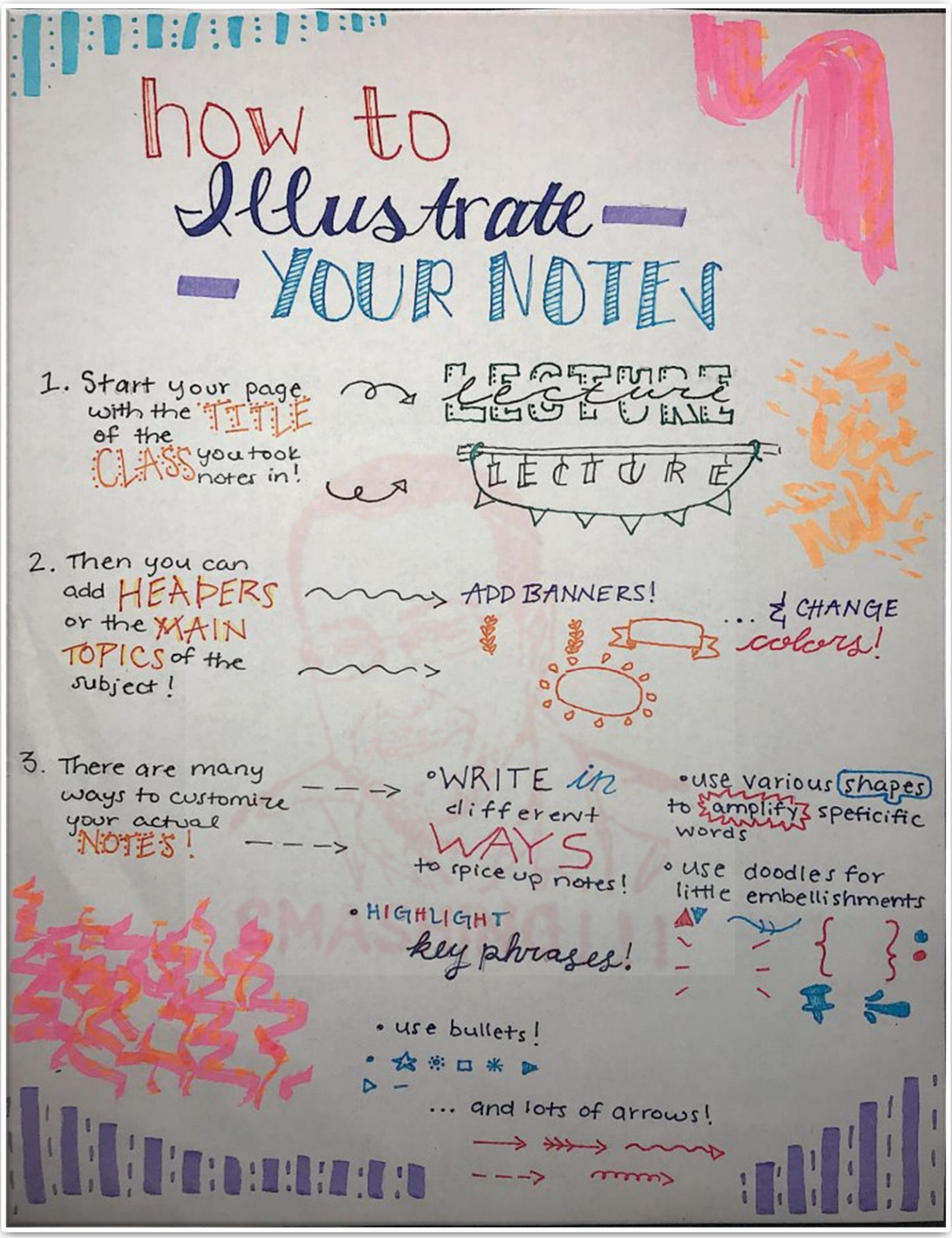
TABLES

y

graphs x

COGS

+ anything specific to the subject - don't be afraid to draw it!


how to
Illustrate
- YOUR NOTES
1. Start your page with the TITLE of the CLASS you took notes in!
LECTURE NOTES
LECTURE
2. Then you can add HEADERS or the MAIN TOPICS of the subject!
ADD BANNERS!
... & CHANGE colors!
3. There are many ways to customize your actual NOTES!
• WRITE in different WAYS to spice up notes!
• use various shapes to amplify speficific words
• use doodles for little embellishments
• HIGHLIGHT key phrases!
• use bullets!
... and lots of arrows!

how i write outlines/take notes

ROMAN NUMERAL METHOD: (outline)

required format by my bio teacher

I. Main Topic
  A. Section Name (pg #)
    1.
    2.
    3.
    4.
    5.
    and so on...
  B. Section Name (pg #)
    1. Important fact/concept/etc.
      a. Expansion/going into details
    2. important fact/concept/etc.
      a.
      b.
      c.
    II. Main Topic
    and so on...

I usually jot notes down in the margins

} important facts, concepts, examples, etc.

} Expansion, details, more examples, etc.

Highlight key points/ definitions/ things the teacher goes over

EXAMPLE

I. Energy and the Cell
  A. Cells transform energy as they perform work (pg. 80)
    1. ~~Energy is the capacity to cause change or to perform work~~. The 2 types of energy are kinetic and potential.
      a. ~~Kinetic energy is the energy of motion~~. Moving objects transfer motion to other matter. ~~Heat~~ is a type of kinetic energy associated with the ~~random movement of atoms/etc~~.

measured in temp

      b. ~~Potential energy is energy that is a result of its location or structure~~. Chemical energy is the potential energy available for release in a chemical reaction.

potential to be kinetic energy

MY USUAL OUTLINE METHOD:

[Section #] Section Name

→ summary from textbook

Heading
{MAIN IDEA}
- info (important dates/ events/ people/ concepts/etc.)

SUBHEADING
- info
- event
  ↳ effect
- info
(Ex.) examples

I usually write the headings and subheadings in a different color

EXAMPLE

[Section 1] The Road to World War I

→ 1914, summer: Crisis in the Balkans led to conflict when a Serbian terrorist assassinated Archduke Francis Ferdinand...

Causes of the War
{MAIN IDEA} Nationalism, militarism, and a system of alliances contributed to the start of World War I.
- system of nation-states that were formed led to competition

NATIONALISM AND ALLIANCES
- Europe's greatest powers were divided into 2 allian

the ~~Triple Alliance~~ (1882) AND the ~~Triple Entente~~ (1907

- Germany
- Austria-Hungary
- Italy

- France
- Great Britain
- Russia

Topic 1 States of Matter Syllabus

1 States of matter

1.1 Solids, liquids and gases

Core	Supplement
1 State the distinguishing properties of solids, liquids and gases	
2 Describe the structures of solids, liquids and gases in terms of particle separation, arrangement and motion	
3 Describe changes of state in terms of melting, boiling, evaporating, freezing and condensing	5 Explain changes of state in terms of kinetic particle theory, including the interpretation of heating and cooling curves
4 Describe the effects of temperature and pressure on the volume of a gas	6 Explain, in terms of kinetic particle theory, the effects of temperature and pressure on the volume of a gas

1.2 Diffusion

Core	Supplement
1 Describe and explain diffusion in terms of kinetic particle theory	2 Describe and explain the effect of relative molecular mass on the rate of diffusion of gases

Exercise: End of Topic Targets Checklist

Recording your targets as you achieve them

For each topic you ought to try to do as many of the following things to get the most out of your time, the most out of the resources available to you so that you grow as a thoughtful and deliberate student.

- Tick each goal off as you complete it in the table that follows.
- Growth is difficult and uncomfortable, but you should choose to do these things, and the other things, not because they are easy, but because they are hard, because that goal will serve to organize and measure the best of our energies and skills, **because that challenge is one that we are willing to accept**, one we are unwilling to postpone, **and one which we intend to win**![5]
- **For more copies of this checklist** see the editable Word file on: https://www.smashingscience.org/a-level-chemistry-caie
- Most of these targets can also be used for other sciences you might be studying, as well as (some) other non-science subjects.

Reviewing your performance

After you have completed every topic you can review your performance, not only in terms of the end of topic test, but also other important behaviours the highly effective students show and grow during their education.

- A structured way to do this reflection can be found in the "***Exercise: End of Topic Review and Reflection***".
- These are systematic ways to reflect and think about a topic you have done, so that you can try new things to deliver a better performance in the next topic.
- As important as understanding what didn't work is to celebrate what did work. **Find your wins from the last topic, recognise them, and celebrate them**. You could, for instance include them when you think about the 3 goals you have accomplished in the To-do Checklist at the start.

[5] Another version of this famous quote is "We chose these things not because they are easy, but because we thought they would be easy."

- Being detailed and specific in what the problem could be if you didn't learn as well as you would like can help you be specific and detailed in how you will fix it. It will also help you find out more about your learning style and give you a better understanding of yourself, and better control over yourself.
- A key component to **executive function** is to think that there is a part of yourself that is the CEO or boss, of all of the other parts of your self and your mind. But most of yourself is not that boss part, so to develop an effective (functional) relationship with yourself it is important that you are working with yourself in a positive and thoughtful and kind way. Do not ask things of yourself that you know are unlikely to happen, or are impossible to achieve. When you are making plans about what you will do to improve, you should aim to be a good boss, someone who delivers important and meaningful outcomes for yourself. A great leader does not just do whatever is easiest, or most popular in the short term, but instead gives a clear plan (what to do, how to do it and when) for how success will happen next time.
- **Small, incremental growth across time is incredibly powerful**. Sometimes it happens by chance, or through luck, but the best way to get constant growth is to be deliberate about it, and rather than thinking (or hoping) you will be better next time, give yourself specific targets, for instance "I will put an extra 10 minutes every day to consolidate my notes and fill in the cue column to my notes in chemistry".

End of Topic 1 Goals Checklist

For each topic you ought to try to do as many of the following things to get the most out of your time, the resources available to you and to help you grow as a student. Tick each goal off as you complete it.
Growth can be painful, but the more of it you do, the easier it can become!!!

Aspect	What you should have done	Yes/No	Level
Interacted with your teacher	Ask your teacher 1 question, about anything, once a week		FUNDAMENTAL
	Try to answer one question asked by your teacher at least once a week		ESSENTIAL
	Ask your teacher one question about something you do not understand in science once a week		ESSENTIAL
	Ask your teacher one question about something to do with science every lesson		EXTENSION
Notes and follow up notes	Complete set of class note		FUNDAMENTAL
	Cornell Notetaking Attempted		ESSENTIAL
	Cornell Notetaking Completed		EXTENSION
	Cornell Notetaking Completed to an exemplary standard		EXCEPTIONAL
	Attempted the Mind Map for this topic		ESSENTIAL
	Completed the Mind Map for this topic		EXTENSION
Textbook	Read ahead before the topic has been started		EXTESNION
	Highlighted key ideas and translate new words		FUNDAMENTAL
	Completed the questions at the end of each 2 page spread in your exercise book		EXTENSION
	Added to your class notes ideas and important information from the textbook that you learnt		EXTENSION
Past Exam Questions	Worked on at least 25% of the exam questions in this workbook		FUNDAMENTAL
	Attempted more than 25% of the questions and those questions you have completed you have marked in a different colour pen		ESSENTIAL
	Completed and marked all questions here		EXTENSION
	Completed, marked and additional key ideas where you have located the most difficult marks added to your notebook		EXCEPTIONAL
	Used the resources available online to answer additional questions not found in this workbook on the current topic.		EXCEPTIONAL
	Ask your teacher about an exam question that they cannot answer		EXCEPTIONALLY SMASHING!!!
Assessed Activities	Complete the word list activity using the word list at the front of each topic as little as possible		FUNDAMENTAL
	Complete 2 assessed activities, either in class or as homework		ESSENTIAL

Aspect	What you should have done	Yes/No	Level
	Complete 2 assessed activities and scored over 70% on average		ESSENTIAL
	Complete 2 assessed activities and scored over 80% on average		EXTENSION
	Complete 2 assessed activities and scored over 90% on average		EXCEPTIONAL
End of Topic Test	Revised sufficiently well to improve upon your score from the previous test (except if you are scoring over 90%, then just write Y for this goal)		ESSENTIAL
	Scored 10% higher than your current average		EXTENSION
	Scored 15% or more than your previous end of topic average		EXCEPTIONAL
	Scored over 90%		EXTESNION
	Scored over 95%		SMASHING!!!
Reading	Spend more than 1 hour a week reading a book **you enjoy** (in any language) about anything.		ESSENTIAL
	Spend more than 3 hours a week reading a book **you enjoy** (in any language) about anything.		EXTENSION
	Spend more than 5 hours a week reading a book **you enjoy** (in any language) about anything.		EXCEPTIONAL
	Spend at least one hour a week reading a book **you enjoy** in English about anything.		EXTENSION
	Spend more than 3 hours a week reading a book **you enjoy** in English about anything.		EXCEPTIONAL
Reflection	You completed this goal setting table		FUNDAMENTAL
	You have looked at the goals you have achieved and the ones you have not and added them up and entered them into the table in the Review and Reflection section		ESSENTIAL
	You have given an answer for every question in the Review and Reflection section at the end of this topic		EXTENSION
	You have Given good and thoughtful answers for every question in the Review and Reflection section at the end of this topic		EXCEPTIONAL

T1 Keywords

Many words used in science have a meaning that is slightly different to their common everyday English meaning, for instance a salt is the product of an acid and base reacting together in chemistry, but normally thought of as table salt (NaCl) in common use.

1	**arrangement** How particles are organized in a solid, liquid or gas. e.g. for a solid it is regular, without any gaps and the particles are touching.
2	**boiling** When a liquid reaches a certain temperature it turns into a gas, which can happen anywhere forming bubbles we can see. e.g. H_2O (l) → H_2O (g)
3	**boiling point** The temperature when a liquid changes into a gas. For pure substances this is very sharp - above this temperature there is only gas, colder than this and there is only liquid. e.g. for pure water it is exactly 100 °C.
4	**condensation** When a gas cools to become a liquid. e.g. H_2O (g) → H_2O (l)
5	**diffusion** When two substances mix as a result of the random motion of particles in a fluid. e.g. when you can smell food shortly after opening a sealed container, or when solid salt dissolves in water.
6	**evaporation** When a liquid becomes a gas at a temperature below the boiling point. Can only happen at the surface of the liquid. e.g. when wet clothes become dry after a few hours on a clothesline.
7	**fluid** Their particles can move around each other. They can flow and will take the shape of their container. e.g. either a liquid or a gas.
8	**freezing** When a liquid, like water, turns to a solid, like ice. e.g. H_2O (l) → H_2O (s)
9	**gas** A state that does not have a fixed volume or shape, it takes both volume and the shape of the container it is in because the particles are not touching (big gaps), they are randomly arranged and moving randomly at high speed. e.g. air, CO_2 (g) or H_2 (g), but not Fe (l).
10	**kinetic (energy)** All particles have a certain amount of this movement energy, when it gets larger, they are able to break the bonds holding them in a fixed position as a solid to become a liquid, then a gas.

	e.g. the useful energy that engines release from the chemical energy in their fuels.
11	**liquid** A state that has fixed volume but takes the shape of the container because the particles are close together (touching) but randomly arranged, they can move easily. e.g. NaCl (l), H_2O (l) or Br_2 (l), but not Fe (s).
12	**matter** Any kind of thing that could exist and includes exotic ideas from physics. e.g. air, water, gold, electrons or even things that have yet to be discovered, but are thought to exist, like dark matter.
13	**melting point** The exact temperature when a solid turns into a liquid. For a pure substance this is very sharp so it can be used to test if something is pure. e.g. for pure water it is exactly 0 °C.
14	**movement (of particles)** For each of the three states of matter this is different in terms of how fast and how far the particles are able to go. e.g. in a gas this is at high speed, in a liquid they slide past each other and in a solid they are in a fixed position, but vibrating.
15	**particles** Any kind of substance that is very small. e.g. all substances, including liquids and gases, are made from these.
16	**physical change** When a substances changes from solid to liquid to gas to liquid. No chemical changes happen, e.g. (s) → (l) or (g) → (l)
17	**random (arrangement)** When particles of a substance have no organisation or pattern and cannot be predicted. e.g. the organisation of particles in a gas or liquid.
18	**regular (arrangement)** When particles are organised into a pattern and ordered, like the particles of a solid. e.g. the organisation of particles in a solid.
19	**solid** A state which has fixed volume and shape because the particles are touching (no gaps) and in a regular arrangement in fixed position, vibrating. e.g. the substances I_2 (s), H_2O (s), NaCl(s), SiO_2 (s), Fe (s) or the alloy steel, but not Fe (l).
20	**states of matter** A specific way that matter is arranged at a specific temperature and pressure. i.e. solid (s), liquid (l) or gas (g).
21	**sublimation**

	When a solid turns directly into a gas without becoming a liquid. “Dry ice” is carbon dioxide that has been frozen into a very cold solid, it is said to be dry because it never forms a liquid. e.g. CO_2 (s) → CO_2 (g)
22	**substance** Matter that has chemical properties. e.g. air, bromine, Br_2 (l), or sodium chloride, NaCl (s), but not light, gravity or time.

T1 Paper 1 Exam Questions

iG Chem 1nw EQ P1 12w to 02s 31marks

Q# 1/ iGCSE Chemistry/Paper 1/2012/w/Paper 11/

1 What are the processes W, X, Y and Z in the following diagram?

$$\text{solid} \underset{Y}{\overset{W}{\rightleftharpoons}} \text{liquid} \underset{Z}{\overset{X}{\rightleftharpoons}} \text{gas}$$

	W	X	Y	Z
A	condensing	boiling	freezing	melting
B	condensing	freezing	melting	boiling
C	melting	boiling	freezing	condensing
D	melting	freezing	condensing	boiling

Q# 2/ iGCSE Chemistry/Paper 1/2012/w/Paper 11/

2 A mixture of sulfur and iron filings needs to be separated. The solubilities of sulfur and iron filings in water and carbon disulfide are shown in the table below.

	solubility in water	solubility in carbon disulfide
sulfur	✗	✓
iron filings	✗	✗

What are possible methods of separating the sulfur and iron filings?

	using water	using carbon disulfide	using a magnet
A	✓	✓	✗
B	✗	✓	✓
C	✓	✗	✓
D	✗	✓	✗

3 Part of the instructions in an experiment reads as follows.

Quickly add 50 cm^3 of acid.

What is the best piece of apparatus to use?

A a burette

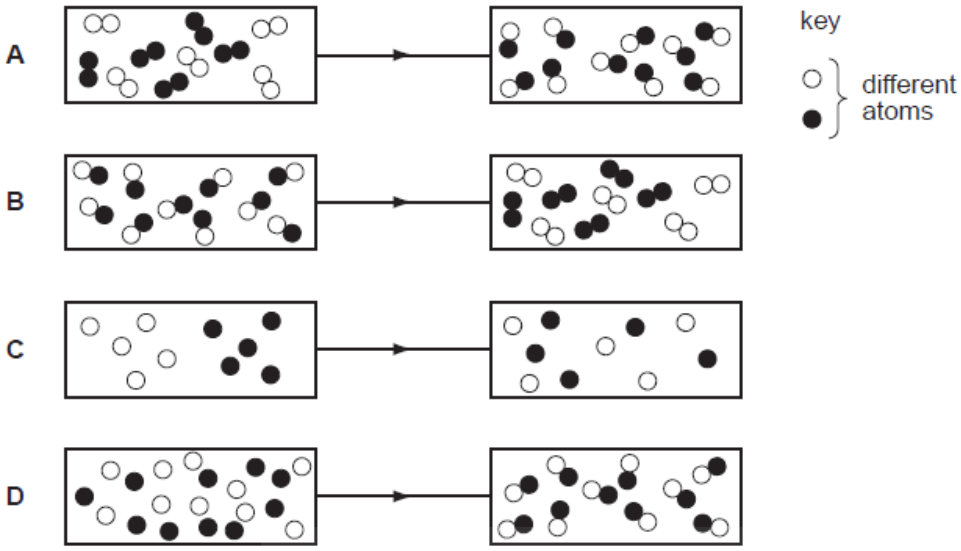
B a conical flask

C a measuring cylinder

D a pipette

Q# 3/ iGCSE Chemistry/Paper 1/2012/s/Paper 11/

1 Which diagram shows the process of diffusion?



Q# 4/ iGCSE Chemistry/Paper 1/2011/w/Paper 11/

1 In which substance are the particles close together and slowly moving past each other?

A air

B ice

C steam

D water

Q# 5/ iGCSE Chemistry/Paper 1/2011/s/Paper 11/

1 The diagrams show the arrangement of particles in three different physical states of substance X.

Which statement about the physical states of substance X is correct?

A Particles in state 1 vibrate about fixed positions.

B State 1 changes to state 2 by diffusion.

C State 2 changes directly to state 3 by condensation.

D The substance in stage 3 has a fixed volume.

Q# 6/ iGCSE Chemistry/Paper 1/2010/w/Paper 11/

1 In which changes do the particles move further apart?

$$\text{gas} \underset{Y}{\overset{W}{\rightleftharpoons}} \text{liquid} \underset{Z}{\overset{X}{\rightleftharpoons}} \text{solid}$$

A W and X **B** W and Z **C** X and Y **D** Y and Z

Q# 7/ iGCSE Chemistry/Paper 1/2010/s/Paper 11/

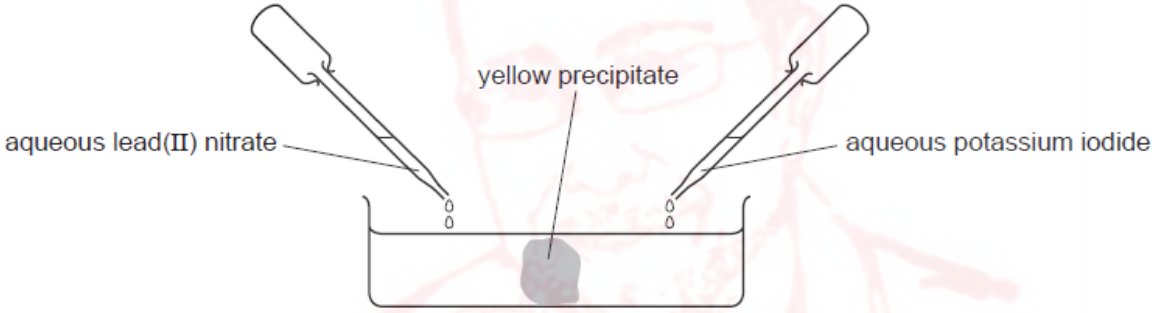
1 The diagram shows a cup of tea.

Which row describes the water particles in the air above the cup compared with the water particles in the cup?

	moving faster	closer together
A	✓	✓
B	✓	✗
C	✗	✓
D	✗	✗

Q# 8/ iGCSE Chemistry/Paper 1/2009/w/Paper 11/

1 Aqueous lead(II) nitrate and aqueous potassium iodide are added to a dish containing water, as shown.



A yellow precipitate forms after a few minutes.

Which process occurs before the precipitate forms?

A diffusion

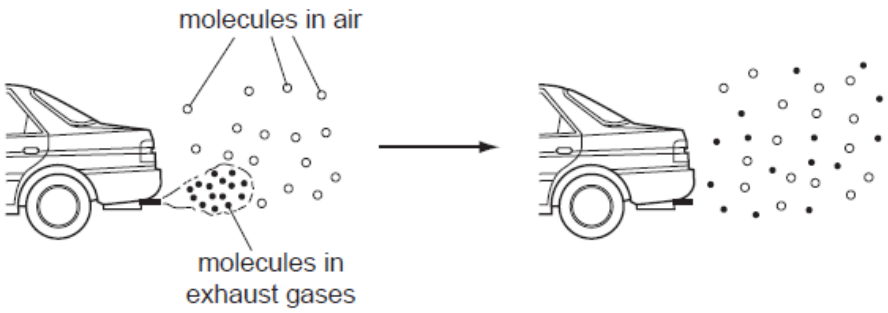
B distillation

C fermentation

D filtration

Q# 9/ iGCSE Chemistry/Paper 1/2009/s/

1 The diagram shows how the molecules in the exhaust gases diffuse into the air.



Which statement describes what happens to these molecules next?

A The molecules fall to the ground because they are heavier than air molecules.

B The molecules go back together as they cool.

C The molecules spread further into the air.

D The molecules stay where they are.

Q# 10/ iGCSE Chemistry/Paper 1/2008/w/

1 In which substance are the particles furthest apart at room temperature?

A ethanol

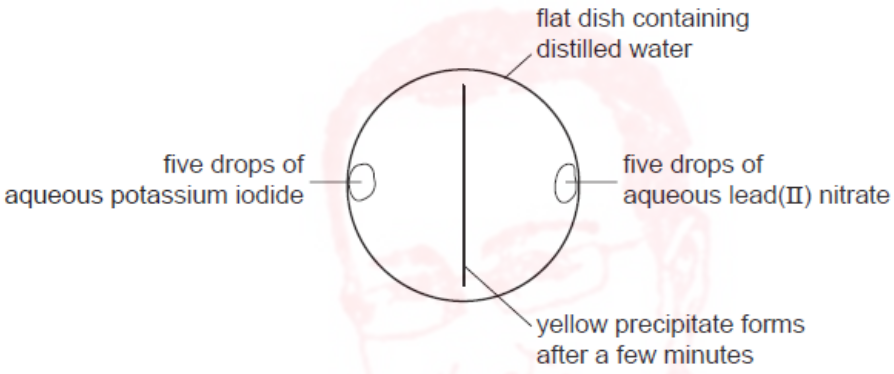
B methane

C salt

D sugar

Q# 11/ iGCSE Chemistry/Paper 1/2008/s/

1 A yellow precipitate is formed in the experiment shown.



How is the precipitate formed?

A Particles collide, diffuse and then react.

B Particles collide, react and then diffuse.

C Particles diffuse, collide and then react.

D Particles diffuse, react and then collide

Q# 12/ iGCSE Chemistry/Paper 1/2007/w/

1 Oxides of nitrogen from car exhausts can spread through the atmosphere.

This occurs because gas molecules move from a region of ……1…… concentration to a region of ……2…… concentration by a process called ……3…… .

Which words correctly complete the gaps?

	1	2	3
A	high	low	diffusion
B	high	low	evaporation
C	low	high	diffusion
D	low	high	evaporation

Q# 13/ iGCSE Chemistry/Paper 1/2007/s/

1 When there is no wind, the scent of flowers can be detected more easily on a warm evening than on a cold evening.

This is because the molecules of the scent .....1..... .....2..... than in colder conditions.

Which words correctly complete gaps 1 and 2?

	gap 1	gap 2
A	condense	nearer to the flowers
B	condense	further from the flowers
C	diffuse	nearer to the flowers
D	diffuse	further from the flowers

Q# 14/ iGCSE Chemistry/Paper 1/2006/w/

1 In which change of state do the particles become more widely separated?

A gas to liquid

B gas to solid

C liquid to gas

D liquid to solid

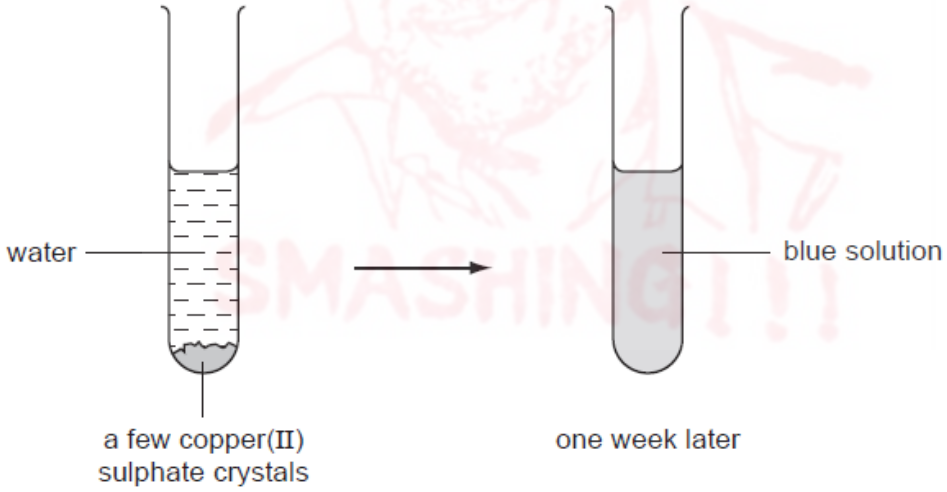
Q# 15/ iGCSE Chemistry/Paper 1/2006/s/

1 At room temperature, in which substance are the particles furthest apart?

A H_2 **B** H_2O **C** Mg **D** MgO

Q# 16/ iGCSE Chemistry/Paper 1/2005/w/

1 Blue copper(II) sulphate crystals are soluble in water.



What has happened after one week?

A crystallisation

B diffusion

C distillation

D filtration

Q# 17/ iGCSE Chemistry/Paper 1/2005/s/

1 In which of the following are the particles arranged in a regular pattern?

A a gas

B a liquid

C a metal

D a solution

Q# 18/ iGCSE Chemistry/Paper 1/2004/w/

1 When steam at 100 °C condenses to water at 25 °C, what happens to the water molecules?

A They move faster and closer together.

B They move faster and further apart.

C They move slower and closer together.

D They move slower and further apart.

2 The melting points and boiling points of four substances are shown.

Which substance is liquid at 100 °C?

substance	melting point / °C	boiling point / °C
A	–203	–17
B	–25	50
C	11	181
D	463	972

Q# 19/ iGCSE Chemistry/Paper 1/2004/s/

1 Some students are asked to describe differences between gases and liquids.

Three of their suggestions are:

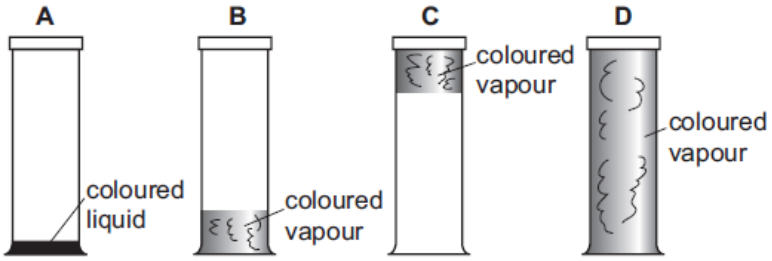
1	gas molecules are further apart;
2	gas molecules are smaller;
3	liquid molecules vibrate around fixed positions.

Which suggestions are correct?

A 1 only **B** 2 only **C** 3 only **D** 1, 2 and 3

2 A coloured liquid vaporises easily at room temperature. Some of the liquid is placed at the bottom of a sealed gas jar.

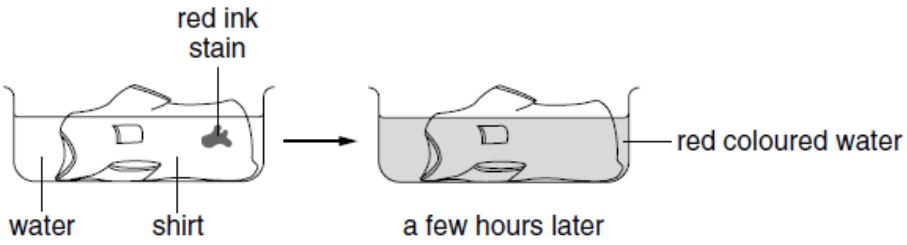
Which diagram shows the appearance of the jar after several hours?



Q# 20/ iGCSE Chemistry/Paper 1/2003/w/

1 A shirt is stained with red ink from a pen.

The shirt is left to soak in a bowl of water.



Which process causes the red colour to spread?

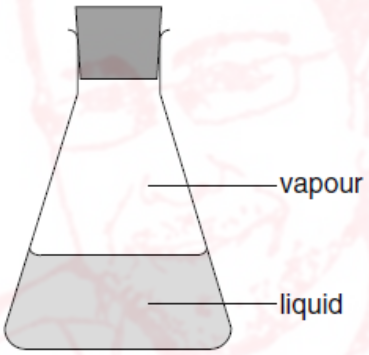
A diffusion

B evaporation

C melting

D neutralisation

2 A sealed conical flask contains a liquid and its vapour, as shown.



What happens when a molecule in the vapour enters the liquid?

	the molecule stops moving	the molecule becomes smaller
A	✓	✓
B	✓	✗
C	✗	✓
D	✗	✗

Q# 21/ iGCSE Chemistry/Paper 1/2003/s/

4 What could be the melting point and boiling point of water containing a dissolved impurity?

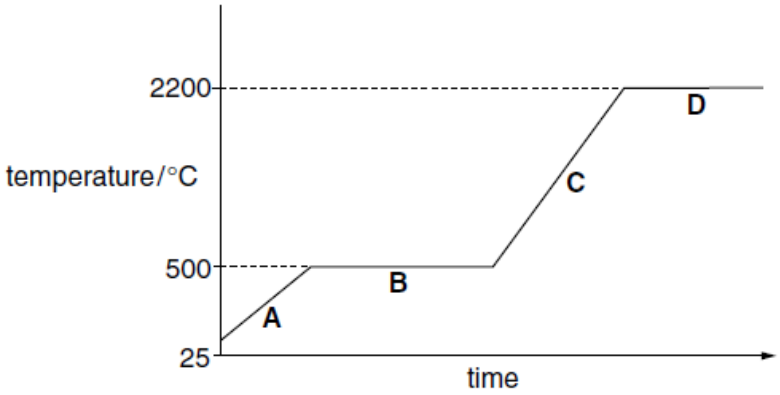
	melting point / °C	boiling point / °C
A	+3	96
B	+3	104
C	–3	96
D	–3	104

Q# 22/ iGCSE Chemistry/Paper 1/2003/s/

2 A solid metal is heated until it turns to vapour.

The graph shows the temperature of the metal during this process.

Which part of the graph shows the melting of the metal?



Q# 23/ iGCSE Chemistry/Paper 1/2003/s/

3 Some chemical compounds are purified by recrystallisation.

What can be used to test the purity of the crystals?

A melting point

B colour of crystals

C size of crystals

D solubility

Q# 24/ iGCSE Chemistry/Paper 1/2002/w/

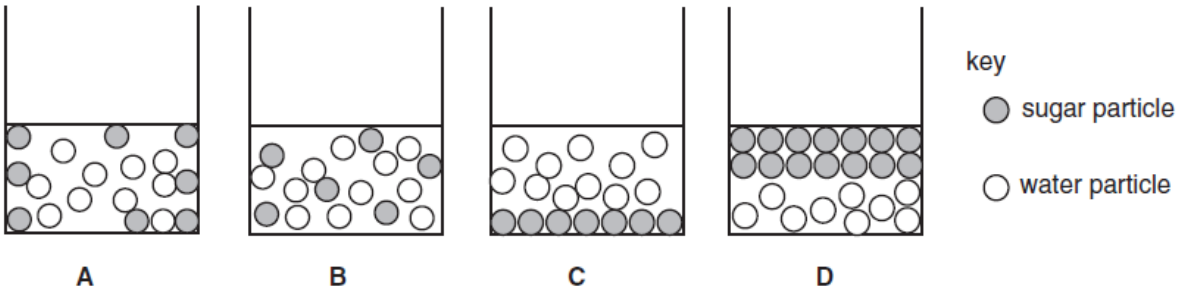
1 Heating a liquid causes it to become a vapour.

What happens to the molecules of the liquid during this process?

	the molecules become bigger	the molecules move further apart
A	✓	✓
B	✓	✗
C	✗	✓
D	✗	✗

2 Some sugar is dissolved in water.

Which diagram shows how the particles are arranged in the solution?



T1 Paper 1 Mark Scheme

Mark Scheme iG Chem 1nw EQ P1 12w to 02s 31marks

Q# 1/ iGCSE Chemistry/Paper 1/2012/w/Paper 11/
1 C

Q# 2/ iGCSE Chemistry/Paper 1/2012/w/Paper 11/
3 C

Q# 3/ iGCSE Chemistry/Paper 1/2012/s/Paper 11/
1 C

Q# 4/ iGCSE Chemistry/Paper 1/2011/w/Paper 11/
1 D

Q# 5/ iGCSE Chemistry/Paper 1/2011/s/Paper 11/
1 D

Q# 6/ iGCSE Chemistry/Paper 1/2010/w/Paper 11/
1 D

Q# 7/ iGCSE Chemistry/Paper 1/2010/s/Paper 11/
1 B

Q# 8/ iGCSE Chemistry/Paper 1/2009/w/Paper 11/
1 A

Q# 9/ iGCSE Chemistry/Paper 1/2009/s/
1 C

Q# 10/ iGCSE Chemistry/Paper 1/2008/w/
1 B

Q# 11/ iGCSE Chemistry/Paper 1/2008/s/
1 C

Q# 12/ iGCSE Chemistry/Paper 1/2007/w/
1 A

Q# 13/ iGCSE Chemistry/Paper 1/2007/s/
1 D

Q# 14/ iGCSE Chemistry/Paper 1/2006/w/
1 C

Q# 15/ iGCSE Chemistry/Paper 1/2006/s/
1 A

Q# 16/ iGCSE Chemistry/Paper 1/2005/w/
1 B

Q# 17/ iGCSE Chemistry/Paper 1/2005/s/
1 C

Q# 18/ iGCSE Chemistry/Paper 1/2004/w/
1 C
2 C

Q# 19/ iGCSE Chemistry/Paper 1/2004/s/
1 A
2 D

Q# 20/ iGCSE Chemistry/Paper 1/2003/w/
1 A
2 D

Q# 21/ iGCSE Chemistry/Paper 1/2003/s/
4 D

Q# 22/ iGCSE Chemistry/Paper 1/2003/s/
2 B

Q# 23/ iGCSE Chemistry/Paper 1/2003/s/
1 C
2 B
3 A

Q# 24/ iGCSE Chemistry/Paper 1/2002/w/
1 C
2 B

T1 Paper 4 Exam Questions

ESSENTIAL EXAM QUESTIONS **Paper 4** Topic 1 50marks Mark Scheme

Q# 1/ iGCSE Chemistry/2015/s/Paper 31/ Q6

(c) Gases diffuse, which means that they move to occupy the total available volume.

(i) Explain, using kinetic particle theory, why gases diffuse.

.....

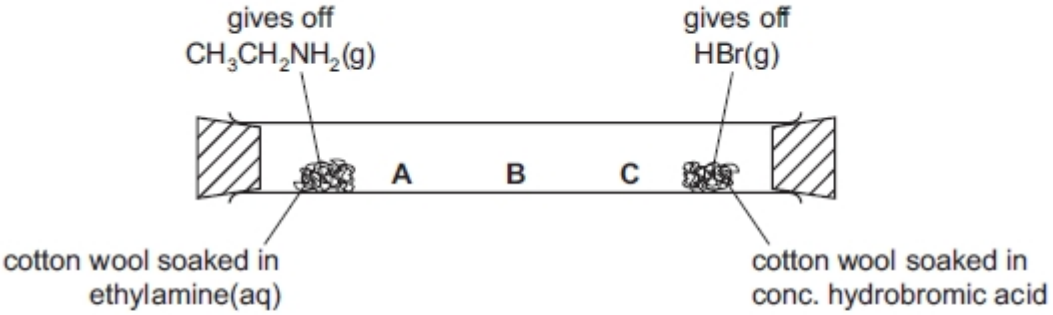
.....

..... [2]

(ii) When the colourless gases hydrogen bromide and ethylamine come into contact, a white solid is formed.

$$CH_3CH_2NH_2(g) + HBr(g) \rightarrow \underset{\text{white solid}}{CH_3CH_2NH_3Br(s)}$$

The following apparatus can be used to compare the rates of diffusion of the two gases ethylamine and hydrogen bromide.



Predict at which position, **A**, **B** or **C**, the white solid will form. Explain your choice.

.....

.....

..... [3]

Q# 2/ iGCSE Chemistry/2014/s/Paper 31/Q3 (c)

(iii) Suggest another method, other than diffusion, by which helium could be separated from the mixture of gases in natural gas.

..... [1]

Q# 3/ iGCSE Chemistry/2014/s/Paper 31/

3 **(a)** Different gases diffuse at different speeds.

(i) What is meant by the term *diffusion*?

.....

..... [1]

(ii) What property of a gas molecule affects the speed at which it diffuses?

..... [1]

(b) Helium is a gas used to fill balloons. It is present in the air in very small quantities. Diffusion can be used to separate it from the air.

Air at 1000 °C is on one side of a porous barrier. The air which passes through the barrier has a larger amount of helium in it.

(i) Why does the air on the other side of the barrier contain more helium?

..... [1]

(ii) Why is it an advantage to have the air at a high temperature?

.....

..... [1]

Q# 4/ iGCSE Chemistry/2012/w/Paper 31/

7 Both strontium and sulfur have chlorides of the type XCl_2. The table below compares some of their properties.

	strontium chloride	sulfur chloride
appearance	white crystals	red liquid
formula	$SrCl_2$	SCl_2
melting point / °C	874	–120
boiling point / °C	1250	59
conductivity of liquid	good	poor
solubility in water	dissolves to form a neutral solution	reacts to form a solution of pH 1

(a) (i) Use the data in the table to explain why sulfur chloride is a liquid at room temperature, 25 °C.

.....

..... [2]

Q# 5/ iGCSE Chemistry/2010/s/Paper 31/

2 Ozone is a form of oxygen. Ozone is present in the upper atmosphere and it prevents dangerous solar radiation from reaching the Earth's surface. Some of the chemicals that diffuse into the upper atmosphere decompose ozone. Chemicals that have this effect are methane (CH_4), chloromethane (CH_3Cl) and an oxide of nitrogen (NO_2).

(i) Which of these three chemicals diffuses the most slowly? Give a reason for your choice.

.....

.....

..... [2]

Q# 6/ iGCSE Chemistry/2006/w/Paper 3/

2 The table shows the melting points, boiling points and electrical properties of the six substances **A** to **F**.

substance	melting point / °C	boiling point / °C	electrical conductor at room temperature	electrical conductor of substance dissolved in water
A	961	2193	good	does not dissolve
B	113	444	does not conduct	does not dissolve
C	0	100	very poor	very poor
D	803	1465	does not conduct	good
E	–5 to -10	102 to 105	good	good
F	-85	-60	does not conduct	does not dissolve

(i) Which **three** substances are solids at room temperature?

..... [1]

(iii) Which **one** is a gas at room temperature?

..... [1]

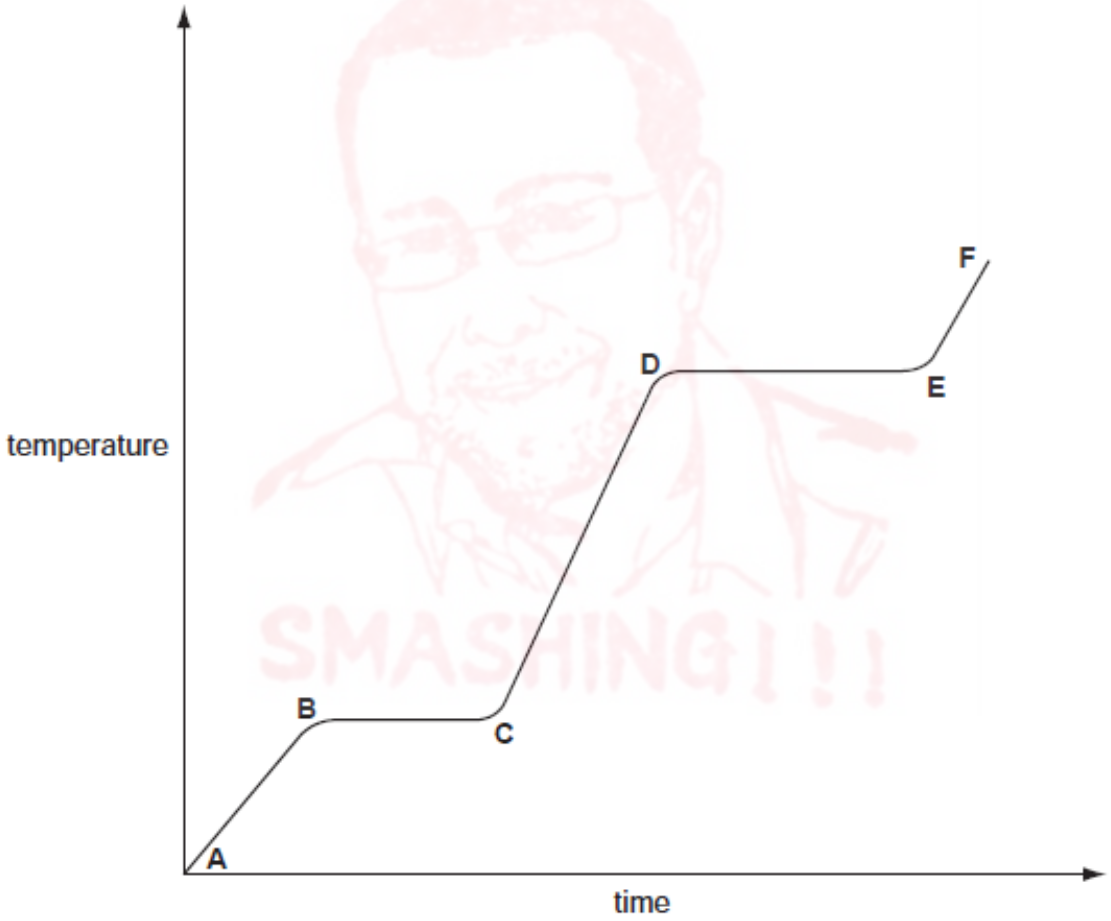
(iv) Which **two** substances are liquids at room temperature?

..... [1]

Q# 7/ iGCSE Chemistry/2005/w/Paper 3/

2 Ethanoic acid is a colourless liquid at room temperature. It has the typical acid properties and forms compounds called ethanoates.

(a) A pure sample of ethanoic acid is slowly heated from 0°C to 150°C and its temperature is measured every minute. The results are represented on the graph below.



(i) Name the change that occurs in the region **D** to **E**.

..... [1]

(ii) What would be the difference in the region **B** to **C** if an impure sample had been used?

..... [1]

(iii) Sketch on the graph how the line would continue if the acid was heated to a higher temperature. [1]

(iv) Complete the following table that compares the separation and movement of the molecules in regions **C** to **D** with those in **E** to **F**.

	C to **D**	**E** to **F**
separation (distance between particles)	.....	.....
movement of particles	random and slow	....
Can particles move apart to fill any volume?	.....	.....

[5]

Q# 8/ iGCSE Chemistry/2005/s/Paper 3/ QiGCSE Chemistry/201

(d) Traces of chlorine can be separated from bromine vapour by diffusion.
Which gas would diffuse the faster and why?

.....

..... [2]

Q# 9/ iGCSE Chemistry/2003/w/Paper 3/

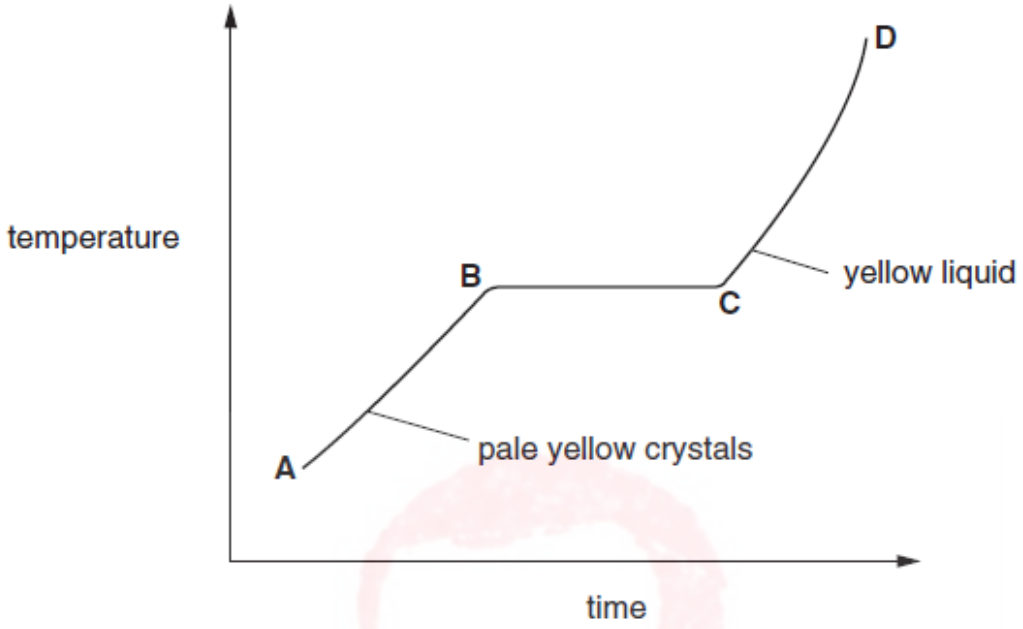
4 Esters occur naturally in plants and animals. They are manufactured from petroleum. Ethyl ethanoate and butyl ethanoate are industrially important as solvents.

(a) (i) Explain the term *solvent*.

.....[1]

Q# 10/ iGCSE Chemistry/2003/s/Paper 3/ Q4

(b) When nitrogen dioxide is cooled, it forms a yellow liquid and then pale yellow crystals. These crystals are heated and the temperature is measured every minute. The following graph can be drawn.



(i) Describe the arrangement and movement of the molecules in the region **A–B**.

.....

.....

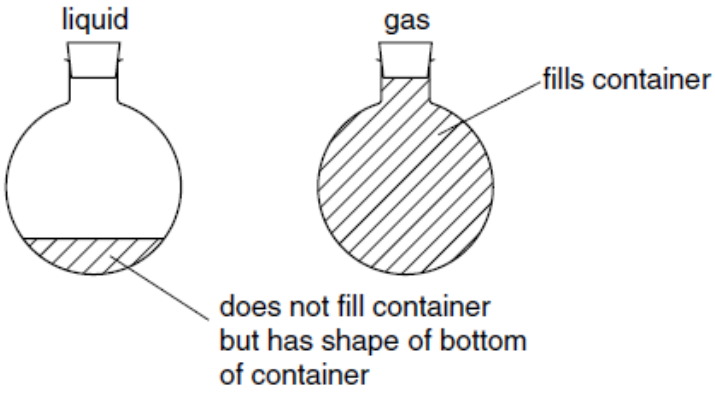
(ii) Name the change that occurs in the region **B–C**

.....[4]

Q# 11/ iGCSE Chemistry/2002/s/Paper 3/

5 **(a)** The Kinetic Theory explains the properties of solids, liquids and gases in terms of the movement of particles.

Liquids and gases both take up the shape of the container but a gas always fills the container. Explain this, using the ideas of the Kinetic Theory.



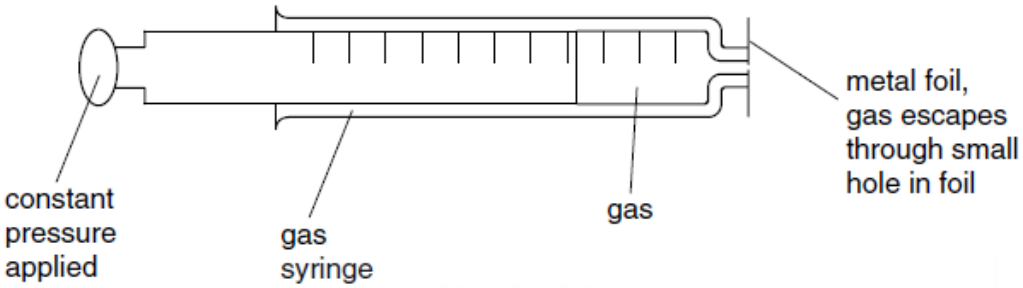
.....

.....

.....

.....[4]

(b) The following apparatus can be used to measure the rate of diffusion of a gas.



(i) What measurements would need to be taken to calculate the rate of diffusion of a gas?

.....[2]

(ii) Which gas, carbon dioxide or sulphur dioxide, would diffuse faster? Explain your choice.

.....

.....

.....[3]

T1 Paper 4 Mark Scheme

Q# 1/ iGCSE Chemistry/2015/s/Paper 31/

6(c)(i)	*Any **two** from:* (particles move in) random motion; (particles) collide; (particles) move from a region of high concentration to low concentration;	2	**A** alternative phrases for collide **A** down a concentration gradient
6(c)(ii)	C; M2 it has a lower (relative) molecular mass (than HBr); M3 ethylamine diffuses faster (than HBr);	3	**A** ethylamine is less dense **A** ethylamine is a lighter molecule but **I** 'ethylamine is lighter' **I** ethylamine is a smaller molecule **A** ethylamine **molecules** or **particles** move faster **A** ECF for M2 and M3 if A is given e.g. HBr diffuses faster for M3 because it is a lighter molecule for M2 **A** ECF for M2 if B is given e.g. they diffuse at same rate for M3 because molecules weigh the same for M2

Q# 2/ iGCSE Chemistry/2014/s/Paper 31/Q3c

(iii) fractional distillation (1) [1]

Q# 3/ iGCSE Chemistry/2014/s/Paper 31/

3 (a) (i) (particles) spread to fill total available volume / move from high concentration to low concentration / moves down a concentration gradient (1) [1]

(ii) mass or M_r (1) [1]

(b) (i) helium atoms / molecules are lighter than molecules in air or N_2 **and** O_2
or helium is less dense than air or N_2 **and** O_2.
or helium diffuses (through the porous barrier) faster than air or N_2 **and** O_2. (1) [1]

(ii) faster rate of diffusion / molecules move faster (at high temperatures). (1) [1]

(iii) fractional distillation (1) [1]

Q# 4/ iGCSE Chemistry/2012/w/Paper 31/

7 (a) (i) melting point is below 25°C; [1]
boiling point above 25°C; [1]
accept: argument based on actual values
note: 25°C is between mp and bp = [2]

Q# 5/ iGCSE Chemistry/2010/s/Paper 31/

2 (i) chloromethane [1]
cond biggest molecular mass / biggest mass of one mole / its molecules
move slowest / heaviest molecule / highest density [1]
accept atomic mass if correct numerical value given
ignore it is the heaviest (gas) / biggest molecule
accept particles or molecules
not atoms

Q# 6/ iGCSE Chemistry/2006/w/Paper 3/

2 More than required number of answers – [0]
(i) **A, B, D** [1]
(ii) **D** [1]
(iii) **F** [1]
(iv) **C** and **E** [1]
(v) **A** [1]
(vi) **E** [1]

Q# 7/

(a)(i) boiling **[1]**

(ii) lower temperature **or**
over temperature range or no plateau **[1]**

(iii) direct continuation of E to F **[1]**

(iv) close **or** touching — far apart **[2]**
fast and random **[1]**
cannot move apart — can move apart **[2]**

Q# 8/ iGCSE Chemistry/2005/s/Paper 3/ QiGCSE Chemistry/201

(d) chlorine **[1]**
COND lower M_r **or** lower density **or** lighter molecules **or** molecules move faster **[2]**

OR lighter **or** based on A_r MAX [1]
smaller with no additional comment **or** sieve idea [0]
N.B. a total of [3] not [2]

Q# 9/ iGCSE Chemistry/2003/w/Paper 3/

4 (a) (i) in which something dissolves [1]

Q# 10/ iGCSE Chemistry/2003/s/Paper 3/ Q4

(b)	(i)	close **or** tightly packed	[1]
		ordered **or** lattice	[1]
		vibrational	[1]
		NOT forces	
	(ii)	melting **or** freezing **or** fusion **or** solidification	[1]

Q# 11/ iGCSE Chemistry/2002/s/Paper 3/Q5 (a)
Particles are free to move in both liquids and gases,
so they can change their shape;
In a gas, there are no bonds between particles, so they are free to assume the volume of the container
In a liquid the particles are connected together by bonds, so can only change their shape, not their volume
Total 4 marks

5 (b) (i)
Time taken
For volume to decrease 2 marks

(ii) Carbon dioxide
Because it has a Mr of 44, SO_2 has an Mr of 64
Molecules with smaller mass diffuse more quickly
1 marks

T1 Essential End of Topic 1 Review and Reflection

This exercise will allow you to see all of your progress in every topic you complete. It will also help you become a more deliberate student, so that you are doing things like talking to a teacher that you might not at the start be comfortable with, but will build really important life skills to allow you to leave your comfort zone and talk to someone who might be interesting, or important, or helpful, even if it might feel easier and therefore better to do less and avoid new people.
Try to be as honest and as detailed as possible. Sometimes you may think you have thought about an idea well, but when you talk with someone else, or write it out, it helps you better understand and allows you think more completely and more clearly.

Did you achieve more goals this topic than last topic (circle)? Yes/No

Fill in this table:

Level	Number of goals achieved at each level	Success rate (%)
FUNDAMENTAL	/5	
ESSENTIAL	/10	
EXTENSION	/13	
EXCEPTIONAL	/10	

Do you feel you tried harder this topic than the previous topic? If yes, how do you know? What helped you to do so? If not, why not?

What could you do differently next time? Try to avoid simply saying "more of *X*", be specific instead, think carefully about the problem, try to think creatively, so if you found your notes less helpful, look at the section at the back about the **Cornell Notetaking System** and write out things you did not do last topic that you would like to try next tropic:

What did you enjoy most about this topic? What was most interesting?

What did you find most difficult? What could you do to make success in this area more likely?

What did you find easiest? Why did you find it easy?

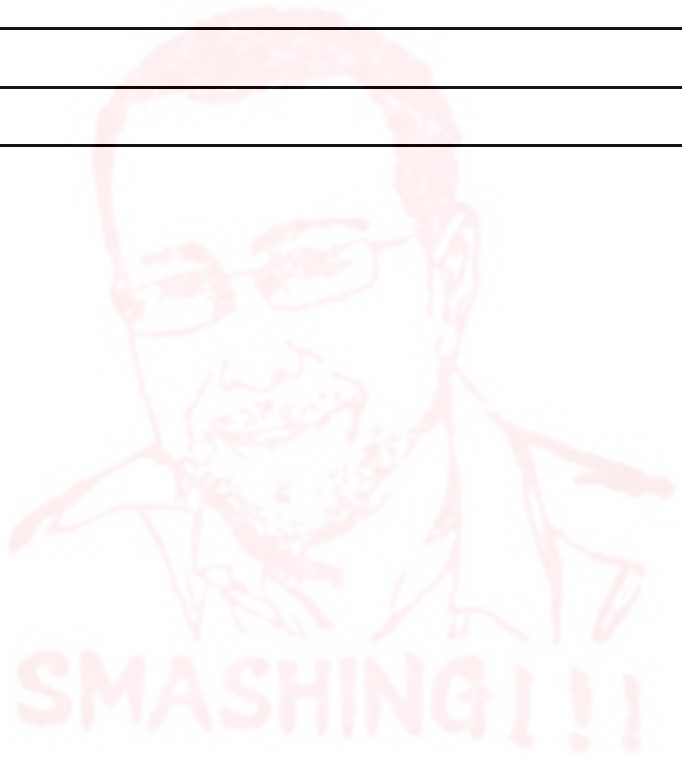
On a scale of 1 being hardest and 5 being most difficult, circle how challenging you found this topic relative to your other AS topics:

1 2 3 4 5

What could be done to make this topic easier to understand?

Do you have any questions about this topic? Is there anything you would like to follow up later?

Google: [topic name] news. **What is the most interesting news about this topic** you found out?



Topic 8 The Periodic Table Syllabus

8 The Periodic Table

8.1 Arrangement of elements

Core

1 Describe the Periodic Table as an arrangement of elements in periods and groups and in order of increasing proton number / atomic number

2 Describe the change from metallic to non-metallic character across a period

3 Describe the relationship between group number and the charge of the ions formed from elements in that group

4 Explain similarities in the chemical properties of elements in the same group of the Periodic Table in terms of their electronic configuration

5 Explain how the position of an element in the Periodic Table can be used to predict its properties

Supplement

6 Identify trends in groups, given information about the elements

8.2 Group I properties

Core

1 Describe the Group I alkali metals, lithium, sodium and potassium, as relatively soft metals with general trends down the group, limited to:
   (a) decreasing melting point
   (b) increasing density
   (c) increasing reactivity

2 Predict the properties of other elements in Group I, given information about the elements

Supplement

8.3 Group VII properties

Core

1 Describe the Group VII halogens, chlorine, bromine and iodine, as diatomic non-metals with general trends down the group, limited to:
   (a) increasing density
   (b) decreasing reactivity

2 State the appearance of the halogens at r.t.p. as:
   (a) chlorine, a pale yellow-green gas
   (b) bromine, a red-brown liquid
   (c) iodine, a grey-black solid

3 Describe and explain the displacement reactions of halogens with other halide ions

4 Predict the properties of other elements in Group VII, given information about the elements

Supplement

8.4 Transition elements

Core

1 Describe the transition elements as metals that:
   (a) have high densities
   (b) have high melting points
   (c) form coloured compounds
   (d) often act as catalysts as elements and in compounds

Supplement

2 Describe transition elements as having ions with variable oxidation numbers, including iron(II) and iron(III)

8.5 Noble gases

Core

1 Describe the Group VIII noble gases as unreactive, monatomic gases and explain this in terms of electronic configuration

Supplement

End of Topic 8 Goals Checklist

For each topic you ought to try to do as many of the following things to get the most out of your time, the resources available to you and to help you grow as a student. Tick each goal off as you complete it. Growth can be painful, but the more of it you do, the easier it can become!!!

Aspect	What you should have done	Yes/No	Level
Interacted with your teacher	Ask your teacher 1 question, about anything, once a week		FUNDAMENTAL
	Try to answer one question asked by your teacher at least once a week		ESSENTIAL
	Ask your teacher one question about something you do not understand in science once a week		ESSENTIAL
	Ask your teacher one question about something to do with science every lesson		EXTENSION
Notes and follow up notes	Complete set of class note		FUNDAMENTAL
	Cornell Notetaking Attempted		ESSENTIAL
	Cornell Notetaking Completed		EXTENSION
	Cornell Notetaking Completed to an exemplary standard		EXCEPTIONAL
	Attempted the Mind Map for this topic		ESSENTIAL
	Completed the Mind Map for this topic		EXTENSION
Textbook	Read ahead before the topic has been started		EXTESNION
	Highlighted key ideas and translate new words		FUNDAMENTAL
	Completed the questions at the end of each 2 page spread in your exercise book		EXTENSION
	Added to your class notes ideas and important information from the textbook that you learnt		EXTENSION
Past Exam Questions	Worked on at least 25% of the exam questions in this workbook		FUNDAMENTAL
	Attempted more than 25% of the questions and those questions you have completed you have marked in a different colour pen		ESSENTIAL
	Completed and marked all questions here		EXTENSION
	Completed, marked and additional key ideas where you have located the most difficult marks added to your notebook		EXCEPTIONAL
	Used the resources available online to answer additional questions not found in this workbook on the current topic.		EXCEPTIONAL
	Ask your teacher about an exam question that they cannot answer		EXCEPTIONALLY SMASHING!!!

Aspect	What you should have done	Yes/No	Level
Assessed Activities	Complete the word list activity using the word list at the front of each topic as little as possible		FUNDAMENTAL
	Complete 2 assessed activities, either in class or as homework		ESSENTIAL
	Complete 2 assessed activities and scored over 70% on average		ESSENTIAL
	Complete 2 assessed activities and scored over 80% on average		EXTENSION
	Complete 2 assessed activities and scored over 90% on average		EXCEPTIONAL
End of Topic Test	Revised sufficiently well to improve upon your score from the previous test (except if you are scoring over 90%, then just write Y for this goal)		ESSENTIAL
	Scored 10% higher than your current average		EXTENSION
	Scored 15% or more than your previous end of topic average		EXCEPTIONAL
	Scored over 90%		EXTESNION
	Scored over 95%		SMASHING!!!
Reading	Spend more than 1 hour a week reading a book **you enjoy** (in any language) about anything.		ESSENTIAL
	Spend more than 3 hours a week reading a book **you enjoy** (in any language) about anything.		EXTENSION
	Spend more than 5 hours a week reading a book **you enjoy** (in any language) about anything.		EXCEPTIONAL
	Spend at least one hour a week reading a book **you enjoy** in English about anything.		EXTENSION
	Spend more than 3 hours a week reading a book **you enjoy** in English about anything.		EXCEPTIONAL
Reflection	You completed this goal setting table		FUNDAMENTAL
	You have looked at the goals you have achieved and the ones you have not and added them up and entered them into the table in the Review and Reflection section		ESSENTIAL
	You have given an answer for every question in the Review and Reflection section at the end of this topic		EXTENSION
	You have Given good and thoughtful answers for every question in the Review and Reflection section at the end of this topic		EXCEPTIONAL

T8 KeyWords

1	**alkali metals** Group I elements. The most reactive group of all metals. e.g. Na(g), K(l) or Li(s), but not Al(s) or O_2(g)
2	**atomic number (*Z*)** The number of protons in the nucleus of an atom. e.g. for the first three elements this number is 1, 2 and 3 respectively ($_1$H, $_2$He and $_3$Li).
3	**displacement reaction** When a more reactive element reacts to force, or push out, a less reactive element in a compound making it pure and uncombined. e.g. Cl_2 (aq) + $2Br^-$ (aq) → $2Cl^-$ (aq) + Br_2 (aq)
4	**fixed points** The unchanging temperatures for a substance to change state at a specific pressure, including its melting and boiling points. For pure water at 1 atmosphere of pressure they include 100 °C and 0°C.
5	**group** The vertical columns in the periodic table of elements. All elements in this collection all have the same number of outer shell electrons, which means that they tend to react in similar ways e.g. these collections: Li, Rb and Fr;

	C, Sn and Pb; but not: N, O and F.
6	**halides** The ions of Group VII elements, or salts containing them e.g. I^-, F^-, or Br^-; but not Cl(g) or Br_2
7	**halogens** Group VII elements. The most reactive group of non-metals. I (g) or F_2 (l); but not Br^- (aq) or O_2(g)
8	**inert** Any substance that will not react in a given set of conditions. e.g. the Noble Gases
9	**main-group elements** Elements in groups I, II, III... to VII and VIII, so excluding all transition metals. e.g. Li, Al, S, Br, Mg, N or Ba; but not Sc, Fe or Au
10	**metalloid (semi-metal)** Elements that display both metallic and non-metallic properties, like silicon which when solid can conduct electricity, but not well (a semiconductor). e.g. Si, B, Ge; but not Na or Cl
11	**metals** Elements that form ions when their atoms lose electrons. This characteristic of their atoms gives rise to the properties of the materials they produce. All of these elements conduct electricity well when solid. e.g. K(s), Fe(s), Al(g) or Hg(l); but not Si(s) or Ne(g)
12	**monoatomic** Made from particles with a single atom. e.g. He(g), Ne(g) and Na(g), but not H_2(g) or O_3(g)
13	**noble gases** Group VIII elements. e.g. Xe (s), He (l) or Kr(aq); but not F_2 (g) or S_8 (s)
14	**period** The horizontal rows in the periodic table of elements. All elements in the same collection have the same number of electron shells, and become less metallic and more non-metallic as you go across. e.g. these collections: F, O and C Na, Cl and Ar; but not: Li, Rb and Fr; C, Sn and Pb;
15	**periodic table** A way to organise all of the first 118 elements so far discovered which gathers all elements with atoms with similar electron structures into families. All elements organised by increasing atomic number, originally they were also collected by some shared chemical properties.
16	**relative atomic mass (A_r)** The average mass of all atomic isotopes of an element. e.g. for He it is 4, but for chlorine it is 35.5
17	**transition metals** Elements found in the middle of the periodic table. They usually share the same physical properties: hard, dense with high fixed points. Their chemical properties include: variable oxidation states and are good catalysts. They form coloured compounds. e.g. Fe, V or Cu, but not Ca or Al
18	**volatile** The ability to evaporate quickly at a lower temperature. Most small simple molecules, like F_2, O_2 or H_2 and all Group VIII elements have this property. Si (s) and Fe (l) do not have this.

Important Elements in this Syllabus

1	**argon** This inert monoatomic gas was used to fill old fashioned filament lightbulbs. Almost 1% of dry air is made from this noble gas.
2	**bromine** A red-brown liquid halogen. x here: $x(aq) + 2I^-(aq) \rightarrow 2Br^-(aq) + I_2(aq)$
3	**bromine water** This orange solution can displace iodide ions in a water-based solution. x here: $x + 2I^-(aq) \rightarrow 2Br^-(aq) + I_2(aq)$
4	**calcium** A fairly reactive group II metal that is found in limestone and chalk. x here: $x(OH)_2(aq) + CO_2(g) \rightarrow xCO_3(s) + H_2O(l)$
5	**chlorine** A pale yellow-green gas used to kill microbes in drinking water. x here: $X_2(aq) + 2Br^-(aq) \rightarrow 2Cl^-(aq) + Br_2(aq)$
6	**chlorine water** This colourless solution can displace bromide ions in a water-based solution. x here: $x + 2Br^-(aq) \rightarrow 2Cl^-(aq) + Br_2(aq)$
7	**copper** A very common transition metal that is unreactive and is a brown coloured solid used in electrical wires. Forms brightly coloured blue compounds in its hydrated 2+ oxidation state.
8	**fluorine** A pale yellow gas, this is the most non-metallic element in the universe. The most reactive halogen.
9	**francium** Possibly the most metallic of all elements. Possibly the most reactive of all group 1 elements.
10	**helium** This inert monoatomic gas is used to fill balloons that float in the air. This element has the lowest boiling point in the universe and was first discovered in the sun's atmosphere.
11	**iodine** A grey-black solid that could be the least reactive halogen. x here: $Br_2(aq) + 2I^-(aq) \rightarrow 2Br^-(aq) + x(aq)$
12	**iodine water** This brown solution cannot displace any halide ion in solution. x if purified here: $Br_2(aq) + 2I^-(aq) \rightarrow 2Br^-(aq) + x$
13	**iron** The most common transition metal that is used for its strength in bridges, and its high density in weights used in fitness. It is green in the 2+ oxidation state, and red-brown in the 3+ oxidation state
14	**lithium** The least reactive and least dense group 1 element with the with the highest melting point. Flames containing its ions burn red.

15	**potassium** A very soft alkali metal that is the most reactive metal of the first 20 elements. Flames containing its ions burn lilac.
16	**sodium** A group 1 metal that is harder than potassium but more reactive than lithium. Flames containing its ions burn yellow.
17	**vanadium** This transition metal can be added to iron to make some of the strongest steels known. The 5+ oxide of this metal is used as a catalyst in the Contact process.

T8 Paper 2 Exam Questions

iG Chem 8nw EQ P2 17w to 16m 38marks

Q# 1/ iGCSE Chemistry/2017/w/Paper 23/www.SmashingScience.org :o)

21 A period of the Periodic Table is shown.

group	I	II	III	IV	V	VI	VII	VIII
element	R	S	T	V	W	X	Y	Z

The letters are not their chemical symbols.

Which statement is correct?

A Element R does not conduct electricity.

B Elements R and Y react together to form an ionic compound.

C Element Z exists as a diatomic molecule.

D Element Z reacts with element T.

22 Some properties of element X are shown.

melting point in °C	98
boiling point in °C	883
reaction with cold water	gives off H_2 gas
reaction when heated with oxygen	burns to give a white solid

In which part of the Periodic Table is X found?

A Group I

B Group VII

C Group VIII

D transition elements

23 The table gives some properties of an element.

melting point in °C	3422
appearance of the element	grey
appearance of the chloride of the element	dark blue
density in g / cm^3	19.2
electrical conductivity when solid	good

Which other property would you expect this element to have?

A acts as a catalyst

B brittle

C forms an acidic oxide

D highly reactive with water

Q# 2/ iGCSE Chemistry/2017/w/Paper 22/www.SmashingScience.org :o)

21 Which statement about nitrogen and phosphorus is **not** correct?

A Both are in the same group of the Periodic Table.

B Both are in the same period of the Periodic Table.

C Both are non-metals.

D Both have the same number of electrons in their outer shell.

22 Sodium and rubidium are elements in Group I of the Periodic Table.

Which statement is correct?

A Sodium atoms have more electrons than rubidium atoms.

B Sodium has a lower density than rubidium.

C Sodium has a lower melting point than rubidium.

D Sodium is more reactive than rubidium.

23 Which properties do the elements chromium, iron and vanadium have in common?

1 They all conduct electricity.

2 They, or their compounds, can act as catalysts.

3 They all form coloured compounds.

A 1, 2 and 3 **B** 1 and 2 only **C** 1 and 3 only **D** 2 and 3 only

21 Which statements about the trends across a period of the Periodic Table are correct?

1 Aluminium is more metallic than sodium.

2 Beryllium is more metallic than carbon.

3 Boron is more metallic than lithium.

4 Magnesium is more metallic than silicon.

A 1 and 2 **B** 1 and 3 **C** 2 and 4 **D** 3 and 4

22 Astatine is an element in Group VII of the Periodic Table.

Astatine is .....1..... reactive than iodine.

The melting point of astatine is .....2..... than the melting point of iodine.

Astatine is .....3..... in colour than bromine.

Which words complete gaps 1, 2 and 3?

	1	2	3
A	less	higher	darker
B	less	lower	lighter
C	more	higher	darker
D	more	lower	lighter

23 Which row describes the properties of a typical transition element?

	melting point	forms coloured compounds	can act as a catalyst
A	high	no	no
B	high	yes	yes
C	low	no	yes
D	low	yes	no

24 Why is argon gas used to fill electric lamps?

A It conducts electricity.

B It glows when heated.

C It is less dense than air.

D It is not reactive.

Q# 4/ iGCSE Chemistry/2017/s/Paper 23/www.SmashingScience.org :o)

23 Ununseptium (atomic number 117) is a man-made element that is below astatine in Group VII of the Periodic Table.

What is the expected state of ununseptium at room temperature?

A a diatomic gas

B a liquid

C a monatomic gas

D a solid

Q# 5/ iGCSE Chemistry/2017/s/Paper 22/www.SmashingScience.org :o)

23 The elements oxygen and sulfur are in the same group of the Periodic Table.

Which statement about oxygen and sulfur is **not** correct?

A They are non-metals.

B They have giant covalent structures.

C They have six electrons in their outer shells.

D They react together to form an acidic oxide.

Q# 6/ iGCSE Chemistry/2017/s/Paper 21/www.SmashingScience.org :o)

22 Which element is less reactive than the other members of its group in the Periodic Table?

A astatine

B caesium

C fluorine

D rubidium

23 The elements in Group IV of the Periodic Table are shown.

carbon

silicon

germanium

tin

lead

flerovium

What does **not** occur in Group IV as it is descended?

A The proton number of the elements increases.

B The elements become more metallic.

C The elements have more electrons in their outer shells.

D The elements have more electron shells.

24 Why are weather balloons sometimes filled with helium rather than hydrogen?

A Helium is found in air.

B Helium is less dense than hydrogen.

C Helium is more dense than hydrogen.

D Helium is unreactive.

Q# 7/ iGCSE Chemistry/2017/m/Paper 22/www.SmashingScience.org :o)

22 Which property of elements increases across a period of the Periodic Table?

A metallic character

B number of electron shells

C number of outer shell electrons

D tendency to form positive ions

23 Magnesium, calcium, strontium and barium are Group II elements.

Group II elements follow the same trends as Group I elements.

Which statements about Group II elements are correct?

1 Calcium reacts faster than magnesium with water.

2 Barium reacts less vigorously than magnesium with dilute acid.

3 Strontium oxidises in air more slowly than barium.

A 1, 2 and 3 **B** 1 and 2 only **C** 1 and 3 only **D** 2 and 3 only

24 The noble gases are in Group VIII of the Periodic Table.

Which statement explains why noble gases are unreactive?

A They all have eight electrons in their outer shells.

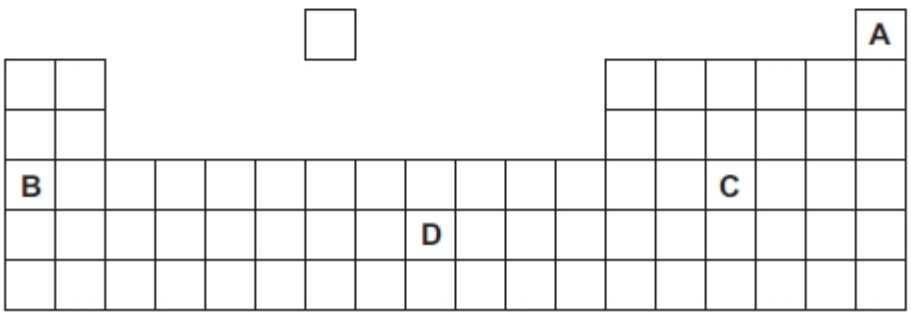
B They all have full outer shells.

C They are all gases.

D They are all monoatomic.

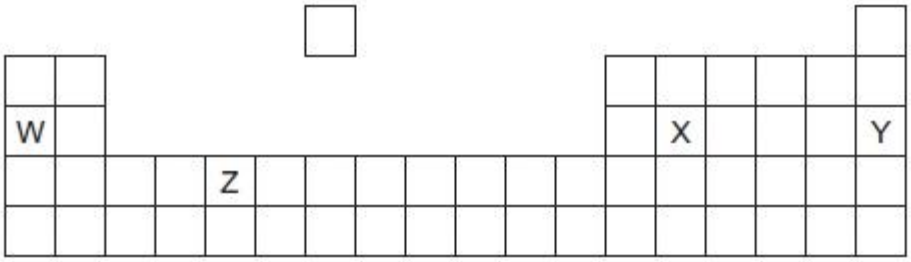
25 Part of the Periodic Table is shown.

Which element is used as a catalyst?



Q# 8/ iGCSE Chemistry/2016/w/Paper 23/www.SmashingScience.org :o)

24 Part of the Periodic Table is shown.



Which row correctly describes the properties of elements W, X, Y and Z?

	has variable oxidation states	reacts with cold water	very unreactive	has four outer shell electrons
A	W	Y	Z	X
B	X	W	Y	Z
C	Z	W	Y	X
D	Z	Y	X	W

Q# 9/ iGCSE Chemistry/2016/w/Paper 22/www.SmashingScience.org :o)

22 What is **not** a property of Group I metals?

A They are soft and can be cut with a knife.

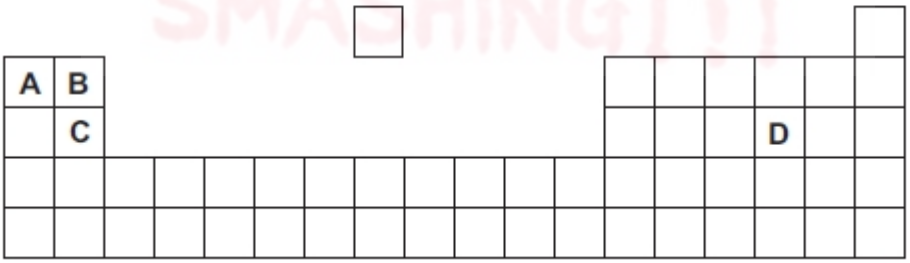
B They react when exposed to oxygen in the air.

C They produce an acidic solution when they react with water.

D They react rapidly with water producing hydrogen gas.

24 Part of the Periodic Table is shown.

Which element has two electrons in its outer shell and three electron shells?



Q# 10/ iGCSE Chemistry/2016/w/Paper 21/www.SmashingScience.org :o)

22 What is **not** a property of Group I metals?

A They are soft and can be cut with a knife.

B They react when exposed to oxygen in the air.

C They produce an acidic solution when they react with water.

D They react rapidly with water producing hydrogen gas.

24 Which statement about transition elements and their compounds is correct?

A All the transition elements have an oxidation state of +2 only.

B Aqueous solutions of the salts of transition elements are generally coloured.

C Transition elements change from metal to non-metal across the period.

D Transition elements can act as catalysts but their compounds cannot.

Q# 11/ iGCSE Chemistry/2016/s/Paper 23/www.SmashingScience.org :o)

22 Which statement about the elements in Group I is correct?

A Hydrogen is evolved when they react with water.

B Ions of Group I elements have a –1 charge.

C Sodium is more reactive than potassium.

D Solid sodium is a poor electrical conductor.

23 Osmium is a transition element.

Which row gives the expected properties of osmium?

	melting point	density	compounds formed
A	high	high	coloured
B	high	high	white
C	high	low	white
D	low	high	coloured

24 Two statements about noble gases are given.

1 Noble gases are reactive, monatomic gases.

2 Noble gases all have full outer shells of electrons.

Which is correct?

A Both statements are correct and statement 2 explains statement 1.

B Both statements are correct but statement 2 does not explain statement 1.

C Statement 1 is correct but statement 2 is incorrect.

D Statement 2 is correct but statement 1 is incorrect.

25 Some properties of substance X are listed.

- It conducts electricity when molten.
- It has a high melting point.
- It burns in oxygen and the product dissolves in water to give a solution with pH 11.

What is X?

A a covalent compound

B a macromolecule

C a metal

D an ionic compound

Q# 12/ iGCSE Chemistry/2016/s/Paper 22/www.SmashingScience.org :o)

22 Rubidium is a Group I metal.

Which statement about rubidium is **not** correct?

A It has a higher melting point than lithium.

B It has one electron in its outer shell.

C It reacts vigorously with water.

D It reacts with chlorine to form rubidium chloride, RbC*l*.

23 The table gives information about four elements, P, Q, R and S.

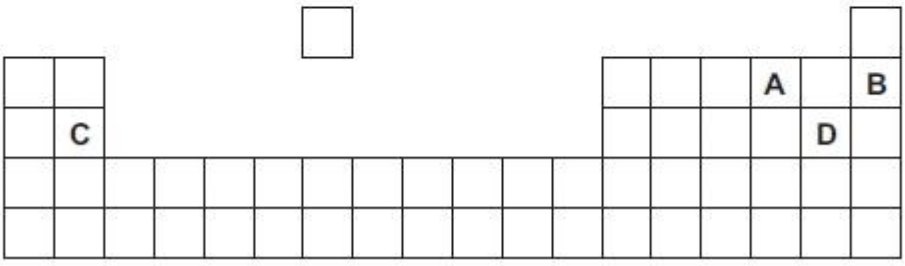
	melting point in °C	electrical conductivity of element when solid	density in g / cm^3	colour of iodide of element
P	98	good	0.97	white
Q	–39	good	13.53	red
R	1410	poor	2.33	colourless
S	1535	good	7.87	green

Which elements could be transition elements?

A P, Q and S **B** Q and S only **C** R and S only **D** S only

24 Part of the Periodic Table is shown.

Which element is a gas that does **not** form a compound with potassium?



21 Where in the Periodic Table is the metallic character of the elements greatest?

	left or right side of a period	at the top or bottom of a group
A	left	bottom
B	left	top
C	right	bottom
D	right	top

22 Some properties of four elements, P, Q, R and S, are shown in the table.

Two of these elements are in Group I of the Periodic Table and two are in Group VII.

element	reaction with water	physical state at room temperature
P	reacts vigorously	solid
Q	does not react with water	solid
R	reacts explosively	solid
S	dissolves giving a coloured solution	liquid

Which statement is correct?

A P is below R in Group I.

B Q is above R in Group I.

C Q is below S in Group VII.

D R is below S in Group VII.

23 Which of the following could be a transition element?

	melting point in °C	density in g/cm^3	colour	electrical conductor
A	114	4.9	purple	no
B	659	2.7	grey	yes
C	1677	4.5	grey	yes
D	3727	2.3	black	yes

24 Two statements about argon are given.

1 Argon has a full outer shell of electrons.

2 Argon is very reactive and is used in lamps.

Which is correct?

A Both statements are correct and statement 2 explains statement 1.

B Both statements are correct but statement 2 does not explain statement 1.

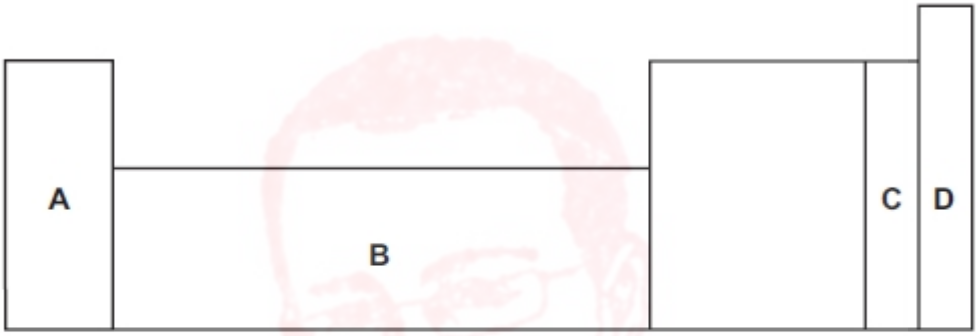
C Statement 1 is correct but statement 2 is incorrect.

D Statement 2 is correct but statement 1 is incorrect.

Q# 14/ iGCSE Chemistry/2016/m/Paper 22/www.SmashingScience.org :o)

22 An element does not conduct electricity and exists as diatomic molecules.

Where in the Periodic Table is the element found?



23 In the Periodic Table, how does the metallic character of the elements vary from left to right across a period?

A It decreases.

B It increases.

C It increases then decreases.

D It stays the same.

24 The elements in a group of the Periodic Table show the following trends.

1 The element with the lowest proton number has the lowest reactivity.

2 All the elements in the group form basic oxides.

3 The density of the elements increases down the group.

4 The melting point of the elements decreases down the group.

In which group are the elements found?

A I **B** IV **C** VI **D** VII

T8 Paper 2 Mark Scheme

Mark Scheme iG Chem 8nw EQ P2 17w to 16m 38marks

Q# 1/ iGCSE Chemistry/2017/w/Paper 23/

21	B
22	A
23	A

Q# 2/ iGCSE Chemistry/2017/w/Paper 22/

21	B
22	B
23	A

Q# 3/ iGCSE Chemistry/2017/w/Paper 21/

21	C
22	A
23	B
24	D

Q# 4/ iGCSE Chemistry/2017/s/Paper 23/

23	D

Q# 5/ iGCSE Chemistry/2017/s/Paper 22/

23	B

Q# 6/ iGCSE Chemistry/2017/s/Paper 21/

22	A
23	C
24	D

Q# 7/ iGCSE Chemistry/2017/m/Paper 22/

22	C
23	C
24	B
25	D

Q# 8/ iGCSE Chemistry/2016/w/Paper 23/

24	**C**

Q# 9/ iGCSE Chemistry/2016/w/Paper 22/

22	**C**
24	**C**

Q# 10/ iGCSE Chemistry/2016/w/Paper 21/

22	**C**
24	**B**

Q# 11/ iGCSE Chemistry/2016/s/Paper 23/

22	**A**
23	**A**
24	**D**
25	**C**

Q# 12/ iGCSE Chemistry/2016/s/Paper 22/

22	**A**
23	**D**
24	**B**

Q# 13/ iGCSE Chemistry/2016/s/Paper 21/

21	**A**
22	**C**
23	**C**
24	**C**

Q# 14/ iGCSE Chemistry/2016/m/Paper 22/

22	**C**
23	**A**
24	**A**

Topic 8 Paper 3 Exam Questions

Q# 1//iGCSE Chemistry/2015/s/Paper 31/

5 The halogens are a group of non-metals in Group VII of the Periodic Table.

(a) The reactivity of the halogens decreases down the group.

Describe an experiment which shows that chlorine is more reactive than iodine. Include an equation in your answer.

.....

.....

.....

..... [3]

Q# 2//iGCSE Chemistry/2014/s/Paper 31/

4 In the Periodic Table, the elements are arranged in columns called Groups and in rows called Periods.

(a) (i) Complete the table for some of the elements in Period 3.

group number	I	II	III	IV	V	VI	VII
symbol	Na	Mg	Al	Si	P	S	Cl
number of valency electrons							
valency							

[2]

(ii) What is the relationship between the group number and the number of valency electrons?

.....

..... [1]

(iii) Explain the relationship between the number of valency electrons and the valency

for the elements Na to Al,

.....

.....

.....

for the elements P to Cl.

.....

.....

.....

[4]

(b) Across a period, the elements change from metallic to non-metallic.

(ii) Describe how the type of bonding in the chlorides formed by these elements changes across this period.

.....

..... [2]

Q# 3//iGCSE Chemistry/2013/w/Paper 31/

1 For each of the following, name an element which matches the description.

(a) It is used as a fuel in nuclear reactors.

..... [1]

(b) It is the only non-metal which is a good conductor of electricity.

..... [1]

(c) Inert electrodes are made from this metal.

..... [1]

(d) This gaseous element is used to fill balloons in preference to hydrogen.

..... [1]

(e) An element which can form an ion of the type X^{3-}.

..... [1]

1 For each of the following, name an element which matches the description.

(a) It is used as a fuel in nuclear reactors.

..... [1]

(b) It is the only non-metal which is a good conductor of electricity.

..... [1]

(c) Inert electrodes are made from this metal.

..... [1]

(d) This gaseous element is used to fill balloons in preference to hydrogen.

..... [1]

(e) An element which can form an ion of the type X^{3-}.

..... [1]

(f) It has the same electron distribution as the calcium ion, Ca^{2+}.

..... [1]

(g) The element is in Period 5 and Group VI.

..... [1]

Q# 4//iGCSE Chemistry/2013/s/Paper 31/

2 An element, **M**, has the electron distribution 2 + 8 + 18 + 3.

(a) Which group in the Periodic Table is element **M** likely to be in?

..... [1]

(b) Predict whether element **M** is a poor or a good conductor of electricity.
Give a reason for your answer.

..... [1]

(c) Binary compounds contain two atoms per molecule, for example HCl.
Identify an element which could form a binary compound with element **M**.

..... [1]

(d) Predict the formula of the sulfate of **M**. The formula of the sulfate ion is SO_4^{2-}.

..... [1]

Q# 5//iGCSE Chemistry/2012/w/Paper 31/

2 Three of the halogens in Group VII are listed below.

chlorine
bromine
iodine

(a) (i) How does their colour change down the Group?

..... [1]

(ii) How do their melting points and boiling points change down the Group?

..... [1]

(iii) Predict the colour and physical state (solid, liquid or gas) of astatine, At.

colour .....

physical state ..... [2]

Q# 6//iGCSE Chemistry/2012/s/Paper 31/

3 The Group I metals show trends in both their physical and chemical properties.

(a) (i) How do their melting points vary down the Group?

..... [1]

(ii) Which element in the Group has the highest density?

..... [1]

(iii) All Group I metals react with cold water. Complete the following equation.

.....Rb + ...H_2O → ..... + ...

[2]

Q# 7//iGCSE Chemistry/2012/s/Paper 31/

4 Vanadium is a transition element. It has more than one oxidation state.
The element and its compounds are often used as catalysts.

(b) Predict **three** physical properties of vanadium which are typical of transition elements.

1. .....

2. .....

3. ..... [2]

Q# 8//iGCSE Chemistry/2011/s/Paper 31/ Q5

(c) Describe how you could distinguish between hydriodic, HI(aq), and hydrobromic, HBr(aq) acids, by bubbling chlorine through these two acids.

result with hydriodic acid .....

result with hydrobromic acid ..... [2]

Q# 9//iGCSE Chemistry/2010/s/Paper 31/

1 Choose an element which fits each of the following descriptions.

(i) It is a yellow solid which burns to form an acidic oxide.

..... [1]

(ii) This element is a black solid which, when heated, forms a purple vapour.

..... [1]

(iii) Most of its soluble salts are blue.

..... [1]

(iv) It has a basic oxide of the type MO which is used to treat acidic soils.

..... [1]

(v) It is an unreactive gas used to fill balloons.

..... [1]

Q# 10//iGCSE Chemistry/2009/s/Paper 31/

3 The following is a list of the electron distributions of atoms of unknown elements.

element	electron distribution
A	2,5
B	2,8,4
C	2,8,8,2
D	2,8,18,8
E	2,8,18,8,1
F	2,8,18,18,7

(a) Choose an element from the list for each of the following descriptions.

(i) It is a noble gas. .....

(ii) It is a soft metal with a low density. .....

(iii) It can form a covalent compound with element **A**. .....

(iv) It has a giant covalent structure similar to diamond. .....

(v) It can form a negative ion of the type X^{3-}. ..... [5]

Q# 11//iGCSE Chemistry/2008/s/Paper 31/

1 For each of the following select an element from Period 4, potassium to krypton, that matches the description.

(a) It is a brown liquid at room temperature. .....

(b) It forms a compound with hydrogen having the formula XH_4. .....

(c) A metal that reacts violently with cold water. .....

(d) It has a complete outer energy level. .....

(e) It has oxidation states of 2 and 3 only. .....

(f) It can form an ion of the type X^-. ..... [6]

Q# 12//iGCSE Chemistry/2007/s/Paper 3/

4 Use your copy of the periodic table to help you answer these questions.

(d) Potassium and vanadium are elements in Period IV.

(i) State **two** differences in their physical properties.

.....

..... [2]

(ii) Give **two** differences in their chemical properties.

.....

..... [2]

(e) Fluorine and astatine are halogens. Use your knowledge of the other halogens to predict the following:

(i) The physical state of fluorine at r.t.p. .....

The physical state of astatine at r.t.p. ..... [2]

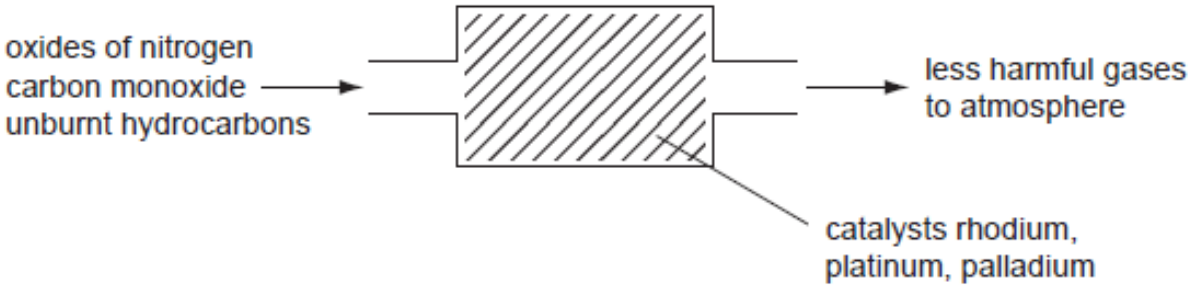
(ii) **Two** similarities in their chemical properties

.....

..... [2]

Q# 13//iGCSE Chemistry/2006/w/Paper 3/ Q4

(c) Catalytic converters reduce pollution from motor vehicles, as shown in the following diagram.



(i) What type of elements are the metals rhodium, platinum and palladium?

..... [1]

Q# 14//iGCSE Chemistry/2006/s/Paper 3/

1 Iron is a transition element.

(a) Which of the following statements about transition elements are correct?

Tick **three** boxes.

The metals are highly coloured e.g. yellow, green, blue. ☐

The metals have low melting points. ☐

Their compounds are highly coloured. ☐

Their compounds are colourless. ☐

The elements and their compounds are often used as catalysts. ☐

They have more than one oxidation state. ☐

[3]

(b) (i) In which Period in the Periodic Table is iron to be found?

..... [1]

Q# 15//iGCSE Chemistry/2005/s/Paper 3/

1 Three of the halogens in Group VII are:

chlorine
bromine
iodine

(a) (i) How does their colour change down the Group?

..... [1]

(ii) How does their physical state (solid, liquid or gas) change down the Group?

..... [1]

(iii) Predict the colour and physical state of fluorine.

colour .....

physical state ..... [2]

(b) Describe how you could distinguish between aqueous potassium bromide and aqueous potassium iodide.

test .....

result with bromide .....

result with iodide ..... [3]

Q# 16//iGCSE Chemistry/2003/s/Paper 3/

5 The first three elements in Period 6 of the Periodic Table of the Elements are caesium, barium and lanthanum.

(a) How many **more** protons, electrons and neutrons are there in one atom of lanthanum than in one atom of caesium. Use your copy of the Periodic Table of the Elements to help you.

number of protons .....

number of electrons .....

number of neutrons ..... [3]

Q# 17//iGCSE Chemistry/2002/w/Paper 3/ Q3

(c) Choose a different element from Period 3 that matches each description.

(i) It has a similar structure to diamond.

.....[1]

(d) The only oxidation state of argon is zero. Why it is used to fill light bulbs?

.....

.....[1]

Q# 18//iGCSE Chemistry/2002/w/Paper 3/

2 Manganese is a transition element. It has more than one valency and the metal and its compounds are catalysts.

(a) (i) Predict **three** other properties of manganese that are typical of transition elements.

.....

.....[3]

Q# 19//iGCSE Chemistry/2002/s/Paper 3/

4 Bromine is one of the halogens in Group VII.

(a) (i) Predict which halogen has the lightest colour.

.....[1]

(ii) Predict which halogens are solids at room temperature.

.....[1]

T8 Paper 3/4 Mark Scheme

Mark Scheme Topic 8 Paper 3 Exam Questions

Q# 1//iGCSE Chemistry/2015/s/Paper 31/

5(a)	M1 add chlorine to (potassium) iodide solution; M2 red/brown/yellow/orange (solution) is formed; M3 $Cl_2 + 2KI \rightarrow 2KCl + I_2$ $Cl_2 + 2I^- \rightarrow 2Cl^- + I_2$;	3	Solution must be implied for M1 **A** any soluble iodide solution **A** black (ppt or solid) **A** multiples **I** state symbols but KI(aq) would allow the solution aspect of mark in M1
5(b)	M1 (0.013 moles of I and 0.065 moles of F atoms gives a) ratio 1:5; Formula = IF_5 ;	2	Award 2 marks for IF_5 **A** one mark for I_5F (as ratio is inverted) **A** one mark for IF_5 or I_5Fl

Q# 2//iGCSE Chemistry/2014/s/Paper 31/

4 (a) (i)

Group number	I	II	III	IV	V	VI	VII
symbol	Na	Mg	Al	Si	P	S	Cl
number of valency electrons	1	2	3	4	5	6	7
valency	1	2	3	4	3	2	1

(1) for each line [2]

(ii) number of valency electrons = the group number (1) [1]

(iii) for Na to Al
the valency is the same as the number of valency (outer) electrons (1)

(because) this is the number of electrons **lost** (for full energy level) (1)

for P to Cl
the valency is 8 – [number of valency (outer) electrons]
or valency + valency electrons = 8 (1)

(because) this is number of electrons **needed** (or to be **gained**) (for full energy level) (1)

(b)

(ii) ionic (metal) chlorides on the left (1)
covalent (non-metal) chlorides on the right (1) [2]

Q# 3//iGCSE Chemistry/2013/w/Paper 31/

1 (a) uranium / plutonium / thorium [1]

(b) graphite / carbon [1]

(c) platinum / titanium / mercury / gold [1]
NOT: carbon / graphite

(d) helium [1]

(e) nitrogen / phosphorus [1]

(f) argon [1]
ACCEPT: any ion 2 + 8 + 8 e.g. K^+ etc.

(g) tellurium [1]
ACCEPT: correct symbol

Q# 4//iGCSE Chemistry/2013/s/Paper 31/

2 (a) 3 or III [1]

(b) good conductor and it is a metal/has delocalised (free) electrons [1]

(c) N **or** P **or** As **or** Sb [1]
accept Bi

(d) $M_2(SO_4)_3$ [1]
accept: $Ga_2(SO_4)_3$

(e) it would react with/dissolves in a named strong acid [1]
it would react with/dissolves in a named alkali [1]
it shows both basic and acid properties =1 [1]
it reacts with both acids and bases/alkalis =1 [1]
[max 2]

Q# 5//iGCSE Chemistry/2012/w/Paper 31/

2 (a) (i) become darker; [1]

(ii) increase; [1]

(iii) black / dark grey; [1]
not: brown
solid; [1]

Q# 6//iGCSE Chemistry/2012/s/Paper 31/

3 (a) (i) decrease down group; [1]

(ii) caesium / francium; [1]

(iii) $2Rb + 2H_2O \rightarrow 2RbOH + H_2$ [2]
not balanced = [1]

Q# 7//iGCSE Chemistry/2012/s/Paper 31/

(b) hard;
strong / high tensile strength;
high mp / bp / high fixed points;
high density; [2]

three properties = [2]
two properties = [1]
not: properties of all metals e.g. good conductor, lustre etc. or form coloured compounds

Q# 8//iGCSE Chemistry/2011/s/Paper 31/ Q5

(c) with hydriodic acid – iodine formed / goes dark brown / grey/black solid [1]

not purple vapour **not** purple/black solution

with hydrobromic acid – bromine formed / goes orange / yellow / brown / reddish brown / red / brown vapour [1]

note can accept brown for iodine provided bromine is different orange/brown etc.

Q# 9//iGCSE Chemistry/2010/s/Paper 31/

1 (i) sulfur [1]

(ii) iodine [1]

(iii) copper **ignore** (II) [1]

(iv) calcium [1]

(v) helium [1]
not name of a compound
accept correct symbols

Q# 10//iGCSE Chemistry/2009/s/Paper 31/

3 (a) (i) D [1]

(ii) E [1]

(iii) B or F [1]

(iv) B [1]

(v) A [1]

Q# 11//iGCSE Chemistry/2008/s/Paper 31/

An incorrectly written symbol, e.g. NA or CL, should be penalised once in a question.

1 (a) bromine [1]

(b) germanium [1]

(c) potassium **or** calcium [1]

(d) krypton [1]

(e) iron **or** cobalt [1]

(f) bromine [1]

Q# 12//iGCSE Chemistry/2007/s/Paper 3/ Q4

(d) (i) ignore a correct chemical property in **(i)**
vanadium harder
vanadium higher melting point **or** boiling point
vanadium higher density
ANY TWO [2]
OR corresponding statements for potassium
NB has to be comparison

(ii) ignore a correct physical property in **(ii)**
potassium more reactive or example of different reactivities-
potassium reacts with cold water, vanadium does not.
potassium one oxidation state, vanadium more than one
vanadium coloured compounds, potassium white **or** colourless
vanadium and its compounds catalysts, not potassium
ANY TWO [2]
NB has to be comment about both elements

(e) (i) fluorine gas [1]
astatine solid [1]

(ii) both have valency of one
both can react with other elements to form halides
both are oxidants
or any correct Chemistry – they both form acidic hydrides
both have diatomic molecules
both accept one electron **or** form ion X^-
both have seven valency electrons
both react with non-metals to form covalent compounds
both react with metals to form ionic compounds
both form acidic oxides
NOT have a valency of 7
ANY TWO [2]

Q# 13//iGCSE Chemistry/2006/w/Paper 3/ Q4

(c) (i) Transition elements/metals **or** d block elements [1]

Q# 14//iGCSE Chemistry/2006/s/Paper 3/

1 (a) compounds are highly coloured **[1]**
used as catalysts **[1]**
more than one oxidation state **[1]**
Four boxes ticked that include three correct choices [2]
Four boxes ticked that include two correct choices [1]
Four boxes ticked that include one correct choices [0]
Five boxes ticked [0]

(b) (i) period 4 **[1]**

Q# 15//iGCSE Chemistry/2005/s/Paper 3/

1 (a) (i) darker **or** actual colours **[1]**
chlorine yellow, yellow/green
bromine orange, brown, brownish red
iodine black grey, purple

(ii) gas, liquid, solid **[1]**
all three needed

(iii) colourless **or** (pale) yellow **[1]**
gas **[1]**

(b) Must have a correct reagent otherwise wc = 0

add chlorine water **or** bubble in chlorine gas **[1]**
yellow **or** orange **or** brown **[1]**
dark brown **or** grey crystals
(**Accept** colour that is darker than for bromide) **[1]**

OR add (acidified) silver nitrate(aq) **[1]**
off white **or** pale yellow **or** cream precipitate **or** soluble in aqueous ammonia **[1]**
yellow precipitate insoluble in aqueous ammonia **[1]**
precipitate essential then either colour **or** solubility in aqueous ammonia

OR add lead nitrate(aq) **[1]**
pale yellow **or** off white **or** cream precipitate **[1]**
yellow precipitate insoluble in aqueous ammonia **[1]**

Accept any test that could work – electrolysis, iron(III) salt
bromine, potassium dichromate, potassium manganate(VII) etc.

Q# 16//iGCSE Chemistry/2003/s/Paper 3/

5 (a)

protons	2
electrons	2
neutrons	4

[3]

Q# 17//iGCSE Chemistry/2002/w/Paper 3/ Q3

(c) (i) silicon [1]

(ii) sodium [1]

(iii) sulphur or chlorine [1]

(d) unreactive **or** inert or does not react [1]

Q# 18//iGCSE Chemistry/2002/w/Paper 3/

2 (a) (i) high densities
high fixed points mp or bp
coloured compounds
hardness
complex ions
ANY three [3]

Q# 19//iGCSE Chemistry/2002/s/Paper 3/

4 (a) (i) fluorine [1]

(ii) iodine and astatine [1]

T8 Essential End of Topic 8 Review and Reflection

This exercise will allow you to see all of your progress in every topic you complete. It will also help you become a more deliberate student, so that you are doing things like talking to a teacher that you might not at the start be comfortable with, but will build really important life skills to allow you to leave your comfort zone and talk to someone who might be interesting, or important, or helpful, even if it might feel easier and therefore better to do less and avoid new people.
Try to be as honest and as detailed as possible. Sometimes you may think you have thought about an idea well, but when you talk with someone else, or write it out, it helps you better understand and allows you think more completely and more clearly.

Did you achieve more goals this topic than last topic (circle)? Yes/No

Fill in this table:

Level	Number of goals achieved at each level	Success rate (%)
FUNDAMENTAL	/5	
ESSENTIAL	/10	
EXTENSION	/13	
EXCEPTIONAL	/10	

Do you feel you tried harder this topic than the previous topic? If yes, how do you know? What helped you to do so? If not, why not?

What could you do differently next time? Try to avoid simply saying "more of *X*", be specific instead, think carefully about the problem, try to think creatively, so if you found your notes less helpful, look at the section at the back about the **Cornell Notetaking System** and write out things you did not do last topic that you would like to try next tropic:

What did you enjoy most about this topic? What was most interesting?

What did you find most difficult? What could you do to make success in this area more likely?

What did you find easiest? Why did you find it easy?

On a scale of 1 being hardest and 5 being most difficult, circle how challenging you found this topic relative to your other AS topics:

1 2 3 4 5

What could be done to make this topic easier to understand?

Do you have any questions about this topic? Is there anything you would like to follow up later?

Google: [topic name] news. **What is the most interesting news about this topic** you found out?

7 Acids, bases and salts

7.1 The characteristic properties of acids and bases

Core

1 Describe the characteristic properties of acids in terms of their reactions with:
   (a) metals
   (b) bases
   (c) carbonates

2 Describe acids in terms of their effect on:
   (a) litmus
   (b) thymolphthalein
   (c) methyl orange

3 State that bases are oxides or hydroxides of metals and that alkalis are soluble bases

4 Describe the characteristic properties of bases in terms of their reactions with:
   (a) acids
   (b) ammonium salts

5 Describe alkalis in terms of their effect on:
   (a) litmus
   (b) thymolphthalein
   (c) methyl orange

6 State that aqueous solutions of acids contain H^+ ions and aqueous solutions of alkalis contain OH^- ions

7 Describe how to compare hydrogen ion concentration, neutrality, relative acidity and relative alkalinity in terms of colour and pH using universal indicator paper

8 Describe the neutralisation reaction between an acid and an alkali to produce water, $H^+(aq) + OH^-(aq) \rightarrow H_2O(l)$

Supplement

9 Define acids as proton donors and bases as proton acceptors

10 Define a strong acid as an acid that is completely dissociated in aqueous solution and a weak acid as an acid that is partially dissociated in aqueous solution

11 State that hydrochloric acid is a strong acid, as shown by the symbol equation, $HCl(aq) \rightarrow H^+(aq) + Cl^-(aq)$

12 State that ethanoic acid is a weak acid, as shown by the symbol equation, $CH_3COOH(aq) \rightleftharpoons H^+(aq) + CH_3COO^-(aq)$

7.2 Oxides

Core

1 Classify oxides as acidic, including SO_2 and CO_2, or basic, including CuO and CaO, related to metallic and non-metallic character

Supplement

2 Describe amphoteric oxides as oxides that react with acids and with bases to produce a salt and water

3 Classify Al_2O_3 and ZnO as amphoteric oxides

7.3 Preparation of salts

Core

1 Describe the preparation, separation and purification of soluble salts by reaction of an acid with:
   (a) an alkali by titration
   (b) excess metal
   (c) excess insoluble base
   (d) excess insoluble carbonate

2 Describe the general solubility rules for salts:
   (a) sodium, potassium and ammonium salts are soluble
   (b) nitrates are soluble
   (c) chlorides are soluble, except lead and silver
   (d) sulfates are soluble, except barium, calcium and lead
   (e) carbonates are insoluble, except sodium, potassium and ammonium
   (f) hydroxides are insoluble, except sodium, potassium, ammonium and calcium (partially)

3 Define a hydrated substance as a substance that is chemically combined with water and an anhydrous substance as a substance containing no water

Supplement

4 Describe the preparation of insoluble salts by precipitation

5 Define the term water of crystallisation as the water molecules present in hydrated crystals, including $CuSO_4 \cdot 5H_2O$ and $CoCl_2 \cdot 6H_2O$

End of Topic 7 Goals Checklist

For each topic you ought to try to do as many of the following things to get the most out of your time, the resources available to you and to help you grow as a student. Tick each goal off as you complete it.
Growth can be painful, but the more of it you do, the easier it can become!!!

Aspect	What you should have done	Yes/No	Level
Interacted with your teacher	Ask your teacher 1 question, about anything, once a week		FUNDAMENTAL
	Try to answer one question asked by your teacher at least once a week		ESSENTIAL
	Ask your teacher one question about something you do not understand in science once a week		ESSENTIAL
	Ask your teacher one question about something to do with science every lesson		EXTENSION
Notes and follow up notes	Complete set of class note		FUNDAMENTAL
	Cornell Notetaking Attempted		ESSENTIAL
	Cornell Notetaking Completed		EXTENSION

Aspect	What you should have done	Yes/No	Level
	Cornell Notetaking Completed to an exemplary standard		EXCEPTIONAL
	Attempted the Mind Map for this topic		ESSENTIAL
	Completed the Mind Map for this topic		EXTENSION
Textbook	Read ahead before the topic has been started		EXTESNION
	Highlighted key ideas and translate new words		FUNDAMENTAL
	Completed the questions at the end of each 2 page spread in your exercise book		EXTENSION
	Added to your class notes ideas and important information from the textbook that you learnt		EXTENSION
Past Exam Questions	Worked on at least 25% of the exam questions in this workbook		FUNDAMENTAL
	Attempted more than 25% of the questions and those questions you have completed you have marked in a different colour pen		ESSENTIAL
	Completed and marked all questions here		EXTENSION
	Completed, marked and additional key ideas where you have located the most difficult marks added to your notebook		EXCEPTIONAL
	Used the resources available online to answer additional questions not found in this workbook on the current topic.		EXCEPTIONAL
	Ask your teacher about an exam question that they cannot answer		EXCEPTIONALLY SMASHING!!!
Assessed Activities	Complete the word list activity using the word list at the front of each topic as little as possible		FUNDAMENTAL
	Complete 2 assessed activities, either in class or as homework		ESSENTIAL
	Complete 2 assessed activities and scored over 70% on average		ESSENTIAL
	Complete 2 assessed activities and scored over 80% on average		EXTENSION
	Complete 2 assessed activities and scored over 90% on average		EXCEPTIONAL
End of Topic Test	Revised sufficiently well to improve upon your score from the previous test (except if you are scoring over 90%, then just write Y for this goal)		ESSENTIAL
	Scored 10% higher than your current average		EXTENSION
	Scored 15% or more than your previous end of topic average		EXCEPTIONAL
	Scored over 90%		EXTESNION
	Scored over 95%		SMASHING!!!
Reading	Spend more than 1 hour a week reading a book **you enjoy** (in any language) about anything.		ESSENTIAL
	Spend more than 3 hours a week reading a book **you enjoy** (in any language) about anything.		EXTENSION
	Spend more than 5 hours a week reading a book **you enjoy** (in any language) about anything.		EXCEPTIONAL
	Spend at least one hour a week reading a book **you enjoy** in English about anything.		EXTENSION
	Spend more than 3 hours a week reading a book **you enjoy** in English about anything.		EXCEPTIONAL
Reflection	You completed this goal setting table		FUNDAMENTAL
	You have looked at the goals you have achieved and the ones you have not and added them up and entered them into the table in the Review and Reflection section		ESSENTIAL
	You have given an answer for every question in the Review and Reflection section at the end of this topic		EXTENSION
	You have Given good and thoughtful answers for every question in the Review and Reflection section at the end of this topic		EXCEPTIONAL

T7 KeyWords

1	**acid** Any substance that breaks apart in water to release H^+ ions (proton doners). They turn universal indicator solution orange or red and have a pH below 7. e.g. $H_2SO_4(aq)$, $CH_3COOH(l)$ or $SO_2(g)$, but not $CO(g)$, $NH_3(aq)$ or $CaO(s)$
2	**acidic oxides** Almost all non-metal oxides and will react with bases. e.g. $CO_2(g)$, $SO_2(g)$or $NO_2(g)$, but not $CO(g)$ or $CaO(s)$
3	**alkalis** Any base that can dissolve in water. They turn universal indicator solution blue or purple and have a pH above 7. e.g. $NaOH(aq)$, $KOH(aq)$ or $NH_3(aq)$ but not $Fe_2O_3(s)$ or $Al_2O_3(s)$
4	**amphoteric** Any substance that will react with both an acid and a base. e.g. $Al_2O_3(s)$ or $ZnO(s)$, but not $Na_2O(s)$
5	**base** Any substance that reacts with an acid which will produce a salt. e.g. $Fe_2O_3(s)$, $NaOH(aq)$ or $NH_3(g)$, but not $SiO_2(s)$ or $HCl(aq)$
6	**basic oxide** Most metal oxides and will react with acids. e.g. $Fe_2O_3(s)$ or $CaO(s)$ but not $Al_2O_3(s)$ or $SiO_2(s)$
7	**concentrated** When a large amount of a substance is dissolved in a solution. e.g. concentrated $H_2SO_4(aq)$ or c. $NaCl(aq)$ or conc. $NaOH(aq)$, but not dil. $NaOH(aq)$
8	**corrosive** Any substance that can react with a material, like a metal or skin, to cause severe damage which often looks like the solid has dissolved into the solution. e.g. concentrated $H_2SO_4(aq)$ or c. $HNO_3(aq)$ or conc. $NaOH(aq)$, but not dil. $NaOH(aq)$ or $H_2O(l)$
9	**dilute** When a small amount of a substance is dissolved in a solution. e.g. dilute H_2SO_4 (aq) or d. NaCl (aq) or dil. NaOH (aq), but not conc. NaOH (aq)
10	**dissociate** When either a solid salt or a covalent molecule breaks apart in water to produce free-moving dissolved ions. e.g. $NaOH(s) \rightarrow Na^+(aq) + OH^-$ or $HCl(aq) \rightarrow H^+(aq) + Cl^-(aq)$
11	**indicator** Any substance that reacts with an acid or a base and changes colour. e.g. methyl orange, thymolphthalein blue and litmus paper

12	**irritant** Any substance that can cause reactions in human skin that can be painful or discomfort. They can be very dangerous if they get into the eye, but is much less damaging to people and materials than corrosive substances. They are often dilute solutions. e.g. dilute H_2SO_4 (aq) or d. NaOH (aq) or household bleach, but not NaCl (aq) or H_2O (l)
13	**Litmus paper** A kind of indicator that has two kinds. The damp red version turns blue if the sample is basic. The damp blue version turns red if the sample is acidic. Can be used to discover is if a solution or gas is either acidic or alkali, but does not give any information about the samples strength.
14	**methyl orange** An indicator that changes from yellow to red when placed in an acidic solution. In dil. HCl (aq) or c. HNO_3 (aq) it is red, but yellow in NaCl (aq) or NaOH (aq).
15	**neutral oxides** A compound that will not react with either an acid or a base e.g. CO(g) but not SO_2 or CaO (s)
16	**neutralisation** A chemical reaction where an acid reacts with a base to produce a salt. $H^+(aq) + OH^-(aq) \rightarrow H_2O(l)$
17	**pH scale** A way to represent how acidic or alkali a solution is. If it is neither then it will have a value of 7. Acids have a value of 1 to 6, neutral solutions are 7 and alkalis are 6 to 14.
18	**precipitation reaction** When two solutions are mixed together and an insoluble solid is formed as a result. e.g. $AgNO_3(aq) + NaCl(aq) \rightarrow AgCl(s) + NaNO_3(aq)$
19	**strong acid** A substance that breaks apart completely in water so that all of its molecules release at least one H^+ ion. They have a pH of around 1. e.g. HCl(aq) or HNO_3(aq) but not CH_3COOH(aq) or NaOHaq)
20	**strong alkali** A substance that will dissolve in water to make a solution with a pH of around 14. e.g. NaOH(aq) or KOH(aq) but not NH_3(aq) or HCl(aq)
21	**suspension** A mixture of a solution and usually particles of an insoluble solid that are small enough to remain evenly spread out within the solution. Precipitation reactions usually produce this kind of mixture.
22	**thymolphthalein blue** An indicator that changes from colourless to blue when placed in an alkali solution.

	In NaOH(aq) it will be blue, but in NaCl(aq) or in HCl(aq) it will be colourless.
23	**Universal Indicator** A mixture of several different indicators in solution which change colours across the full range of pH. When added to a sample it changes colour which can be used to find the unknown pH. This turns purple in strong alkali and red in strong acid but is green in neutral solutions.
24	**weak acid** A substance that only partially breaks apart in water so that only some of its molecules release H^+ ions. They have a pH of around 3 to 6. e.g. $CH_3COOH(aq)$ and $H_3PO_4(aq)$ but not HCl(aq) or NaOH(aq)
25	**weak alkali** A substance that will dissolve in water to make a solution with a pH of around 8 to 12. e.g. $NH_3(aq)$ or $Na_2CO_3(aq)$ but not NaOH(aq) or HCl(aq)

Essential Topic 8 Compounds and Substannces

26	**aluminium oxide** An amphoteric metal oxide that will react with both acids and bases. The metal oxide found in the ore bauxite.
27	**ammonia** A weak non-metal base and alkali. As a gas it turns damp red litmus paper blue. x here: $NH_4NO_3(aq) + NaOH(aq) \rightarrow NaNO_3(aq) + x(aq) + H_2O(l)$
28	**calcium carbonate** A white insoluble salt found in chalk, limestone and marble rocks. x here: $CaCl_2(aq) + Na_2CO_3(aq) \rightarrow x(s) + 2NaCl(aq)$
29	**carbon dioxide** An acidic non-metal oxide gas that turns limewater from colourless to milky white. x here: $CaCO_3(s) + HNO_3(aq) \rightarrow Ca(NO_3)_2(aq) + H_2O(l) + x(g)$
30	**carbon monoxide** A neutral non-metal oxide that will not react with either acids or bases. A toxic gas produced of incomplete combustion with a carbon containing fuel.
31	**chlorine** A diatomic element gas that can bleach damp blue litmus paper white. x here: $x(aq) + 2Br^-(aq) \rightarrow 2Cl^-(aq) + Br_2(aq)$

32	**copper (II) oxide** A black solid containing the copper 2+ ion. x here: $x(s) + H_2SO_4(aq) \rightarrow CuSO_4(aq) + H_2O(l)$
33	**copper sulfate** A salt made from the reaction of copper (II) oxide reacting with sulfuric acid. x here: $CuO(s) + H_2SO_4(aq) \rightarrow x(aq) + H_2O(l)$
34	**ethanoic acid** A colourless weak acid found in vinegar containing 2 carbon atoms. x here: $x(aq) \rightleftharpoons CH_3COO^-(aq) + H^+(aq)$
35	**hydrochloric acid** The most common strong acid containing chlorine. x here: $CaCO_3 + x(aq) \rightarrow CaCl_2(aq) + H_2O(aq)$
36	**hydrogen** A flammable element gas that gives a “squeeky pop” with a lit splint. x here: $Zn(s) + H_2SO_4(aq) \rightarrow ZnSO_4(aq) + x(g)$
37	**nitric acid** The most common strong acid containing nitrogen. x here: $2x(aq) + Ag_2O(s) \rightarrow 2AgNO_3(aq) + H_2O(l)$
38	**oxygen** A diatomic non-metal gas that relights a glowing splint. x here: methane + x → carbon dioxide + water
39	**sodium carbonate** A water-soluble carbonate that would give a yellow flame in a flame test. x here: x + hydrochloric acid → sodium chloride + water + carbon dioxide
40	**sodium chloride** The ionic product of sodium hydroxide reacting with hydrochloric acid. Also called table salt. x here: $HCl(aq) + NaOH(aq) \rightarrow X(aq) + H_2O(l)$

41	**sulfur dioxide** An acidic non-metal oxide that can be oxidised by the purple oxidising agent $KMnO_4(aq)$ which turns colourless. x here: $2x(g) + O_2 \rightleftharpoons 2SO_3(g)$
42	**sulfuric acid** The most common strong acid containing sulfur. x here: $x(s) + Zn(s) \rightarrow ZnSO_4(aq) + H_2(g)$

Essential Topic 8 Key Science Ideas and Titration KeyWords

43	**accuracy** How close to a true value a measurement is. A volume of 25.00cm3 measured by a volumetric pipette has more of this than a volume of 25.00cm3 measured by a burette.
44	**beaker** A container that is shaped like a cylinder, usually made from glass that can be used as a way to contain reactants during a reaction. Although this container often has marks to indicate a rough measure of volume, these should not be used as a measuring device.
45	**Bunsen burner** A device that allows gas to be burnt in a controllable way to deliver a great deal of heat. Has a hole at the base that can be closed to produce a yellow flame called a safety flame because it is easy to see. When fully open it gives a blue flame called a roaring flame because of the sound it makes.
46	**burette** A measuring device that can measure a variable amount of a liquid that is less than 50cm3. A measuring device that can be used to slowly add and measure 25.50cm3 or 16.85cm3, but is not accurate enough for 25.00cm3.
47	**conical flask** A container where the diameter gets smaller towards its top which allows the contents to be mixed easily by swirling it. This is the container that contains the limiting reactant that the excess reactant from the burette is poured into.
48	**crystallization** The process of creating solids which have particles that have a regular arrangement from a mobile state. This happens in saturated solutions when you lower their temperature. Another name for the separation technique that produces a solid from a solution usually through evaporation.
49	**dropping pipette** A way to transfer small volumes, usually drops of liquids from a storage container to a reaction container. This device is used to add 3 drops of indicator to a the limiting reactant in the conical flask in a titration.

50	**evaporating basin** A ceramic bowl shaped container that is used to remove solvent from a solution at a temperature below the boiling point. When this is used, crystals of the solute form where the surface of the solution contact the sides of this container.
51	**flame test** A way to identify unknown substances by heating them up by putting them into a source of heat, like a Bunsen burner. For potassium ions this results in a lilac colour, for copper ions it delivers a blue-green colour.
52	**gentle heat** An amount of heat that is appropriate for the substances being heated so that they are not damaged by thermal decomposition. This can be provided using an electrical heater on a low setting appropriate for the substance being heated.
53	**gentle washing** When done with distilled water this can remove any impurities in the solution on a wet solid. For water soluble solids this process will remove soluble impurities, but without losing too much of the solid.
54	**measuring cylinder** The least accurate measuring device used to measure a variable volume of liquids. In addition to being able to quickly add measured volumes of liquids, important for starting rate experiments, it can also be used to measure the volume of a gas produced if filled with water and turned upside down.
55	**meniscus** The name of the curve on the surface of a liquid like water makes when it is in a tube like a burette. When using an instrument like a burette, your eyes should be level with this and you should use the bottom, lowest part of this to make your reading.
56	**precision** How many decimal places of a given unit a device measures to. A 50.00cm3 burette has more of this than a 50cm3 measuring cylinder.
57	**reliability** When repeated measurements are closer to each other they have more of this. This can be increased by performing more of the same experiment and taking the average. Titrations are repeated until two titres are within 0.10cm3 of each other to show that the value for the volume used will have this.
58	**titre** The total volume of excess reactant added from the burette in a titration needed to reach the end point. x here: (final volume of burette reading) – (initial volume of burette) = x
59	**volumetric pipette** The most accurate measuring device used to measure the volume of a fixed amount, usually exactly 25.00cm3, of liquid.

	A measuring device that can be used to slowly add and measure 25.00cm3 of liquid only, but not 25.50cm3 or 16.85cm3.
60	**white tile** A ceramic surface that is placed under the conical flask in a titration to allow the colour change indicating the end point to be seen better. A hard and bright square used to make it easier to see colour changes in containers.

T7 Paper 2 Exam Questions

iG Chem 7nw EQ P2 17w to 16m 46marks

Q# 1/ iGCSE Chemistry/2017/w/Paper 23/www.SmashingScience.org :o)

19 Three solids, P, Q and R, all react with dilute sulfuric acid to produce zinc sulfate.

P and R produce gases during the reaction.

The gas produced when P reacts will not burn. The gas produced when R reacts will burn.

What are P, Q and R?

	P	Q	R
A	zinc	zinc hydroxide	zinc carbonate
B	zinc carbonate	zinc	zinc oxide
C	zinc carbonate	zinc hydroxide	zinc
D	zinc oxide	zinc carbonate	zinc

20 Which ion forms a green precipitate with aqueous sodium hydroxide that dissolves in an excess of aqueous sodium hydroxide?

A Ca^{2+} **B** Cr^{3+} **C** Cu^{2+} **D** Fe^{2+}

Q# 2/ iGCSE Chemistry/2017/w/Paper 22/www.SmashingScience.org :o)

19 Copper(II) sulfate can be prepared by adding excess copper(II) carbonate to sulfuric acid.

Why is an **excess** of copper(II) carbonate added?

A to ensure all the copper(II) carbonate has reacted

B to ensure all the sulfuric acid has reacted

C to increase the rate of reaction

D to increase the yield of copper(II) sulfate

20 Compound P reacts with hydrochloric acid to produce a gas that turns limewater milky.

What is P?

A sodium carbonate

B sodium chloride

C sodium hydroxide

D sodium sulfate

17 Some properties of four oxides are listed.

Oxide 1 reacts with both acids and alkalis to form salts.

Oxide 2 reacts with acids to form salts but does not react with alkalis.

Oxide 3 reacts with alkalis to form salts but does not react with acids.

Oxide 4 does not react with acids or alkalis.

Which row describes the oxides?

	oxide 1	oxide 2	oxide 3	oxide 4
A	amphoteric	acidic	basic	neutral
B	amphoteric	basic	acidic	neutral
C	neutral	acidic	basic	amphoteric
D	neutral	basic	acidic	amphoteric

18 What is **not** a typical characteristic of acids?

A They react with alkalis producing water.

B They react with **all** metals producing hydrogen.

C They react with carbonates producing carbon dioxide.

D They turn blue litmus paper red.

19 Zinc sulfate is made by reacting an excess of zinc oxide with dilute sulfuric acid.

The excess zinc oxide is then removed from the solution.

Which process is used to obtain solid zinc sulfate from the solution?

A crystallisation

B dissolving

C filtration

D fractional distillation

20 What is used to test for chlorine?

A a glowing splint

B damp litmus paper

C limewater

D potassium manganate(VII) solution

18 Which oxide is amphoteric?

A Al_2O_3 **B** CaO **C** Na_2O **D** SO_2

19 Chloric(I) acid, HClO, is formed when chlorine dissolves in water. It is a weak acid.

What is meant by the term *weak acid*?

A It contains fewer hydrogen atoms than a strong acid.

B It is easily neutralised by a strong alkali.

C It is less concentrated than a strong acid.

D It is only partially ionised in solution.

20 Silver nitrate reacts with sodium chloride to produce silver chloride and sodium nitrate. The equation for the reaction is shown.

$$AgNO_3(aq) + NaCl(aq) \rightarrow AgCl(s) + NaNO_3(aq)$$

How is silver chloride separated from the reaction mixture?

A crystallisation

B distillation

C evaporation

D filtration

21 Aqueous sodium hydroxide reacts with an aqueous solution of compound Y to give a green precipitate.

Aqueous ammonia also reacts with an aqueous solution of compound Y to give a green precipitate.

In each case the precipitate is insoluble when an excess of reagent is added.

Which ion is present in Y?

A chromium(III)

B copper(II)

C iron(II)

D iron(III)

18 Which type of oxide is aluminium oxide?

A acidic

B amphoteric

C basic

D neutral

19 Which statements about a weak acid, such as ethanoic acid, are correct?

1 It reacts with a carbonate.

2 It does not neutralise aqueous sodium hydroxide solution.

3 It turns red litmus blue.

4 It is only partially ionised in aqueous solution.

A 1 and 2 **B** 1 and 4 **C** 2 and 3 **D** 3 and 4

20 Silver chloride is a white solid which is insoluble in water.

Which statement describes how a sample of pure silver chloride can be made?

A Add aqueous silver nitrate to aqueous sodium chloride and then filter.

B Add aqueous silver nitrate to dilute hydrochloric acid, evaporate and then crystallise.

C Add silver carbonate to dilute hydrochloric acid, evaporate and then crystallise.

D Add silver to dilute hydrochloric acid, filter and then wash the residue.

21 Dilute sulfuric acid is added to two separate aqueous solutions, X and Y. The observations are shown.

solution X	white precipitate
solution Y	bubbles of a colourless gas

Which row shows the ions present in the solutions?

	solution X	solution Y
A	Ba^{2+}	CO_3^{2-}
B	Ca^{2+}	Cl^-
C	Cu^{2+}	CO_3^{2-}
D	Fe^{2+}	NO_3^-

18 Zinc oxide is amphoteric.

Which row describes the reactions of zinc oxide?

	reaction with hydrochloric acid	reaction with aqueous sodium hydroxide
A	✓	✓
B	✓	✗
C	✗	✓
D	✗	✗

key

✓ = reaction occurs

✗ = reaction does not occur

19 Which row shows how the hydrogen ion concentration and pH of ethanoic acid compare to those of hydrochloric acid of the same concentration?

	ethanoic acid compared to hydrochloric acid	
	hydrogen ion concentration	pH
A	higher	higher
B	higher	lower
C	lower	higher
D	lower	lower

20 A pure sample of the insoluble salt barium carbonate can be made using the method given.

step 1 Dissolve barium chloride in water.

step 2 Separately dissolve sodium carbonate in water.

step 3 Mix the two solutions together.

step 4 Filter the mixture.

step 5

step 6 Dry the residue between two sheets of filter paper.

Which instruction is missing from step 5?

A Heat the residue to dryness.

B Heat the residue to the point of crystallisation.

C Place the filtrate in an evaporating basin.

D Wash the residue with water.

21 Substance X reacts with warm dilute hydrochloric acid to produce a gas which decolourises acidified aqueous potassium manganate(VII).

Substance X gives a yellow flame in a flame test.

What is X?

A potassium chloride

B potassium sulfite

C sodium chloride

D sodium sulfite

Q# 7/ iGCSE Chemistry/2017/m/Paper 22/www.SmashingScience.org :o)

18 Beryllium oxide reacts with both sulfuric acid and aqueous sodium hydroxide.

Which type of oxide is beryllium oxide?

A acidic

B amphoteric

C basic

D neutral

19 A student investigates two acids W and X.

The same volumes of W and X are reacted separately with excess magnesium.

The student makes the following observations.

1 Hydrogen gas is produced at a faster rate with W than with X.

2 The total volume of hydrogen gas produced is the same for both acids.

Which statement explains these observations?

A The pH of W is higher than the pH of X.

B W is an organic acid.

C W is a stronger acid than X.

D W is more concentrated than X.

20 A student is given an unknown solution.

Which two tests provide evidence that the solution is copper(II) sulfate?

1 adding dilute hydrochloric acid

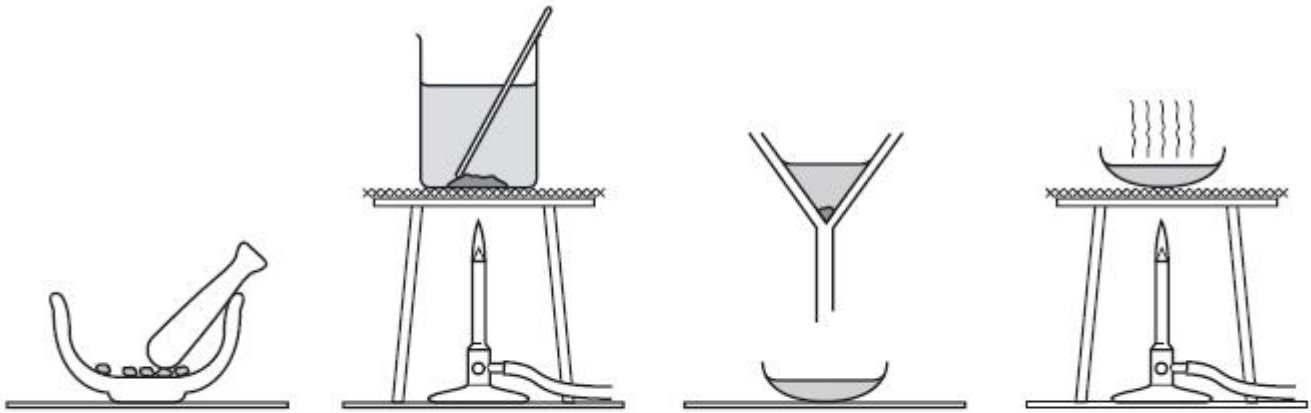
2 adding aqueous sodium hydroxide

3 adding dilute nitric acid, then silver nitrate solution

4 adding dilute nitric acid, then barium nitrate solution

A 1 and 3 B 1 and 4 C 2 and 3 D 2 and 4

21 The diagram shows the steps in the preparation of a salt.



step 1 step 2 step 3 step 4

Which salt is prepared by this method?

A barium sulfate

B copper(II) sulfate

C potassium sulfate

D sodium sulfate

Q# 8/ iGCSE Chemistry/2016/w/Paper 23/www.SmashingScience.org :o)

23 Compound T is added to dilute hydrochloric acid and warmed gently.

The mixture gives off a gas which turns acidified aqueous potassium manganate(VII) from purple to colourless.

A flame test on compound T gives a lilac flame.

What is compound T?

A sodium sulfate

B sodium sulfite

C potassium sulfate

D potassium sulfite

Q# 9/ iGCSE Chemistry/2016/w/Paper 22/www.SmashingScience.org :o)

23 Aqueous sodium hydroxide was added slowly, until in excess, to separate solutions of W, X, Y and Z.

The results are shown.

solution	initial observation with aqueous sodium hydroxide	final observation with excess aqueous sodium hydroxide
W	white precipitate formed	precipitate dissolves
X	white precipitate formed	no change
Y	pale blue precipitate formed	no change
Z	green precipitate formed	no change

Which row identifies the metal ions in the solutions?

	metal ion in solution W	metal ion in solution X	metal ion in solution Y	metal ion in solution Z
A	aluminium	calcium	copper(II)	iron(II)
B	aluminium	calcium	iron(II)	copper(II)
C	aluminium	iron(II)	calcium	copper(II)
D	calcium	aluminium	copper(II)	iron(II)

Q# 10/ iGCSE Chemistry/2016/w/Paper 21/www.SmashingScience.org :o)

23 Four substances, P, Q, R and S, are tested as shown.

test	substance			
	P	Q	R	S
dilute hydrochloric acid added	gas given off which 'pops' with a lighted splint	gas given off which turns limewater milky	no reaction	no reaction
dilute aqueous sodium hydroxide added and warmed gently	no reaction	no reaction	gas given off which turns damp, red litmus paper blue	no reaction

What are P, Q, R and S?

	P	Q	R	S
A	Mg	Na_2CO_3	NH_4Cl	$NaCl$
B	Mg	NH_4Cl	Na_2CO_3	$NaCl$
C	Mg	Na_2CO_3	$NaCl$	NH_4Cl
D	Na_2CO_3	Mg	$NaCl$	NH_4Cl

18 Germanium oxide is a white powder.

Germanium oxide reacts with concentrated hydrochloric acid.

Germanium oxide reacts with concentrated aqueous sodium hydroxide.

Germanium oxide does not dissolve when added to water.

Which type of oxide is germanium oxide?

A acidic

B amphoteric

C basic

D neutral

19 Hydrogen chloride gas reacts with water to produce an acidic solution. The equation for the reaction is shown.

$$HCl + H_2O \rightarrow Cl^- + H_3O^+$$

Which statement describes what happens during the reaction?

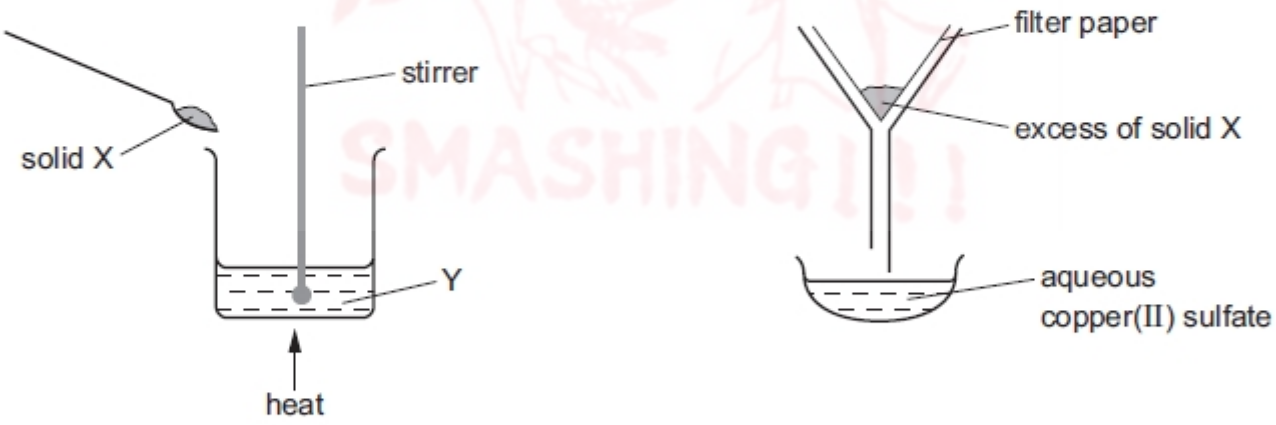
A The chloride ion is formed by accepting an electron from the water.

B The hydrogen chloride loses an electron to form the chloride ion.

C The water accepts a proton from the hydrogen chloride.

D The water donates a proton to the hydrogen chloride.

20 The apparatus shown is used to prepare aqueous copper(II) sulfate.



What are X and Y?

	X	Y
A	copper	aqueous iron(II) sulfate
B	copper(II) chloride	sulfuric acid
C	copper(II) oxide	sulfuric acid
D	sulfur	aqueous copper(II) chloride

21 Information about some silver compounds is shown in the table.

compound	formula	solubility in water
silver carbonate	Ag_2CO_3	insoluble
silver chloride	$AgCl$	insoluble
silver nitrate	$AgNO_3$	soluble
silver oxide	Ag_2O	insoluble

Which equation shows a reaction which **cannot** be used to make a silver salt?

A $AgNO_3(aq) + HCl(aq) \rightarrow AgCl(s) + HNO_3(aq)$

B $Ag_2O(s) + 2HNO_3(aq) \rightarrow 2AgNO_3(aq) + H_2O(l)$

C $Ag_2CO_3(s) + 2HNO_3(aq) \rightarrow 2AgNO_3(aq) + H_2O(l) + CO_2(g)$

D $2Ag(s) + 2HCl(aq) \rightarrow 2AgCl(s) + H_2(g)$

Q# 12/ iGCSE Chemistry/2016/s/Paper 23/www.SmashingScience.org :o)

20 Barium sulfate is an insoluble salt.

It can be made by reacting copper(II) sulfate solution with barium nitrate solution.

$$CuSO_4(aq) + Ba(NO_3)_2(aq) \rightarrow Cu(NO_3)_2(aq) + BaSO_4(s)$$

What is the correct order of steps to obtain a pure, dry sample of barium sulfate from the reaction mixture?

	step 1	step 2	step 3
A	filter	evaporate the filtrate to dryness	leave the solid formed to cool
B	filter	evaporate the filtrate to the point of crystallisation	leave the filtrate to cool
C	filter	leave the residue in a warm place to dry	wash the residue with water
D	filter	wash the residue with water	leave the residue in a warm place to dry

Q# 13/ iGCSE Chemistry/2016/s/Paper 22/www.SmashingScience.org :o)

20 Silver chloride is insoluble in water and is prepared by precipitation.

Which two substances can be used to make silver chloride?

A barium chloride and silver nitrate

B hydrochloric acid and silver

C hydrochloric acid and silver bromide

D sodium chloride and silver iodide

18 Which statements are properties of an acid?

1 reacts with ammonium sulfate to form ammonia

2 turns red litmus blue

	1	2
A	✓	✓
B	✓	✗
C	✗	✓
D	✗	✗

19 Which row describes whether an amphoteric oxide reacts with acids and bases?

	reacts with acids	reacts with bases
A	no	no
B	no	yes
C	yes	no
D	yes	yes

20 Which substance reacts with dilute sulfuric acid to form a salt that can be removed from the resulting mixture by filtration?

A aqueous barium chloride

B aqueous sodium hydroxide

C copper

D copper(II) carbonate

Q# 15/ iGCSE Chemistry/2016/m/Paper 22/www.SmashingScience.org :o)

18 Concentrated hydrochloric acid is a *strong acid*.

What is meant by the terms 'strong' and 'acid'?

	strong	acid
A	contains a low proportion of water	accepts protons
B	contains a low proportion of water	donates protons
C	fully ionised	accepts protons
D	fully ionised	donates protons

19 Which oxide is amphoteric?

A aluminium oxide

B calcium oxide

C carbon monoxide

D sodium oxide

20 A salt is made by adding an excess of an insoluble metal oxide to an acid.

How is the excess metal oxide removed from the mixture?

A chromatography

B crystallisation

C distillation

D filtration

21 A substance is heated with aluminium foil in aqueous sodium hydroxide. A gas is produced which turns damp, red litmus paper blue.

Which anion is present in the substance?

A carbonate

B iodide

C nitrate

D sulfate

T7 Paper 2 Mark Scheme

Mark Scheme iG Chem 7nw EQ P2 17w to 16m 46marks

Q# 1/ iGCSE Chemistry/2017/w/Paper 23/

19	C
20	B

Q# 2/ iGCSE Chemistry/2017/w/Paper 22/

19	B
20	A

Q# 3/ iGCSE Chemistry/2017/w/Paper 21/

17	B
18	B
19	A
20	B

Q# 4/ iGCSE Chemistry/2017/s/Paper 23/

18	A
19	D
20	D
21	C

Q# 5/ iGCSE Chemistry/2017/s/Paper 22/

18	B
19	B
20	A
21	A

Q# 6/ iGCSE Chemistry/2017/s/Paper 21/

18	A
19	C
20	D
21	D

Q# 7/ iGCSE Chemistry/2017/m/Paper 22/

18	B
19	C
20	D
21	B

Q# 8/ iGCSE Chemistry/2016/w/Paper 23/

23	**D**

Q# 9/ iGCSE Chemistry/2016/w/Paper 22/

23	**A**

Q# 10/ iGCSE Chemistry/2016/w/Paper 21/

23	**A**

Q# 11/ iGCSE Chemistry/2016/w/Paper 21/

18	**B**
19	**C**
20	**C**

Q# 12/ iGCSE Chemistry/2016/s/Paper 23/

18	**D**
19	**D**
20	**D**

Q# 13/ iGCSE Chemistry/2016/s/Paper 22/

20	**A**

Q# 14/ iGCSE Chemistry/2016/s/Paper 21/

18	**D**
19	**D**
20	**A**

Q# 15/ iGCSE Chemistry/2016/m/Paper 22/

18	**D**
19	**A**
20	**D**
21	**C**

Tests for ions (Topic 7)

Tests for anions

anion	test	test result
carbonate (CO_3^{2-})	add dilute acid	effervescence, carbon dioxide produced
chloride (Cl^-) [in solution]	acidify with dilute nitric acid, then add aqueous silver nitrate	white ppt.
bromide (Br^-) [in solution]	acidify with dilute nitric acid, then add aqueous silver nitrate	cream ppt.
iodide (I^-) [in solution]	acidify with dilute nitric acid, then add aqueous silver nitrate	yellow ppt.
nitrate (NO_3^-) [in solution]	add aqueous sodium hydroxide, then aluminium foil; warm carefully	ammonia produced
sulfate (SO_4^{2-}) [in solution]	acidify, then add aqueous barium nitrate	white ppt.
sulfite (SO_3^{2-})	add dilute hydrochloric acid, warm gently and test for the presence of sulfur dioxide	sulfur dioxide produced will turn acidified aqueous potassium manganate(VII) from purple to colourless

Tests for aqueous cations

cation	effect of aqueous sodium hydroxide	effect of aqueous ammonia
aluminium (Al^{3+})	white ppt., soluble in excess giving a colourless solution	white ppt., insoluble in excess
ammonium (NH_4^+)	ammonia produced on warming	–
calcium (Ca^{2+})	white ppt., insoluble in excess	no ppt. or very slight white ppt.
chromium(III) (Cr^{3+})	green ppt., soluble in excess	grey-green ppt., insoluble in excess
copper (Cu^{2+})	light blue ppt., insoluble in excess	light blue ppt., soluble in excess, giving a dark blue solution
iron(II) (Fe^{2+})	green ppt., insoluble in excess	green ppt., insoluble in excess
iron(III) (Fe^{3+})	red-brown ppt., insoluble in excess	red-brown ppt., insoluble in excess
zinc (Zn^{2+})	white ppt., soluble in excess, giving a colourless solution	white ppt., soluble in excess, giving a colourless solution

Tests for gases

gas	test and test result
ammonia (NH_3)	turns damp, red litmus paper blue
carbon dioxide (CO_2)	turns limewater milky
chlorine (Cl_2)	bleaches damp litmus paper
hydrogen (H_2)	'pops' with a lighted splint
oxygen (O_2)	relights a glowing splint
sulfur dioxide (SO_2)	turns acidified aqueous potassium manganate(VII) from purple to colourless

Flame tests for metal ions

metal ion	flame colour
lithium (Li^+)	red
sodium (Na^+)	yellow
potassium (K^+)	lilac
copper(II) (Cu^{2+})	blue-green

iG Chem 7 EQ P3 15w to 01s NEW 188marks

Q# 1/ iGCSE Chemistry/2015/w/Paper 31/

2 Describe how to separate the following. In each example, give a description of the procedure used and explain why this method works.

(d) Magnesium hydroxide from a mixture of magnesium hydroxide and zinc hydroxide.

procedure .....

.....

explanation .....

.....

[3]

Q# 2/ iGCSE Chemistry/2015/s/Paper 31/

6 Acid-base reactions are examples of proton transfer.

(a) Ethylamine is a weak base and sodium hydroxide is a strong base.

(i) In terms of proton transfer, explain what is meant by the term *weak base*.

.....

..... [2]

(ii) Given aqueous solutions of both bases, describe how you could show that sodium hydroxide is the stronger base. How could you ensure a 'fair' comparison between the two solutions?

.....

.....

.....

..... [3]

(b) Ethylamine reacts with acids to form salts.

$$CH_3CH_2NH_2 + HCl \rightarrow \underset{\text{ethylammonium chloride}}{CH_3CH_2NH_3Cl}$$

(i) Complete the equation for the reaction between sulfuric acid and ethylamine. Name the salt formed.

.....$CH_3CH_2NH_2$ + ... → .....

name of salt ..... [3]

(ii) Amines and their salts have similar chemical properties to ammonia and ammonium salts.

Suggest a reagent that could be used to displace the weak base, ethylamine, from its salt ethylammonium chloride.

..... [1]

Q# 3/ iGCSE Chemistry/2014/w/Paper 31/

1 **(a)** Match the following pH values to the solutions given below.

1 3 7 10 13

The solutions all have the same concentration.

solution	**pH**
aqueous ammonia, a weak base	.....
dilute hydrochloric acid, a strong acid	.....
aqueous sodium hydroxide, a strong base	.....
aqueous sodium chloride, a salt	.....
dilute ethanoic acid, a weak acid	.....

[5]

(b) Explain why solutions of hydrochloric acid and ethanoic acid with the same concentration, in mol/dm^3, have a different pH.

.....

.....

..... [2]

(c) Measuring pH is one way of distinguishing between a strong acid and a weak acid. Describe another method.

method .....

.....

results .....

.....

[2]

Q# 4/ iGCSE Chemistry/2014/s/Paper 31/ Q4

(b) Across a period, the elements change from metallic to non-metallic.

(i) Describe how the type of oxide changes across this period.

.....

..... [2]

Q# 5/ iGCSE Chemistry/2013/s/Paper 31/

6 Ammonia is a compound which only contains the elements nitrogen and hydrogen. It is a weak base.

(a) (i) Define the term *base*.

..... [1]

(ii) Given aqueous solutions of ammonia and sodium hydroxide, both having a concentration of 0.1 mol/dm^3, how could you show that ammonia is the weaker base?

.....

.....

..... [2]

Q# 6/ iGCSE Chemistry/2013/s/Paper 31/

2 An element, **M**, has the electron distribution 2 + 8 + 18 + 3.

(e) The hydroxide of **M** is a white powder which is insoluble in water.
Describe how you could show that this hydroxide is amphoteric.

.....

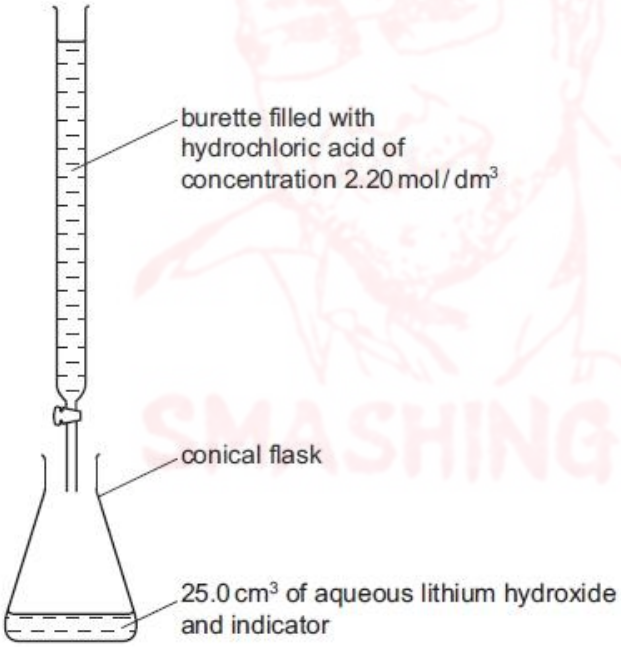
.....

..... [2]

Q# 7/ iGCSE Chemistry/2013/s/Paper 31/

7 The hydroxides of the Group I metals are soluble in water. Most other metal hydroxides are insoluble in water.

(a) (i) Crystals of lithium chloride can be prepared from lithium hydroxide by titration.



25.0 cm^3 of aqueous lithium hydroxide is pipetted into the conical flask.
A few drops of an indicator are added. Dilute hydrochloric acid is added slowly to the alkali until the indicator just changes colour. The volume of acid needed to neutralise the lithium hydroxide is noted.

A neutral solution of lithium chloride, which still contains the indicator, is left. Describe how you could obtain a neutral solution of lithium chloride which does **not** contain an indicator.

.....

..... [2]

(ii) You cannot prepare a neutral solution of magnesium chloride by the same method. Describe how you could prepare a neutral solution of magnesium chloride.

.....

.....

..... [3]

(b) The concentration of the hydrochloric acid was 2.20 mol / dm^3. The volume of acid needed to neutralise the 25.0 cm^3 of lithium hydroxide was 20.0 cm^3. Calculate the concentration of the aqueous lithium hydroxide.

$$LiOH + HCl \rightarrow LiCl + H_2O$$

.....

.....

..... [2]

(c) Lithium chloride forms three hydrates. They are $LiCl.H_2O$, $LiCl.2H_2O$ and $LiCl.3H_2O$. Which **one** of these three hydrates contains 45.9% of water?
Show how you arrived at your answer.

.....

.....

..... [3]

Q# 8/ iGCSE Chemistry/2012/w/Paper 31/ Q7

(b) Strontium chloride-6-water can be made from the insoluble compound, strontium carbonate, by the following reactions.

$$SrCO_3(s) + 2HCl(aq) \rightarrow SrCl_2(aq) + CO_2(g) + H_2O(l)$$

$$SrCl_2(aq) + 6H_2O(l) \rightarrow SrCl_2.6H_2O(s)$$

The following method was used to prepare the crystals.

1 Add excess strontium carbonate to hot hydrochloric acid.
2 Filter the resulting mixture.
3 Partially evaporate the filtrate and allow to cool.
4 Filter off the crystals of $SrCl_2.6H_2O$.
5 Dry the crystals between filter papers.

(i) How would you know when excess strontium carbonate had been added in step 1?

.....

..... [1]

(ii) Why is it necessary to filter the mixture in step 2?

..... [1]

(iii) In step 3, why partially evaporate the filtrate rather than evaporate to dryness?

..... [1]

Q# 9/ iGCSE Chemistry/2012/w/Paper 31/

4 Silicon(IV) oxide, SiO_2, and zirconium(IV) oxide, ZrO_2, are both macromolecules. They have similar physical properties but silicon(IV) oxide is acidic and zirconium(IV) oxide is amphoteric.

(c) (i) Name a reagent that reacts with the oxides of both elements.

..... [1]

(ii) Name a reagent that reacts with only one of the oxides.

reagent .....

oxide which reacts ..... [2]

Q# 10/ iGCSE Chemistry/2012/s/Paper 31/

2 Three ways of making salts are

- titration using a soluble base or carbonate
- neutralisation using an insoluble base or carbonate
- precipitation.

(a) Complete the following table of salt preparations.

method	reagent 1	reagent 2	salt
titration	....	....	sodium nitrate
neutralisation	nitric acid	....	copper(II) nitrate
precipitation	....	....	silver(I) chloride
neutralisation	sulfuric acid	zinc(II) carbonate	....

[6]

(b) (i) Write an ionic equation with state symbols for the preparation of silver(I) chloride.

..... [2]

(ii) Complete the following equation.

$$ZnCO_3 + H_2SO_4 \rightarrow \ldots\ldots\ldots\ldots + \ldots\ldots\ldots\ldots + \ldots\ldots\ldots\ldots$$

[2]

Q# 11/ iGCSE Chemistry/2011/w/Paper 31/ Q5

(c) Describe how you could test the solution to find out which ion, Fe^{2+} or Fe^{3+}, is present.

.....

.....

..... [3]

Q# 12/ iGCSE Chemistry/2011/w/Paper 31/

1 This question is concerned with the following oxides.

sulfur dioxide
carbon monoxide
lithium oxide
aluminium oxide
nitrogen dioxide
strontium oxide

(a) (i) Which of the above oxides will react with hydrochloric acid but not with aqueous sodium hydroxide?

..... [1]

(ii) Which of the above oxides will react with aqueous sodium hydroxide but not with hydrochloric acid?

..... [1]

(iii) Which of the above oxides will react with both hydrochloric acid and aqueous sodium hydroxide?

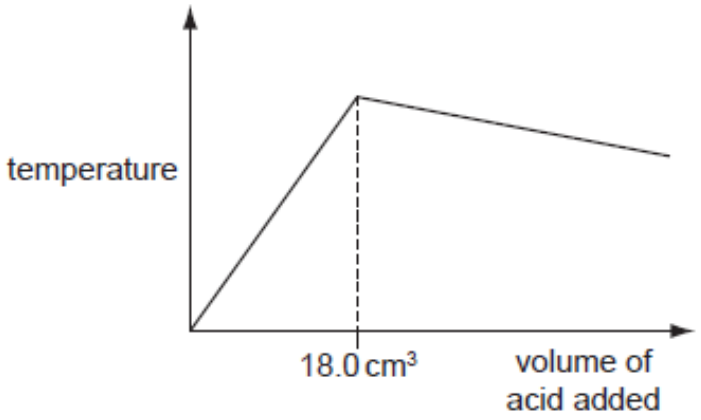
..... [1]

(iv) Which of the above oxides will not react with hydrochloric acid or with aqueous sodium hydroxide?

..... [1]

Q# 13/ iGCSE Chemistry/2011/s/Paper 31/ Q5

(d) 20.0 cm^3 of aqueous sodium hydroxide, 2.00 mol / dm^3, was placed in a beaker. The temperature of the alkali was measured and 1.0 cm^3 portions of hydriodic acid were added. After each addition, the temperature of the mixture was measured. Typical results are shown on the graph.



$$NaOH(aq) + HI(aq) \rightarrow NaI(aq) + H_2O(l)$$

(iii) In another experiment, it was shown that 15.0 cm^3 of the acid neutralised 20.0 cm^3 of aqueous sodium hydroxide, 1.00 mol/dm^3. Calculate the concentration of the acid.

.....

..... [2]

Q# 14/ iGCSE Chemistry/2011/s/Paper 31/ Q2

(c) The selenide ion reacts with water.

$$Se^{2-} + H_2O \rightarrow HSe^- + OH^-$$

What type of reagent is the selenide ion in this reaction? Give a reason for your choice.

.....

..... [3]

Q# 15/ iGCSE Chemistry/2011/s/Paper 31/ NOT with Q5(a)

5 (a) (i) $2Li + 2HI \rightarrow 2LiI + H_2$

(ii) zinc carbonate + hydriodic acid → zinc iodide + carbon dioxide + water

(iii) $MgO + 2HI \rightarrow MgI_2 + H_2O$

(b) Two of the reactions in **(a)** are acid/base and one is redox. Which one is redox? Explain your choice.

.....

.....

..... [2]

Q# 16/ iGCSE Chemistry/2011/s/Paper 31/

5 Hydriodic acid, HI(aq), is a strong acid. Its salts are iodides.

(a) It has the reactions of a typical strong acid. Complete the following equations.

(i) .....Li + ...HI → ..... + ... [1]

(ii) zinc carbonate + hydriodic acid → ..... + ... + ...

[1]

(iii) MgO + ...HI → ..... + ...

[1]

Q# 17/ iGCSE Chemistry/2010/w/Paper 31/ Q6

(b) Beryllium hydroxide, a white solid, is an amphoteric hydroxide.

(i) Name another metal which has an amphoteric hydroxide.

..... [1]

(ii) Suggest what you would observe when an excess of aqueous sodium hydroxide is added gradually to aqueous beryllium sulfate.

.....

..... [2]

Q# 18/ iGCSE Chemistry/2010/w/Paper 31/

8 Soluble salts can be made using a base and an acid.

(a) Complete this method of preparing dry crystals of the soluble salt cobalt(II) chloride-6-water from the insoluble base cobalt(II) carbonate.

Step 1

Add an excess of cobalt(II) carbonate to hot dilute hydrochloric acid.

Step 2

.....

.....

Step 3

.....

.....

Step 4

.....

..... [4]

Q# 19/ iGCSE Chemistry/2009/w/Paper 3/

2 Oxides are classified as acidic, basic, neutral and amphoteric.

(a) Complete the table.

type of oxide	pH of solution of oxide	example
acidic		
basic		
neutral		

[6]

(b) (i) Explain the term *amphoteric*.

.....

..... [1]

(ii) Name two reagents that are needed to show that an oxide is amphoteric.

.....

..... [2]

Q# 20/ iGCSE Chemistry/2009/s/Paper 31/ Q7

(b) They react with water to form acidic solutions.

$$HCl + H_2O \rightleftharpoons H_3O^+ + Cl^-$$

$$HF + H_2O \rightleftharpoons H_3O^+ + F^-$$

(i) Explain why water behaves as a base in both of these reactions.

.....

..... [2]

(ii) At equilibrium, only 1% of the hydrogen chloride exists as molecules, the rest has formed ions. In the other equilibrium, 97% of the hydrogen fluoride exists as molecules, only 3% has formed ions.

What does this tell you about the strength of each acid?

.....

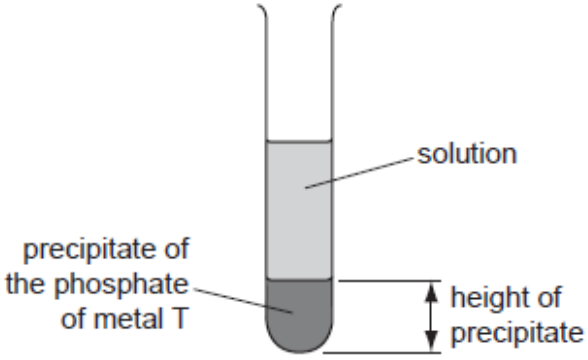
..... [2]

(iii) How would the pH of these two solutions differ?

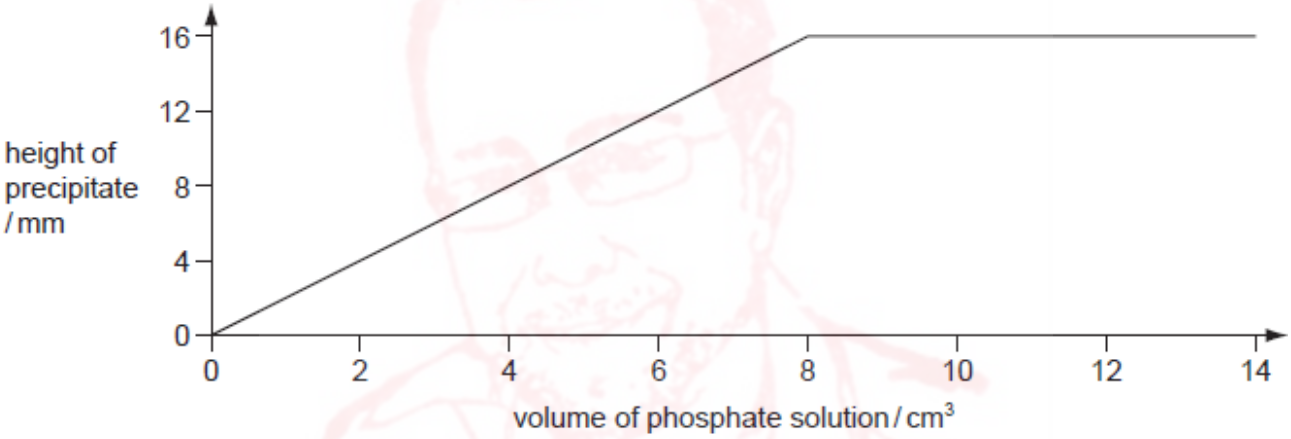
..... [1]

(b) The formulae of insoluble compounds can be found by precipitation reactions.

To 12.0 cm^3 of an aqueous solution of the nitrate of metal T was added 2.0 cm^3 of aqueous sodium phosphate, Na_3PO_4. The concentration of both solutions was 1.00 mol / dm^3. When the precipitate had settled, its height was measured.



The experiment was repeated using different volumes of the phosphate solution. The results are shown on the following graph.



What is the formula of the phosphate of metal T? Give your reasoning.

.....

.....

.....

..... [3]

Q# 22/ iGCSE Chemistry/2009/s/Paper 31/

5 Insoluble salts are made by precipitation.

(a) A preparation of the insoluble salt calcium fluoride is described below.

To 15 cm^3 of aqueous calcium chloride, 30 cm^3 of aqueous sodium fluoride is added. The concentration of both solutions is 1.00 mol / dm^3. The mixture is filtered and the precipitate washed with distilled water. Finally, the precipitate is heated in an oven.

(i) Complete the equation.

Ca^{2+} + ...F^- ⟶ ..... [2]

(ii) Why is the volume of sodium fluoride solution double that of the calcium chloride solution?

.....

..... [1]

(iii) Why is the mixture washed with distilled water?

.....

..... [1]

(iv) Why is the solid heated?

.....

..... [1]

Q# 23/ iGCSE Chemistry/2008/w/Paper 31/

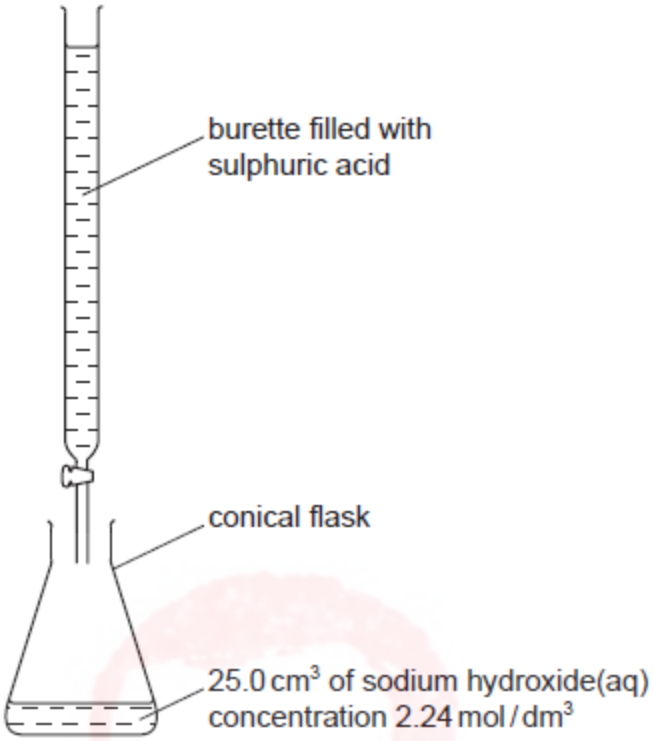
1 Complete the following table.

gas	test for gas
ammonia	
	bleaches damp litmus paper
hydrogen	
	relights a glowing splint
	turns limewater milky

[Total: 5]

Q# 24/ iGCSE Chemistry/2008/s/Paper 31/

7 Crystals of sodium sulphate-10-water, $Na_2SO_4.10H_2O$, are prepared by titration.



(a) 25.0 cm^3 of aqueous sodium hydroxide is pipetted into a conical flask.
A few drops of an indicator are added. Using a burette, dilute sulphuric acid is slowly added until the indicator just changes colour. The volume of acid needed to neutralise the alkali is noted.

Suggest how you would continue the experiment to obtain pure, dry crystals of sodium sulphate-10-water.

.....

.....

.....

..... [4]

Q# 25/ iGCSE Chemistry/2008/s/Paper 31/

5 Carbonyl chloride, $COCl_2$, is a colourless gas. It is made by the following reaction.

$$CO(g) + Cl_2(g) \underset{\text{heat}}{\overset{\text{cool}}{\rightleftharpoons}} COCl_2(g)$$

(c) Carbonyl chloride reacts with water to form two acidic compounds.
Suggest which acidic compounds are formed.

1. .....

2. ..... [2]

Q# 26/ iGCSE Chemistry/2008/s/Paper 31/

4 Sulphuric acid is a typical strong acid.

(a) Change the equations given into a different format.

(i) $Mg + H_2SO_4 \longrightarrow MgSO_4 + H_2$
Change into a word equation.

..... [1]

(ii) lithium oxide + sulphuric acid ⟶ lithium sulphate + water
Change into a symbol equation.

..... [2]

(iii) $CuO + 2H^+ \longrightarrow Cu^{2+} + H_2O$
Change the ionic equation into a symbol equation.

..... [2]

(iv) $Na_2CO_3 + H_2SO_4 \longrightarrow Na_2SO_4 + CO_2 + H_2O$
Change into a word equation.

..... [1]

(b) When sulphuric acid dissolves in water, the following reaction occurs.
$H_2SO_4 + H_2O \longrightarrow HSO_4^- + H_3O^+$
Explain why water is behaving as a base in this reaction.

..... [2]

(c) Sulphuric acid is a strong acid, ethanoic acid is a weak acid.
Explain the difference between a strong acid and a weak acid.

.....

..... [2]

Q# 27/ iGCSE Chemistry/2007/w/Paper 3/

5 Methylamine, CH_3NH_2, is a weak base. Its properties are similar to those of ammonia.

(a) When methylamine is dissolved in water, the following equilibrium is set up.

$$\underset{\text{base}}{CH_3NH_2} + \underset{\text{acid}}{H_2O} \rightleftharpoons CH_3NH_3^+ + OH^-$$

(i) Suggest why the arrows are not the same length.

..... [1]

(ii) Explain why water is stated to behave as an acid and methylamine as a base.

.....

..... [2]

(b) An aqueous solution of the strong base, sodium hydroxide, is pH 12. Predict the pH of an aqueous solution of methylamine which has the same concentration. Give a reason for your choice of pH.

.....

..... [2]

(c) Methylamine is a weak base like ammonia.

(i) Methylamine can neutralise acids.

$$2CH_3NH_2 + H_2SO_4 \rightarrow (CH_3NH_3)_2\,SO_4$$
methylammonium sulphate

Write the equation for the reaction between methylamine and hydrochloric acid. Name the salt formed.

.....

..... [2]

(ii) When aqueous methylamine is added to aqueous iron(II) sulphate, a green precipitate is formed. What would you see if iron(III) chloride solution had been used instead of iron(II) sulphate?

..... [1]

(iii) Suggest the name of a reagent that will displace methylamine from one of its salts, for example methylammonium sulphate.

..... [1]

Q# 28/ iGCSE Chemistry/2007/s/Paper 3/

3 There are three methods of preparing salts.

Method **A** – use a burette and an indicator.

Method **B** – mix two solutions and obtain the salt by precipitation.

Method **C** – add an excess of base or a metal to a dilute acid and remove the excess by filtration.

For each of the following salt preparations, choose one of the methods **A**, **B** or **C**, name any additional reagent needed and then write or complete the equation.

(i) the soluble salt, zinc sulphate, from the insoluble base, zinc oxide

method .....

reagent .....

word equation ..... [3]

(ii) the soluble salt, potassium chloride, from the soluble base, potassium hydroxide

method .....

reagent .....

equation ..... + ... → $KCl + H_2O$ [3]

(iii) the insoluble salt, lead(II) iodide, from the soluble salt, lead(II) nitrate

method .....

reagent .....

equation Pb^{2+} + ... → ..... [4]

[Total: 10]

Q# 29/ iGCSE Chemistry/2006/s/Paper 3/ Q3

(d) This question is concerned with the following oxides.

aluminium oxide	Al_2O_3
calcium oxide	CaO
carbon dioxide	CO_2
carbon monoxide	CO
magnesium oxide	MgO
sulphur dioxide	SO_2

(i) Which of the above oxides will react with hydrochloric acid but not with aqueous sodium hydroxide?

..... [1]

(ii) Which of the above oxides will react with aqueous sodium hydroxide but not with hydrochloric acid?

..... [1]

(iii) Which of the above oxides will react both with hydrochloric acid and with aqueous sodium hydroxide?

..... [1]

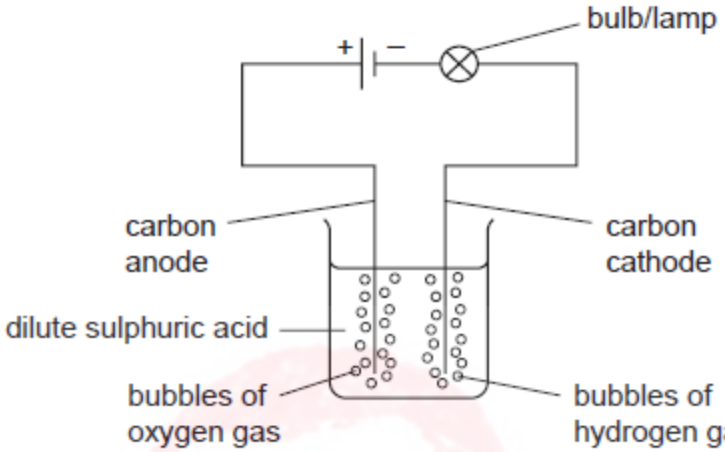
(iv) Which of the above oxides will react neither with hydrochloric acid nor with aqueous sodium hydroxide?

.....

[1]

Q# 30/ iGCSE Chemistry/2006/s/Paper 3/ Q3

(b) The following apparatus was set up to investigate the electrical conductivity of dilute acids.



Dilute sulphuric acid is a strong acid. If it was replaced by a weak acid, what **two** differences in the observations would you expect to make?

.....

.....

.....

[2]

Q# 31/ iGCSE Chemistry/2006/s/Paper 3/ Q2

(c) The equation for the reaction of **X** with cold water is given below.

$$2X(s) + 2H_2O(l) \longrightarrow 2XOH(aq) + H_2(g)$$

(i) Describe the test you would use to show that the gas evolved is hydrogen.

.....

.....

[1]

(ii) How could you show that the water contained a compound of the type **X**OH?

.....

.....

[2]

(iii) In which group of the Periodic Table does metal **X** belong?

.....

[1]

(iv) The ore of **X** is its chloride. Suggest how metal **X** could be extracted from its chloride.

.....

[2]

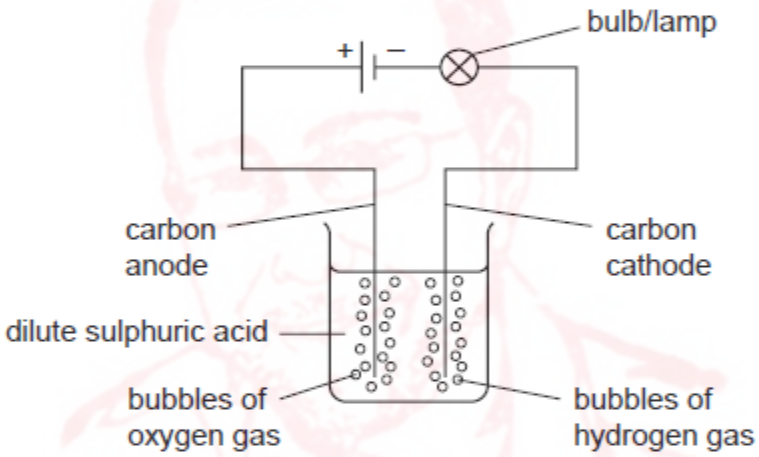
3 **(a)** Four bottles were known to contain aqueous ammonia, dilute hydrochloric acid, sodium hydroxide solution and vinegar, which is dilute ethanoic acid. The bottles had lost their labels. The pH values of the four solutions were 1, 4, 10 and 13.

Complete the table.

solution	pH
aqueous ammonia	
dilute hydrochloric acid	
sodium hydroxide solution	
vinegar	

[2]

(b) The following apparatus was set up to investigate the electrical conductivity of dilute acids.



Dilute sulphuric acid is a strong acid. If it was replaced by a weak acid, what **two** differences in the observations would you expect to make?

.....

.....

..... [2]

(c) When nitric acid is added to water the following reaction occurs.

$$HNO_3 + H_2O \longrightarrow NO_3^- + H_3O^+$$

Give the name and the formula of the particle which is transferred from nitric acid to water.

name .....

formula ..... [2]

Q# 33/ iGCSE Chemistry/2005/w/Paper 3/ Q6

(b) In the above method, a soluble salt was prepared by neutralising an acid with an insoluble base. Other salts have to be made by different methods.

(i) Give a brief description of how the soluble salt, rubidium sulphate could be made from the soluble base, rubidium hydroxide.

.....

.....

.....

..... [3]

(ii) Suggest a method of making the insoluble salt, calcium fluoride.

.....

.....

.....

..... [3]

Q# 34/ iGCSE Chemistry/2005/w/Paper 3/ Q5

(c) The major ore of strontium is its carbonate, $SrCO_3$. Strontium is extracted by the electrolysis of its molten chloride.

(i) Name the reagent that will react with the carbonate to form the chloride.

..... [1]

Q# 35/ iGCSE Chemistry/2005/s/Paper 3/ Q2

(b) Describe how you could show by adding aqueous sodium hydroxide and aqueous ammonia that a solution contained zinc ions.

result with sodium hydroxide .....

excess sodium hydroxide .....

result with aqueous ammonia .....

excess aqueous ammonia ..... [3]

Q# 36/ iGCSE Chemistry/2005/s/Paper 3/Q3

(d) Propanoic acid is a weak acid.

(i) The following equation represents its reaction with ammonia.

$$CH_3-CH_2-COOH + NH_3 \longrightarrow CH_3-CH_2-COO^- + NH_4^+$$

Explain why propanoic acid behaves as an acid and ammonia as a base.

.....

..... [3]

(ii) Explain the expression *weak acid.*

..... [1]

Q# 37/ iGCSE Chemistry/2005/s/Paper 3/

3 A South Korean chemist has discovered a cure for smelly socks. Small particles of silver are attached to a polymer, poly(propene), and this is woven into the socks.

(b) To show that the polymer contains silver the following test was carried out.

The polymer fibres were chopped into small pieces and warmed with nitric acid. The silver atoms were oxidised to silver(I) ions. The mixture was filtered. Aqueous sodium chloride was added to the filtrate and a white precipitate formed.

(i) Why was the mixture filtered?

..... [1]

(ii) Explain why the change of silver atoms to silver ions is oxidation.

..... [1]

(iii) Give the name of the white precipitate.

..... [1]

Q# 38/ iGCSE Chemistry/2005/s/Paper 3/Q6

(c) Complete the following table by writing "reaction" or "no reaction" in the spaces provided.

oxide	type of oxide	reaction with acid	reaction with alkali
magnesium	basic	.....	.....
aluminium	amphoteric	.....	.....

[2]

Q# 39/ iGCSE Chemistry/2004/w/Paper 3/ QiGCSE Chemistry/201 (d)

(i) Describe how you could show that the gas collected in this experiment is oxygen.

[1]

Q# 40/ iGCSE Chemistry/2004/w/Paper 3/

2 The salt copper(II) sulphate can be prepared by reacting copper(II) oxide with sulphuric acid.

Complete the list of instructions for making copper(II) sulphate using **six** of the words below.

blue cool dilute filter

saturated sulphate white oxide

Instructions

1 Add excess copper(II) oxide to _____ sulphuric acid in a beaker and boil it.

2 _____ to remove the unreacted copper(II) oxide.

3 Heat the solution until it is _____.

4 _____ the solution to form _____

coloured crystals of copper (II) _____. [6]

Q# 41/ iGCSE Chemistry/2004/s/Paper 3/ Q2 (b)

(iii) Rock phosphate (calcium phosphate) is obtained by mining. It reacts with concentrated sulphuric acid to form the fertiliser, superphosphate. Predict the formula of each of these phosphates.

fertiliser	ions	formula
calcium phosphate	Ca^{2+} and PO_4^{3-}	.....
calcium superphosphate	Ca^{2+} and $H_2PO_4^-$	..... [2]

(iv) The ionic equation for the reaction between the phosphate ion and sulphuric acid is shown below.

$$PO_4^{3-} + 2H_2SO_4 \rightarrow H_2PO_4^- + 2HSO_4^-$$

Explain why the phosphate ion is described as acting as a base in this reaction.

..... [2]

T7 Paper 3/4 Mark Scheme

Mark Scheme iG Chem 7 EQ P3 15w to 01s NEW 188marks

Q# 1/ iGCSE Chemistry/2015/w/Paper 31/

2(d)	add sodium hydroxide solution; filter; zinc hydroxide (is amphoteric it) will react or will dissolve / magnesium hydroxide does not react or does not dissolve;	1 1 1

Q# 2/ iGCSE Chemistry/2015/s/Paper 31/

6(a)(i)	M1 proton acceptor; M2 does not accept (protons) readily **OR** less able to accept protons (than strong bases);	 2	**A** alternative words to 'acceptor' e.g. 'receiver' **I** references to pH **A** 'hydrogen ion' or 'H^+' for proton **I** accepts fewer / less protons
6(a)(ii)	M1 same concentration of both bases; M2 measure their pH; M3 the higher pH is the stronger base;	 3	 **A** suitable method e.g. universal indicator or pH paper or pH meter **I** litmus or methyl orange or phenolphthalein **I** titration methods for M2 and M3 **A** suitable colours of both weak strong bases e.g. ethylamine is (greeny)blue, NaOH is darker blue/purple **A** alternative methods for M2 and M3 e.g. measure conductivity (M2) and higher conductivity is the stronger base (M3) e.g.add aluminium / Al (M2) and stronger base gives faster rate of effervescence / more fizzing / more bubbling (M3)
6(b)(i)	$2CH_3CH_2NH_2 + H_2SO_4 \rightarrow (CH_3CH_2NH_3)_2SO_4$ species; balancing; the salt is ethylammonium sulfate;	 3	**A** multiples **I** state symbols **A** one mark for correct product **A** close spellings **A** diethylammonium sulfate
6(b)(ii)	sodium hydroxide / calcium hydroxide / NaOH / $Ca(OH)_2$;	1	**A** any Group 1 or Group 2 hydroxide or oxide

Q# 3/ iGCSE Chemistry/2014/w/Paper 31/

1 (a) Match the following pH values to the solutions given below.

1 3 7 10 13

The solutions all have the same concentration.

solution	pH
aqueous ammonia, weak base	10
dilute hydrochloric acid, a strong acid	1
aqueous sodium hydroxide, a strong base	13
aqueous sodium chloride, a salt	7
dilute ethanoic acid, a weak acid	3

[5]

(b) Hydrochloric acid strong acid **or** ethanoic acid weak acid [1]
OR: hydrochloric acid completely ionised **or** ethanoic acid partially ionised
hydrochloric acid greater concentration of/more H^+ ions (than ethanoic acid) [1]

(c) Rate of reaction with Ca, Mg, Zn, Fe [1]

Strong (hydrochloric) acid bubbles faster **or** more bubbles **or** dissolves faster [1]

OR: rate of reaction with (metal) carbonate [1]
strong (hydrochloric) acid faster **or** more bubbles **or** dissolves faster (only if carbonate insoluble) [1]

OR: electrical conductivity [1]
strong (hydrochloric) acid better conductor [1]

Q# 4/ iGCSE Chemistry/2014/s/Paper 31/ Q4

(b) (i) Assume change is from L to R unless clearly stated:
basic to amphoteric to acidic (2) [2]

Q# 5/ iGCSE Chemistry/2013/s/Paper 31/

6 (a) (i) proton or H^+ acceptor [1]

(ii) (measure) pH or (use) UI indicator [1]
note: can be implied need not be explicit
sodium hydroxide has higher pH / ammonia(aq) has lower pH [1]
(this sentence would score 2 marks)
or
appropriate colours with UI / appropriate numerical values [1]
ammonia is closer to green, blue-green, turquoise or lighter blue
sodium hydroxide is darker blue / purple / violet [1]
or
measure electrical conductivity [1]
can be implied need not be explicit
ammonia (aq) is the poorer conductor/ sodium hydroxide is the better conductor [1]

Q# 6/ iGCSE Chemistry/2013/s/Paper 31/ Q2

(e) it would react with/dissolves in a named strong acid [1]
it would react with/dissolves in a named alkali [1]
it shows both basic and acid properties =1 [1]
it reacts with both acids and bases/alkalis =1 [1]
[max 2]

Q# 7/ iGCSE Chemistry/2013/s/Paper 31/

7 (a) (i) add carbon / animal charcoal [1]
filter [1]

OR

repeat experiment without indicator [1]
using same quantity / volume of acid [1]

(ii) add magnesium metal / carbonate / oxide / hydroxide
to (hot) (hydrochloric) acid [1]

cond: until in excess **or** no more dissolves **or** reacts [1]

cond: filter (to remove unreacted solid) [1]

(b) number of moles of HCl = 0.020 x 2.20 = 0.044 [1]
number of moles of LiOH = 0.044
concentration of LiOH = $0.044/0.025 = 1.769\,(mol/dm^3)$ [1]
accept 1.75 to 1.77 need 2 dp
correct answer scores = 2

(c) (for $LiCl.2H_2O$)
mass of one mole = 78.5 [1]
percentage water = 36 / 78.5 x 100 [1]
45.9 so is $LiCl.2H_2O$ [1]
only award the marks if you can follow the reasoning and it gives 45.9% of water

note: if correct option given mark this and ignore the rest of the response

allow: max 2 for applying a correct method to another hydrate, [1] for the method and [1] for the correct value, working essential

Q# 8/ iGCSE Chemistry/2012/w/Paper 31/ Q7

(b) (i) strontium carbonate does not dissolve / no effervescence; [1]
note: not just reaction is complete

(ii) to remove excess / unreacted / undissolved strontium carbonate; [1]

(iii) water of crystallisation needed / $6H_2O$ in crystals / would get anhydrous salt / would not get hydrated salt / crystals dehydrate; [1]
not: just to obtain crystals

Q# 9/ iGCSE Chemistry/2012/w/Paper 31/ Q4

(c) (i) sodium hydroxide / any named alkali / reactive metal; [1]

(ii) named acid; [1]
zirconium oxide; [1]

Q# 10/ iGCSE Chemistry/2012/s/Paper 31/

2 (a) nitric acid; [1]
sodium hydroxide / carbonate / hydrogen carbonate; [1]

copper(II) oxide / hydroxide / carbonate; [1]

any named soluble chloride; [1]
accept: *hydrochloric acid / hydrogen chloride*
silver(I) nitrate / ethanoate / sulfate; [1]
must be soluble silver salt **not** *silver oxide / carbonate*

zinc(II) sulfate [1]

(b) (i) $Ag^+(aq) + Cl^-(aq) \rightarrow AgCl(s)$ [2]
equation correct state symbols missing [1]

(ii) $ZnCO_3 + H_2SO_4 \rightarrow ZnSO_4 + CO_2 + H_2O$ [2]
correct formula for zinc sulfate = 1

[Total: 10]

Q# 11/ iGCSE Chemistry/2011/w/Paper 31/ Q5

(c) add sodium hydroxide solution / ammonia(aq) [1]
Fe^{2+} green precipitate [1]
Fe^{3+} brown precipitate [1]

Q# 12/ iGCSE Chemistry/2011/w/Paper 31/

1 (a) (i) lithium oxide / strontium oxide [1]

(ii) sulfur dioxide / nitrogen dioxide [1]

(iii) aluminium oxide [1]

(iv) carbon monoxide [1]
accept: correct formulae

Q# 13/ iGCSE Chemistry/2011/s/Paper 31/ Q5(d)

(iii) 1.33 / 1.3 / 1.3333 (mol/dm^3) scores both marks [2]
not 1.34
for a correct method – $M_1 V_1$ / moles of NaOH = 0.02
with an incorrect answer **only** [1]

Q# 14/ iGCSE Chemistry/2011/s/Paper 31/ Q2

(c) base [1]
not alkali
accepts a proton [2]
accepts hydrogen ion / H^+ **only** [1]
proton and H^+ [2]

Q# 15/ iGCSE Chemistry/2011/s/Paper 31/ Q5

(b) reaction 1 is redox / Li/2HI reaction [1]
cond reason either oxidation number/state / electron transfer [1]

Q# 16/ iGCSE Chemistry/2011/s/Paper 31/

5 **(a) (i)** $2Li + 2HI \rightarrow 2LiI + H_2$ [1]

(ii) zinc carbonate + hydriodic acid $\rightarrow$ zinc iodide + carbon dioxide + water [1]

(iii) $MgO + 2HI \rightarrow MgI_2 + H_2O$ [1]

Q# 17/ iGCSE Chemistry/2010/w/Paper 31/ Q6

(b) (i) zinc / aluminium / lead / tin / chromium [1]

(ii) white precipitate [1]
precipitate dissolves / colourless solution forms / forms a clear solution / soluble in excess [1]

Q# 18/ iGCSE Chemistry/2010/w/Paper 31/

8 **(a)** filter / centrifuge / decant [1]
(partially) evaporate / heat / boil [1]
allow to crystallise / cool / let crystals form [1]
dry crystals / dry between filter paper / leave in a warm place to dry [1]
"dry" on its own must be a verb
evaporate to dryness only marks 1 and 2
note if discuss residue only mark 1

Q# 19/ iGCSE Chemistry/2009/w/Paper 3/

2 **(a)** pH < 7 [1]
example [1]

pH > 7 [1]
example [1]
NOT amphoteric oxides Be, Al, Zn, Pb, Sn etc

pH = 7 [1]
example H_2O, CO, NO [1]
the two marks are not linked, mark each independently
NOT amphoteric oxides Be, Al, Zn, Pb, Sn etc.

(b) (i) shows both basic and acidic properties [1]

(ii) a named strong acid [1]
a named alkali [1]

Q# 20/ 7iGCSE Chemistry/2009/s/Paper 31/ Q7

(b) (i) because it accepts a proton [2]
accepts hydrogen ion **or** H^+ **ONLY** [1]
proton and H^+ [2]

(ii) hydrogen chloride is a strong acid [1]
hydrogen fluoride is a weak acid [1]
weaker **or** stronger correctly applied for [2]

(iii) hydrogen chloride (aqueous) would have lower pH [1]
OR hydrogen fluoride (aqueous) would have higher pH
If values suggested, not over 7

Q# 21/ iGCSE Chemistry/2009/s/Paper 31/ Q5

(b) $T_3(PO_4)_2$ allow correct example [1]
explain why 8 cm^3 react fully [1]
comment about mole ratio [1]

Q# 22/ iGCSE Chemistry/2009/s/Paper 31/

5 (a) (i) $Ca^{2+} + 2F^- \rightarrow CaF_2$ [2]
Not balanced **ONLY** [1]
Both species must be correct for first mark. Second mark is for correct balancing.

(ii) Mole ratio Ca^{2+}: F^- is 1:2 [1]
Answer must mention moles
accept argument based on charges or number of ions
accept 2 moles of NaF react with 1 mole of $CaCl_2$
NOT just "2" in equation
If fluorine must specify atoms or ions

(iii) to remove traces of solutions **or** to remove soluble impurities **or** to remove a named salt sodium chloride **or** sodium fluoride **or** calcium chloride [1]
To remove impurities is not enough

(iv) to dry (precipitate) **or** to remove water **or** to evaporate water [1]
NOT to evaporate some of water **NOT** to crystallise salt

Q# 23/ iGCSE Chemistry/2008/w/Paper 31/

1 red litmus paper blue [1]
OR white fumes/smoke with HCl (g) **or** (aq)

chlorine [1]

"pop" with a lighted splint **or** burn with a pop **or** goes pop and extinguishes flame [1]
NOT glowing splint

oxygen [1]

carbon dioxide [1]
ACCEPT correct formulae

[Total: 5]

Q# 24/ iGCSE Chemistry/2008/s/Paper 31/

7 (a) repeat experiment without indicator **or** use carbon to remove indicator [1]
(partially) evaporate **or** boil **or** heat [1]
allow to cool **or** crystallise **or** crystals [1]
dry crystals [1]
MUST be in correct order
NB evaporate to dryness, marks one and two **ONLY**

Q# 25/ iGCSE Chemistry/2008/s/Paper 31/

5

(c) hydrogen chloride **or** hydrochloric acid [1]
carbon dioxide **or** carbonic acid **or** hydrogen carbonate [1]

Q# 26/ iGCSE Chemistry/2008/s/Paper 31/

4 (a) (i) magnesium + sulphuric acid = magnesium sulphate + hydrogen [1]
ACCEPT hydrogen sulphate

(ii) $Li_2O + H_2SO_4 \rightarrow Li_2SO_4 + H_2O$ [2]
formulae correct but not balanced [1]

(iii) $CuO + H_2SO_4 \rightarrow CuSO_4 + H_2O$ [2]
OR $CuO + 2HCl \rightarrow CuCl_2 + H_2O$
OR $CuO + 2HNO_3 \rightarrow Cu(NO_3)_2 + H_2O$
formulae correct but not balanced [1]

(iv) sodium carbonate + sulphuric acid → sodium sulphate + carbon dioxide + water [1]

(b) it accepts a proton [2]
it accepts a hydrogen ion [1] **ONLY**

(c) sulphuric acid is completely ionised [1]
or few molecules and many ions
ethanoic acid is partially ionised [1]
or many molecules and few ions

Q# 27/ iGCSE Chemistry/2007/w/Paper 3/

5 (a) (i) equilibrium to left **or** many molecules and few ions **or**
partially ionised **or** reverse reaction favoured [1]

(ii) Water donates proton [1]
methylamine accepts a proton [1]
NOTE If hydrogen ion then **ONLY** [1] provided both are correct

(b) less than 12 more than 7 [1]
smaller concentration of hydroxide ions **or** partially dissociated **or**
poor proton acceptor **or** poor H^+ acceptor [1]
NOT it is a weak base

(c) (i) $CH_3NH_2 + HCl = CH_3NH_3Cl$ [1]
methylammonium chloride [1]
NOTE the equation must be as written, the equation with sulphuric acid has been given as guidance.

(ii) brown precipitate [1]
ACCEPT orange **or** red/brown **or** brick red **or** brown/red

(iii) sodium hydroxide **or** any named strong base [1]

Q# 28/ iGCSE Chemistry/2008/s/Paper 31/

3 (i) method C [1]
sulphuric acid (allow if given in equation) [1]
zinc oxide + sulphuric acid = zinc sulphate + water [1]

(ii) method A [1]
hydrochloric acid [1]
$KOH + HCl = KCl + H_2O$ [1]

(iii) method B [1]
potassium iodide **or** any soluble iodide [1]
$Pb^{2+} + 2I^- = PbI_2$ accept a correct equation even if soluble iodide is wrong [2]
Not balanced - $Pb^{2+} + I^- = PbI_2$ ONLY [1]

Q# 29/ iGCSE Chemistry/2006/s/Paper 3/ Q3

(d) (i) CaO and MgO [1]

(ii) CO_2 and SO_2 [1]

(iii) Al_2O_3 [1]

(iv) CO [1]

Q# 30/ iGCSE Chemistry/2006/s/Paper 3/ Q3

(b) With strong acid bulb brighter [1]
faster rate of bubbles [1]
OR corresponding comments for weak acid

Q# 31/ iGCSE Chemistry/2006/s/Paper 3/ Q2

(c) (i) goes "pop" with burning splint [1]
or mixed with air and ignited goes pop
NOT glowing splint

(ii) test and observable result [1]
universal indicator goes blue
or pH paper goes blue
or high pH, accept 13, 14
or ammonium ion gives off ammonia
or with metallic cations forms a precipitate [1]
NOT litmus
ONLY accept - neutralises acids with an observable result,
e.g. becomes warm.

(iii) Group 1 [1]

(iv) electrolysis [1]
COND molten [1]

Q# 32/ iGCSE Chemistry/2006/s/Paper 3/

3 (a) ammonia 10
hydrochloric acid 1
sodium hydroxide 13
ethanoic acid 4
All correct [2]
Two correct [1]

(b) With strong acid bulb brighter [1]
faster rate of bubbles [1]
OR corresponding comments for weak acid

(c) proton **NOT** hydrogen ion [1]
H^+ not conditional on proton [1]
Only way for [2] is proton and H^+

Q# 33/ iGCSE Chemistry/2005/w/Paper 3/ Q6

(b)(i) sulphuric acid
COND description of titration
repeat without indicator **or** with carbon
evaporation
any **TWO** **[3]**

(ii) suitable reactants calcium chloride and sodium fluoride **[1]**
COND upon correct reagents
filter **[1]**
wash and dry precipitate **[1]**

OR Accept synthesis
calcium **[1]**
fluorine **[1]**
burn **or** heat **[1]** **[3]**

Q# 34/ iGCSE Chemistry/2005/w/Paper 3/ Q5

(c)(i) hydrochloric acid **[1]**

Q# 35/ iGCSE Chemistry/2005/s/Paper 3/ Q2

(b) for zinc and sodium hydroxide white precipitate **[1]**
dissolves in excess (only if precipitate mentioned) **[1]**

for zinc and ammonia same results **[1]**
Mark either first (sodium hydroxide **or** aqueous ammonia), if completely correct, then an additional [1] can be awarded for stating that the other has the same results.

Q# 36/ iGCSE Chemistry/2005/s/Paper 3/
3

(d) (i) acid loses a proton **[2]**
base accepts a proton **[1]**

OR same explanation but acid loses a hydrogen ion (1)
and base gains hydrogen ion (1)

(ii) only partially ionised **or** poor hydrogen ion donor **or** poor proton donor **[1]**
NOT does not form many hydrogen ions in water **or** low concentration of hydrogen ions
NOT pH

Q# 37/ iGCSE Chemistry/2005/s/Paper 3/
3

(b) (i) to remove fibres **or** remove solid
NOT precipitate, **NOT** impurities, **NOT** to obtain a filtrate **[1]**

(ii) because silver atoms have lost electrons **[1]**
OR oxidation number increased

(iii) silver chloride **[1]**

Q# 38/ iGCSE Chemistry/2005/s/Paper 3/

(c) reaction no reaction **[1]**
reaction reaction **[1]**

Q# 39/ iGCSE Chemistry/2004/w/Paper 3/ QiGCSE Chemistry/201

(d) (i) glowing splint burst into flame or rekindled **[1]**
Must have glowing or equivalent idea
OR any similar description that includes the two points glowing and relights.

Q# 40/ iGCSE Chemistry/2004/w/Paper 3/

2 dilute
filter
saturated
cool
blue
sulphate **[6]**

Q# 41/ iGCSE Chemistry/2004/s/Paper 3/ Q2 (b)

(iii) $Ca_3(PO_4)_2$ **[1]**

$Ca(H_2PO_4)_2$ **[1]**

(iv) only acceptable responses are:
accepts a proton **[2]**
accepts H^+ **[1]** only

Q# 42/ iGCSE Chemistry/2004/s/Paper 3/

4 (a) (i) Named soluble zinc salt **[1]**
corresponding sodium salt **[1]**
If hydroxide **or** oxide then 0/2

(ii) Correct equation **[2]**
not balanced **[1]** only

(iii) Correct equation **[2]**

(b) (i) $Fe^{3+} + 3OH^- = Fe(OH)_3$ **[1]**

(ii) Max at $8cm^3$ **[1]**
Same shape of graph

Just the above shape, the height of the precipitate and the volume of sodium hydroxide are irrelevant **[1]**

(iii) Maximum then height of precipitate decreases **[1]**
or graph slopes down to x axis **or** comes to zero

hydroxide dissolves in excess **or** it is amphoteric **[1]**

T7 Essential End of Topic 7 Review and Reflection

This exercise will allow you to see all of your progress in every topic you complete. It will also help you become a more deliberate student, so that you are doing things like talking to a teacher that you might not at the start be comfortable with, but will build really important life skills to allow you to leave your comfort zone and talk to someone who might be interesting, or important, or helpful, even if it might feel easier and therefore better to do less and avoid new people.
Try to be as honest and as detailed as possible. Sometimes you may think you have thought about an idea well, but when you talk with someone else, or write it out, it helps you better understand and allows you think more completely and more clearly.

Did you achieve more goals this topic than last topic (circle)? Yes/No

Fill in this table:

Level	Number of goals achieved at each level	Success rate (%)
FUNDAMENTAL	/5	
ESSENTIAL	/10	
EXTENSION	/13	
EXCEPTIONAL	/10	

Do you feel you tried harder this topic than the previous topic? If yes, how do you know? What helped you to do so? If not, why not?

What could you do differently next time? Try to avoid simply saying "more of *X*", be specific instead, think carefully about the problem, try to think creatively, so if you found your notes less helpful, look at the section at the back about the **Cornell Notetaking System** and write out things you did not do last topic that you would like to try next tropic:

What did you enjoy most about this topic? What was most interesting?

What did you find most difficult? What could you do to make success in this area more likely?

What did you find easiest? Why did you find it easy?

On a scale of 1 being hardest and 5 being most difficult, circle how challenging you found this topic relative to your other AS topics:

1 2 3 4 5

What could be done to make this topic easier to understand?

Do you have any questions about this topic? Is there anything you would like to follow up later?

Google: [topic name] news. **What is the most interesting news about this topic** you found out?

12 Experimental techniques and chemical analysis

12.1 Experimental design

Core

1 Name appropriate apparatus for the measurement of time, temperature, mass and volume, including:
   (a) stopwatches
   (b) thermometers
   (c) balances
   (d) burettes
   (e) volumetric pipettes
   (f) measuring cylinders
   (g) gas syringes
2 Suggest advantages and disadvantages of experimental methods and apparatus
3 Describe a:
   (a) solvent as a substance that dissolves a solute
   (b) solute as a substance that is dissolved in a solvent
   (c) solution as a mixture of one or more solutes dissolved in a solvent
   (d) saturated solution as a solution containing the maximum concentration of a solute dissolved in the solvent at a specified temperature
   (e) residue as a substance that remains after evaporation, distillation, filtration or any similar process
   (f) filtrate as a liquid or solution that has passed through a filter

Supplement

12.2 Acid–base titrations

Core

1 Describe an acid–base titration to include the use of a:
   (a) burette
   (b) volumetric pipette
   (c) suitable indicator
2 Describe how to identify the end-point of a titration using an indicator

Supplement

12.3 Chromatography

Core

1 Describe how paper chromatography is used to separate mixtures of soluble coloured substances, using a suitable solvent

2 Interpret simple chromatograms to identify:
   (a) unknown substances by comparison with known substances
   (b) pure and impure substances

Supplement

3 Describe how paper chromatography is used to separate mixtures of soluble colourless substances, using a suitable solvent and a locating agent

   Knowledge of specific locating agents is **not** required

4 State and use the equation for R_f:

$$R_f = \frac{\text{distance travelled by substance}}{\text{distance travelled by solvent}}$$

12.4 Separation and purification

Core

1 Describe and explain methods of separation and purification using:
   (a) a suitable solvent
   (b) filtration
   (c) crystallisation
   (d) simple distillation
   (e) fractional distillation

2 Suggest suitable separation and purification techniques, given information about the substances involved

3 Identify substances and assess their purity using melting point and boiling point information

Supplement

12.5 Identification of ions and gases

Core

1 Describe tests to identify the anions:
   (a) carbonate, CO_3^{2-}, by reaction with dilute acid and then testing for carbon dioxide gas
   (b) chloride, Cl^-, bromide, Br^-, and iodide, I^-, by acidifying with dilute nitric acid then adding aqueous silver nitrate
   (c) nitrate, NO_3^-, reduction with aluminium foil and aqueous sodium hydroxide and then testing for ammonia gas
   (d) sulfate, SO_4^{2-}, by acidifying with dilute nitric acid and then adding aqueous barium nitrate
   (e) sulfite, SO_3^{2-}, by reaction with acidified aqueous potassium manganate(VII)

Supplement

12.5 Identification of Ions and gases continued

Core

2 Describe tests using aqueous sodium hydroxide and aqueous ammonia to identify the aqueous cations:
   (a) aluminium, Al^{3+}
   (b) ammonium, NH_4^+
   (c) calcium, Ca^{2+}
   (d) chromium(III), Cr^{3+}
   (e) copper(II), Cu^{2+}
   (f) iron(II), Fe^{2+}
   (g) iron(III), Fe^{3+}
   (h) zinc, Zn^{2+}

3 Describe tests to identify the gases:
   (a) ammonia, NH_3, using damp red litmus paper
   (b) carbon dioxide, CO_2, using limewater
   (c) chlorine, Cl_2, using damp litmus paper
   (d) hydrogen, H_2, using a lighted splint
   (e) oxygen, O_2, using a glowing splint
   (f) sulfur dioxide, SO_2, using acidified aqueous potassium manganate(VII)

4 Describe the use of a flame test to identify the cations:
   (a) lithium, Li^+
   (b) sodium, Na^+
   (c) potassium, K^+
   (d) calcium, Ca^{2+}
   (e) barium, Ba^{2+}
   (f) copper(II), Cu^{2+}

Supplement

End of Topic 12 Goals Checklist

For each topic you ought to try to do as many of the following things to get the most out of your time, the resources available to you and to help you grow as a student. Tick each goal off as you complete it.
Growth can be painful, but the more of it you do, the easier it can become!!!

Aspect	What you should have done	Yes/No	Level
Interacted with your teacher	Ask your teacher 1 question, about anything, once a week		FUNDAMENTAL
	Try to answer one question asked by your teacher at least once a week		ESSENTIAL
	Ask your teacher one question about something you do not understand in science once a week		ESSENTIAL
	Ask your teacher one question about something to do with science every lesson		EXTENSION
Notes and follow up notes	Complete set of class note		FUNDAMENTAL
	Cornell Notetaking Attempted		ESSENTIAL
	Cornell Notetaking Completed		EXTENSION
	Cornell Notetaking Completed to an exemplary standard		EXCEPTIONAL
	Attempted the Mind Map for this topic		ESSENTIAL

Aspect	What you should have done	Yes/No	Level
	Completed the Mind Map for this topic		EXTENSION
Textbook	Read ahead before the topic has been started		EXTESNION
	Highlighted key ideas and translate new words		FUNDAMENTAL
	Completed the questions at the end of each 2 page spread in your exercise book		EXTENSION
	Added to your class notes ideas and important information from the textbook that you learnt		EXTENSION
Past Exam Questions	Worked on at least 25% of the exam questions in this workbook		FUNDAMENTAL
	Attempted more than 25% of the questions and those questions you have completed you have marked in a different colour pen		ESSENTIAL
	Completed and marked all questions here		EXTENSION
	Completed, marked and additional key ideas where you have located the most difficult marks added to your notebook		EXCEPTIONAL
	Used the resources available online to answer additional questions not found in this workbook on the current topic.		EXCEPTIONAL
	Ask your teacher about an exam question that they cannot answer		EXCEPTIONALLY SMASHING!!!
Assessed Activities	Complete the word list activity using the word list at the front of each topic as little as possible		FUNDAMENTAL
	Complete 2 assessed activities, either in class or as homework		ESSENTIAL
	Complete 2 assessed activities and scored over 70% on average		ESSENTIAL
	Complete 2 assessed activities and scored over 80% on average		EXTENSION
	Complete 2 assessed activities and scored over 90% on average		EXCEPTIONAL
End of Topic Test	Revised sufficiently well to improve upon your score from the previous test (except if you are scoring over 90%, then just write Y for this goal)		ESSENTIAL
	Scored 10% higher than your current average		EXTENSION
	Scored 15% or more than your previous end of topic average		EXCEPTIONAL
	Scored over 90%		EXTESNION
	Scored over 95%		SMASHING!!!
Reading	Spend more than 1 hour a week reading a book **you enjoy** (in any language) about anything.		ESSENTIAL
	Spend more than 3 hours a week reading a book **you enjoy** (in any language) about anything.		EXTENSION
	Spend more than 5 hours a week reading a book **you enjoy** (in any language) about anything.		EXCEPTIONAL
	Spend at least one hour a week reading a book **you enjoy** in English about anything.		EXTENSION
	Spend more than 3 hours a week reading a book **you enjoy** in English about anything.		EXCEPTIONAL
Reflection	You completed this goal setting table		FUNDAMENTAL
	You have looked at the goals you have achieved and the ones you have not and added them up and entered them into the table in the Review and Reflection section		ESSENTIAL
	You have given an answer for every question in the Review and Reflection section at the end of this topic		EXTENSION
	You have Given good and thoughtful answers for every question in the Review and Reflection section at the end of this topic		EXCEPTIONAL

Topic 12 KeyWords

1	**apparatus** The scientific term for a device or collection of devices used for experiments. e.g. a beaker, balance or Bunsen burner, but not Cu(s), HCl(aq) or air
2	**balance** A device that measures mass. This allows measurements to be made with the units of grams and kilograms.
3	**beaker** A cylindrical container with a spout on the rim which makes pouring from it easier. When it is made out of glass it can also be used to heat up liquids. Although it has gradations on the side which give a rough idea of the volume contained inside, it should never be sued to measure volume.
4	**burette** A device to measure variable volumes of liquid to 50cm^3. This is more accurate than a measuring cylinder, but less accurate than a volumetric pipette. This allows measurements to be made with the units of cubic centimetres, cm^3. Usually used in titrations to measure how much of the reactant in excess is needed to completely use up the limiting reactant.
5	**chromatogram** A solid flat sheet, like paper, that displays the results of chromatography. Filter paper with a pencil line near one end and various spots above showing how a mixture separated.
6	**chromatography** A method to separate a large variety of mixtures, like those found in coloured dyes based on differences in properties like solubility. Can also be used to separate colourless mixtures like amino acids if a locating agent is used.
7	**colourless** Having no colour. e.g. air, $H_2O(l)$, NaCl(aq) and $SiO_2(s)$, but not $CuSO_4(aq)$ or $Br_2(l)$
8	**condenser** A device that provides a cold surface so that a gas released (e.g. in distillation), can be converted into a liquid and collected. Cold water from a tap flows into the outer layer at bottom to help keep the surface of the tube inside cool. Warmer water leaves out of the top of the outer layer of glass.
9	**conical flask** A container that has a larger radius at its bottom that gets smaller towards its top. It can have a bung fitted to seal the top, or be swirled to allow the contents to be mixed and is always used to store the limiting reactant in titrations.
10	**crystallisation** A method to separate the solute from a solution. A saturated solution will have its temperature lowered or some solvent removed so that solute precipitates out as a solid. e.g. conc. NaCl (aq) → NaCl (s)

11	**decanting** A method to separate a pure liquid from either a more dense liquid that cannot mix with it, or a more dense insoluble solid. The less dense liquid is carefully poured into another container, leaving behind the mixture. This can separate seawater from sand, or oil from water, but not NaCl from NaCl(aq) or CH_3OH from CH_3OH(aq).
12	**dissolving** The process that allows a solute to form a solution with a solvent. What happens when NaCl(s) mixes with H_2O(l) to form NaCl(aq).
13	**distillation** A method to separate a pure liquid from a solution. The liquid with the lowest boiling point leaves first from the heated solution. The gas is then condensed into a pure liquid. This can sperate H_2O(l) from $CuSO_4$(aq), or H_2O(l) from NaCl(aq).
14	**downward delivery** A method to collect a gas that is more dense than air by allowing it to flow down into a container like a gas jar. Can collect ^{84}Kr(g) or ^{131}Xe(g), but not $^{1}H_2$(g) or ^{4}He(g).
15	**end point** When a reaction has used up all of the limiting reactant and therefore finished. e.g. for this reaction NaOH(aq) + HCl(aq)→ NaCl(aq) + H_2O(l) it is when the pH of the solution becomes 7
16	**filter paper** A sheet of a flat solid that allows liquids to easily flow through it, but insoluble solids do not pass through. Chromatograms can also be made from this material.
17	**filtrate** The solution that has lost the insoluble solid after the mixture has been filtered. e.g. the NaCl(aq) from a mixture of NaCl(aq) and SiO_2(s) after filtration
18	**filtration** A method to separate a solution from a mixture of a solution and an insoluble solid. e.g. a way to separate $CuSO_4$(aq) from a mixture of $CuSO_4$(aq) and insoluble CuO(s)
19	**fractional distillation** A method to separate a pure liquid form a mixture of liquids. The most volatile liquid boils first from the heated mixture. The heating is controlled so the temperature of the gases produced is below the boiling point of the next most volatile liquid. The gas is then condensed into a pure liquid. This is used to sperate pure liquids from the mixtures found in crude oil (petroleum). It can also separate the gases in air if it is done at very low temperatures.
20	**fractioning column** A glass cylinder filled with glass beads that allows gases to flow through it and helps ensure that only the most volatile liquid is removed from a mixture of liquids. The large surface area of the glass beads provide a larger surface area which helps any evaporated gases from less volatile liquids condense and return to the mixture.
21	**gas syringe** A device to measure very accurately the volume of a gas. This must be large enough for the volume of gas to be collected to be effective.
22	**glass stirring rod** A device that allows solutions to be mixed in a beaker. Conical flasks do not need this because their contents can be mixed by swirling them instead.

23	**indicator** Any substance that changes in a way we can observe, like changing colour, when an event or an amount of reaction has happened. e.g. thymolphthalein blue or methyl orange.
24	**insoluble** When a substance cannot dissolve in a solution. e.g. C(s) for $H_2O(l)$, or NaCl(s) for saturated NaCl(aq)
25	**locating agent** A substance that can bond with a colourless substance to make it visible on a chromatogram. e.g. ninhydrin, which can react with colourless amino acids to make them visible when a mixture of them have been separated by chromatography
26	**measuring cylinder** A device that measures a variable volume of a liquid. It is less accurate, but allows for the liquid to be added quickly, for instance in experiments involving rate of reaction. This allows measurements to be made with the units of cubic centimetres, cm^3.
27	**mixture** Two or more different substances not chemically bonded together. They are easy to separate. e.g. air, NaCl(aq) or $CH_3OH(aq)$
28	**pure substance** A single element or compound that has a sharp melting and boiling points that are unique to it. e.g. distilled water, Fe(s) or $CH_4(g)$ but not NaCl(aq), air or $CH_3OH(aq)$
29	**residue** The substances that stay behind after mixtures have gone through methods like evaporation, filtering or distillation. e.g. the $SiO_2(s)$ from a mixture of NaCl(aq) and $SiO_2(s)$ after filtration
30	**R_f value** A ratio of the distance travelled by different parts of a mixture on a chromatogram relative to the solvent front. It is always smaller than 1. e.g. distance travelled by spot/distance travelled by solvent front
31	**risk assessment** A way to evaluate the methods, equipment and reagents used in an experiment so that suitable steps can be taken to ensure that the work is done safely. This helps to explain why wearing a lab coat and safety specs are essential in a lab and sometimes requires experiments to be carried out in fume cupboards.
32	**round bottom flask** A glass container that can be used to provide even heat to a solution. The special shape also allows it to fit well inside an electric heater.
33	**saturated** A liquid mixture that will no longer allow any more solute to dissolve into it at a given temperature. When the soluble solute becomes insoluble for a solution at a certain temperature.
34	**solubility** The property of being able to dissolve in a solvent. For solid solutes this property increases as the temperature increases.

35	**soluble** If a substance can dissolve in a solvent. e.g. these substances have this property for water: NaCl(s), $CH_3OH(l)$ and sugar, but these do not: AgCl(s), Cu(s) and $SiO_2(s)$
36	**solute** Any solid substance that can dissolve in a solvent to produce a solution. e.g. in NaCl(aq) it is NaCl, for $CuSO_4(aq)$ it is $CuSO_4$, but not SiO_2 in a mixture of $SiO_2(s)$ and $H_2O(l)$
37	**solution** A mixture between a solvent and a dissolved solute. e.g. NaCl(aq) or $CuSO_4(aq)$, but not SiO_2 in a mixture of $SiO_2(s)$ and $H_2O(l)$
38	**solvent** A liquid that can dissolve a solute to form a solution. For chromatography ethanol often is the best choice for this liquid.
39	**solvent front** The distance travelled by the liquid up the chromatography paper used in chromatography. It should not be allowed to reach the top of the chromatogram.
40	**stopwatch** A device to measure time. This delivers measurements in the units of seconds, minutes and hours.
41	**sulfite** A less common type of negative ion containing sulfur and oxygen. The ion SO_3^{2-}.
42	**thermometer** A device that measures temperature. This delivers measurements in the units of degrees Celsius, ^oC.
43	**titration** A method to find an unknown concentration through a chemical reaction with a reactant of known concentration. The concentration is worked out using molar ratios of reactants and the discovered volume needed of one reactant to totally react with a fixed volume of the other reactant. The end point for this experiment is when you stop adding the reagent in excess from the burette. For acid base reactions that are colourless an indicator like methyl orange needs to be added so that the change in pH that results when the limiting reactant has been used up can be easily seen which allows you to finish this investigation.
44	**upward delivery** A method to collect a gas that is less dense than air by allowing it to flow up into a container like a gas jar. Can collect $^1H_2(g)$ or $^4He(g)$ but not $^{84}Kr(g)$ or $^{131}Xe(g)$.
45	**volumetric pipette** The most accurate device to measure the volume of a liquid. It only measures a single, fixed volume, usually $25cm^3$. It measures the volume of the limiting reactant in a titration which is placed in a conical flask.

iG Chem 12nw EQ P2 17w to 16m 25marks

Q# 1/ iGCSE Chemistry/2017/w/Paper 23/www.SmashingScience.org :o)

2 25 cm^3 of an alkali are added to 20 cm^3 of an acid. The temperature change is measured.

Which apparatus is **not** needed in the experiment?

A 25 cm^3 measuring cylinder

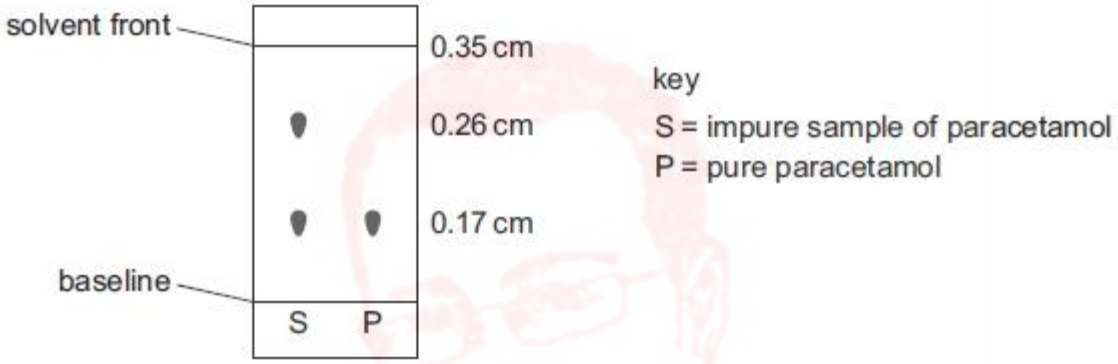
B 100 cm^3 beaker

C balance

D thermometer

3 The painkiller paracetamol is synthesised from 4-aminophenol.

Chromatography was carried out on an impure sample of paracetamol. The results are shown (not drawn to scale).



The sample of paracetamol was contaminated with 4-aminophenol only.

What is the R_f value of 4-aminophenol?

A 0.49 **B** 0.65 **C** 0.74 **D** 1.35

Q# 2/ iGCSE Chemistry/2017/w/Paper 22/www.SmashingScience.org :o)

2 During an experiment a measurement is recorded in cm^3.

Which apparatus is used?

A balance

B measuring cylinder

C stopclock

D thermometer

3 A student carried out paper chromatography on a mixture of amino acids.

The student sprayed the dried chromatogram with a locating agent.

What is the function of the locating agent?

A to dissolve the amino acids

B to form coloured spots with the amino acids

C to preserve the amino acids

D to stop the amino acids reacting

Q# 3/ iGCSE Chemistry/2017/w/Paper 21/www.SmashingScience.org :o)

2 A student put 25.0 cm^3 of dilute hydrochloric acid into a conical flask.

The student added 2.5 g of solid sodium carbonate and measured the change in temperature of the mixture.

Which apparatus does the student need to use to obtain the most accurate results?

A balance, measuring cylinder, thermometer

B balance, pipette, stopwatch

C balance, pipette, thermometer

D burette, pipette, thermometer

3 The results obtained from a chromatogram are shown.

	distance travelled / cm
solvent	5.0
substance X	3.0
substance Y	2.5

Which row gives the R_f values of substance X and substance Y?

	R_f (X)	R_f (Y)
A	0.5	0.6
B	0.6	0.5
C	1.6	2.0
D	2.0	1.6

Q# 4/ iGCSE Chemistry/2017/s/Paper 23/www.SmashingScience.org :o)

2 A compound, X, has a melting point of 71 °C and a boiling point of 375 °C.

Which statement about X is correct?

A It is a liquid at 52 °C and a gas at 175 °C.

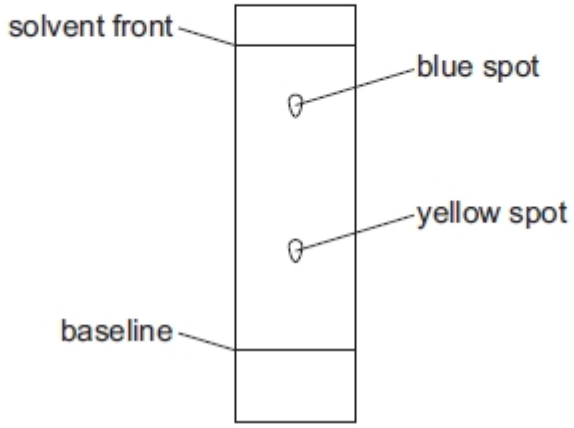
B It is a liquid at 69 °C and a gas at 380 °C.

C It is a liquid at 75 °C and a gas at 350 °C.

D It is a liquid at 80 °C and a gas at 400 °C.

3 A student used chromatography to analyse a green food colouring.

The chromatogram obtained is shown.



The table lists some yellow food dyes and their R_f values.

Which yellow food dye does the green food colouring contain?

	yellow food dye	R_f value
A	Quinolene Yellow	0.48
B	Sunset Yellow	0.32
C	tartrazine	0.69
D	Yellow 2G	0.82

Q# 5/ iGCSE Chemistry/2017/s/Paper 22/www.SmashingScience.org :o)

2 Impurities change the melting and boiling points of substances.

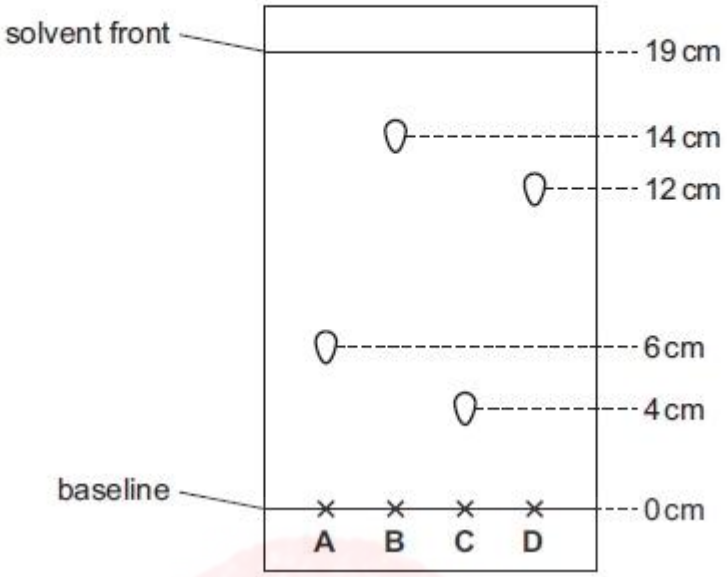
Sodium chloride is added to a sample of pure water.

How does the addition of sodium chloride affect the melting point and boiling point of the water?

	melting point	boiling point
A	increases	increases
B	increases	decreases
C	decreases	increases
D	decreases	decreases

3 The diagram shows a chromatogram of four substances.

Which substance has an R_f value of approximately 0.32?



Q# 6/ iGCSE Chemistry/2017/s/Paper 21/www.SmashingScience.org :o)

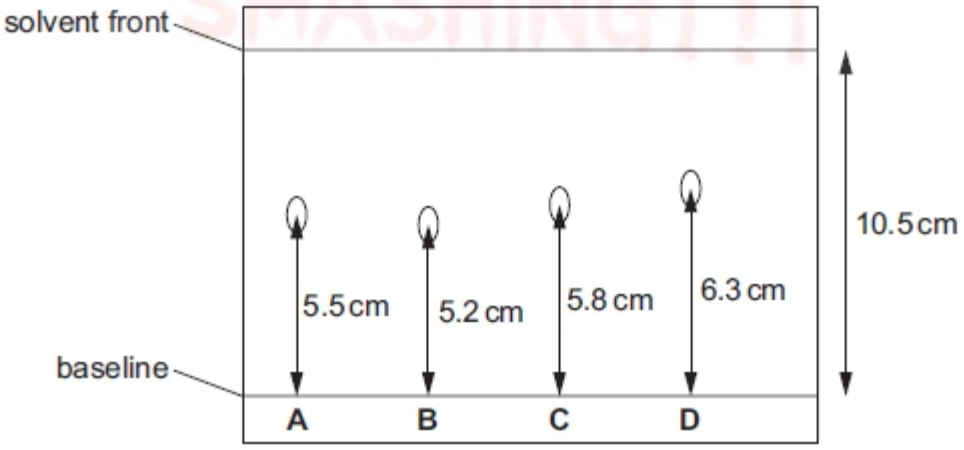
2 Pure water has a boiling point of 100 °C and a freezing point of 0 °C.

What is the boiling point and freezing point of a sample of aqueous sodium chloride?

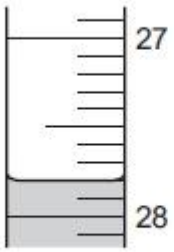
	boiling point / °C	freezing point / °C
A	98	–2
B	98	2
C	102	–2
D	102	2

3 A chromatogram obtained from the chromatography of four substances is shown.

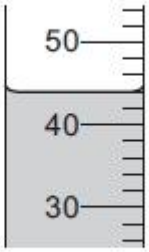
Which substance has an R_f value of 0.6?



2 The diagrams show liquids in a burette and a measuring cylinder.



burette

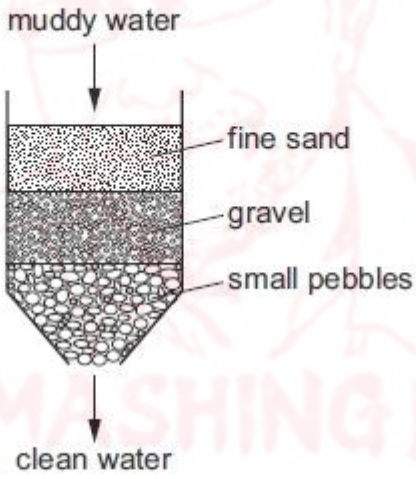


measuring cylinder

Which row shows the correct readings for the burette and the measuring cylinder?

	burette	measuring cylinder
A	27.8	42
B	27.8	44
C	28.2	42
D	28.2	44

3 The diagram shows how muddy water can be purified.



Which process for purifying the muddy water is shown?

A crystallisation

B distillation

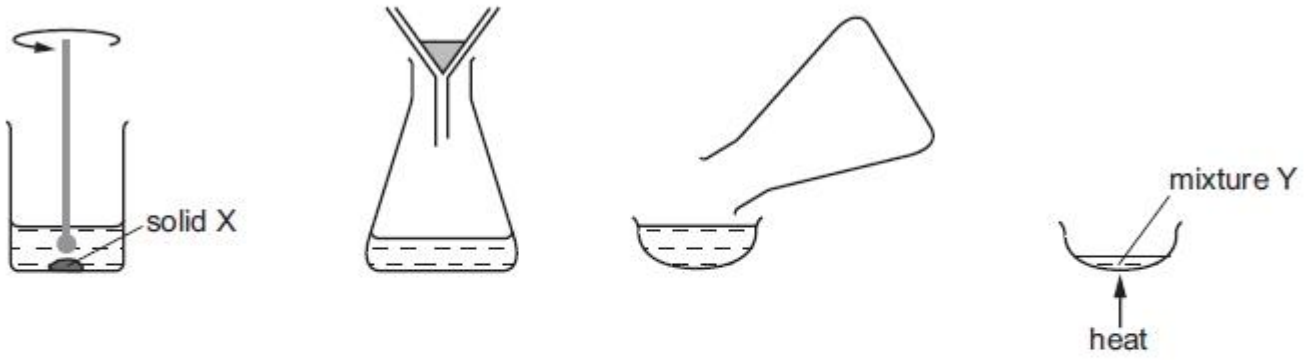
C filtration

D solvent extraction

Q# 8/ iGCSE Chemistry/2016/w/Paper 23/www.SmashingScience.org :o)

3 A solid X is purified in five steps.

The first four steps of the purification are shown in the diagram.



step 1 step 2 step 3 step 4

In **step 5**, how is a pure sample of solid X obtained from mixture Y?

A dissolving

B distillation

C evaporating

D filtering

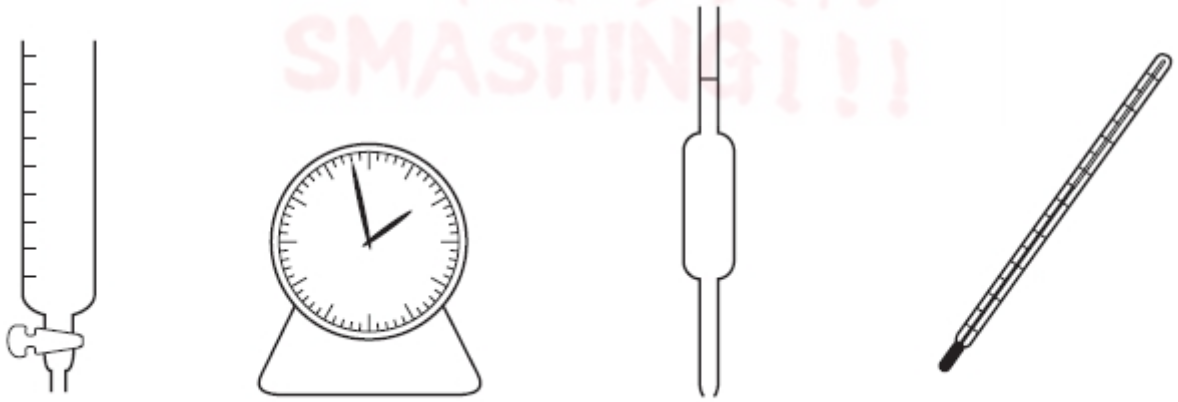
Q# 9/ iGCSE Chemistry/2016/w/Paper 21/www.SmashingScience.org :o)

2 A student mixes 25 cm^3 samples of dilute hydrochloric acid with different volumes of aqueous sodium hydroxide.

In each case, the student measures the change in temperature to test if the reaction is exothermic.

Which piece of apparatus is **not** needed?

A **B** **C** **D**



burette clock pipette thermometer

3 Information about the solubility of four solids, P, Q, R and S, is given in the table.

	P	Q	R	S
solubility in water	dissolves	insoluble	insoluble	dissolves

A student attempted to separate mixtures of these solids using the following method.

1 Add the mixture to a beaker of water and stir.

2 Filter the mixture.

3 Crystallise one of the solids from the filtrate.

Which of the following mixtures could **not** be separated by this method?

A a mixture of P and R

B a mixture of Q and P

C a mixture of Q and R

D a mixture of R and S

Q# 10/ iGCSE Chemistry/2016/s/Paper 23/www.SmashingScience.org :o)

2 Chromatography experiments are carried out on four substances, P, Q, R and S.

The same solvent is used in each experiment.

The resulting chromatograms are shown below.

Which statement is **not** correct?

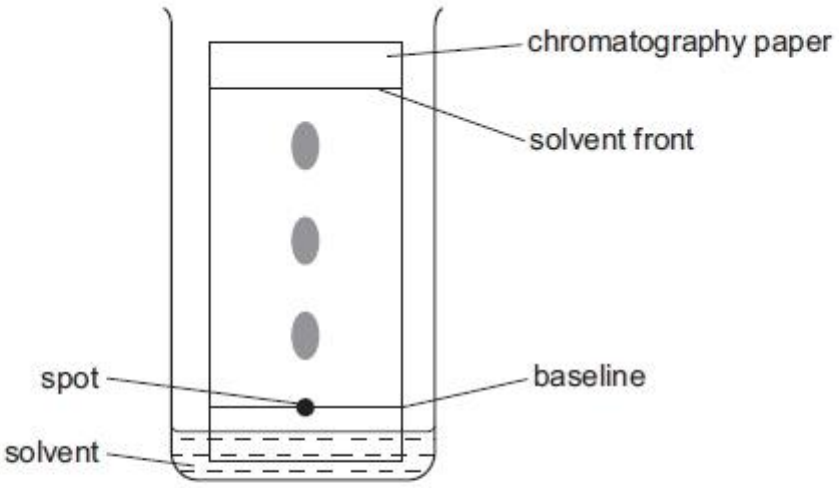
A P and Q are pure substances.

B P and R are different substances.

C R and S are pure substances.

D S is a mixture of substances.

3 The diagram shows the apparatus used to separate the different components of a mixture by chromatography.



Which statement about this experiment is correct?

A A locating agent is used to find the position of the solvent front.

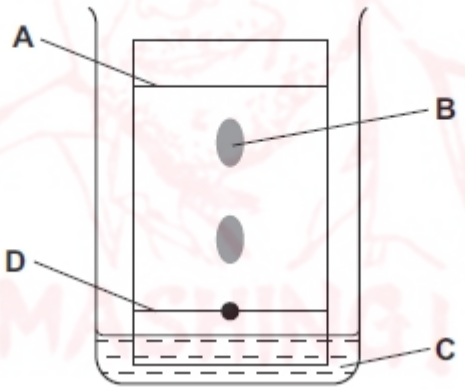
B The components to be separated must be soluble in the solvent.

C The baseline on which the spot of the mixture is placed is drawn in ink.

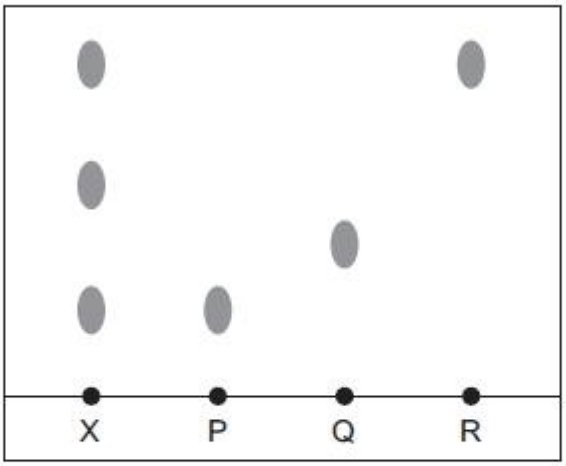
D The R_f value is calculated by $\frac{\text{the distance travelled by the solvent front}}{\text{the distance travelled by the component}}$

Q# 11/ iGCSE Chemistry/2016/s/Paper 22/www.SmashingScience.org :o)

2 In the chromatography experiment shown, which label represents the solvent front?



3 X is a mixture of colourless compounds. The diagram shows a chromatogram of X and of three pure compounds, P, Q and R.



Which statement is **not** correct?

A A locating agent was used to develop the chromatogram of X.

B P and R could be present in X.

C P and R have different solubilities in the solvent.

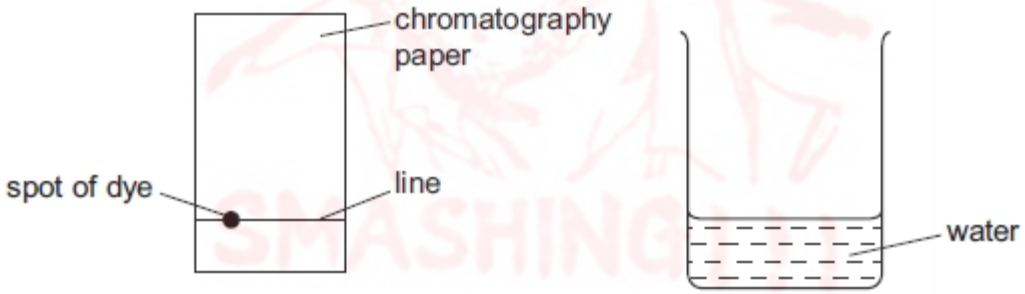
D Q has a greater R_f value than R.

Q# 12/ iGCSE Chemistry/2016/s/Paper 21/www.SmashingScience.org :o)

2 A sample of a dye is investigated by chromatography.

A line is drawn across a piece of chromatography paper and a spot of the dye is placed on it.

The paper is placed in water.

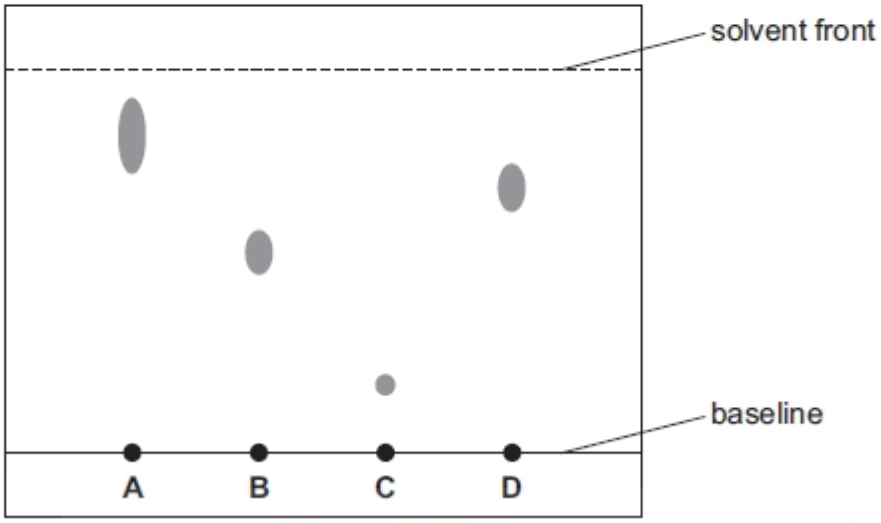


Which row is correct?

	what is used to draw the line	position of spot
A	ink	above the level of the water
B	ink	below the level of the water
C	pencil	above the level of the water
D	pencil	below the level of the water

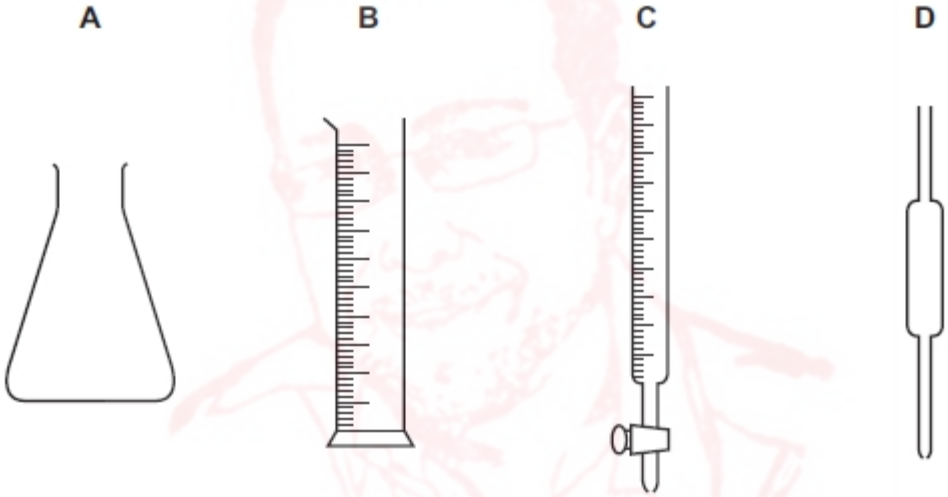
3 The paper chromatogram below was obtained from four different dyes.

Which dye has an R_f value of 0.7?



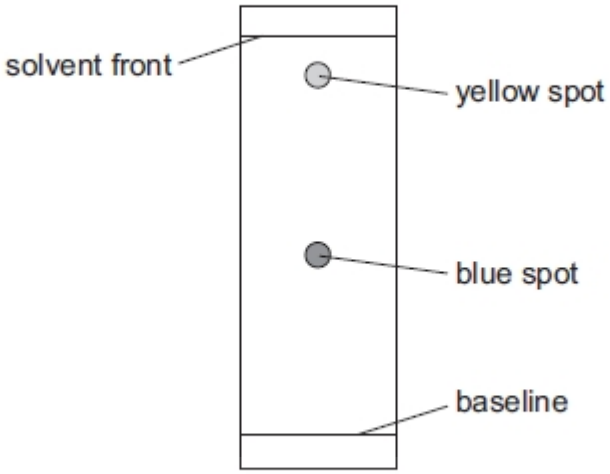
Q# 13/ iGCSE Chemistry/2016/m/Paper 22/www.SmashingScience.org :o)

2 Which piece of apparatus is used to measure variable quantities of liquid in a titration?



3 A sample of a green food colouring was separated into its component colours using paper chromatography.

The results obtained are shown.



What is the R_f value of the blue spot?

A 0.45 **B** 0.90 **C** 1.10 **D** 2.20

T12 Paper 2 Mark Scheme

Mark Scheme iG Chem 12nw EQ P2 17w to 16m 25marks

Q# 1/ iGCSE Chemistry/2017/w/Paper 23/

3	C

Q# 2/ iGCSE Chemistry/2017/w/Paper 22/

2	B
3	B

Q# 3/ iGCSE Chemistry/2017/w/Paper 21/

2	C
3	B

Q# 4/ iGCSE Chemistry/2017/s/Paper 23/

2	D
3	B

Q# 5/ iGCSE Chemistry/2017/s/Paper 22/

2	C
3	A

Q# 6/ iGCSE Chemistry/2017/s/Paper 21/

2	C
3	D

Q# 7/ iGCSE Chemistry/2017/m/Paper 22/

2	B
3	C

Q# 8/ iGCSE Chemistry/2016/w/Paper 23/

3	**D**

Q# 9/ iGCSE Chemistry/2016/w/Paper 21/

2	**B**
3	**C**

Q# 10/ iGCSE Chemistry/2016/s/Paper 23/

2	**C**
3	**B**

Q# 11/ iGCSE Chemistry/2016/s/Paper 22/

2	**A**
3	**D**

Q# 12/ iGCSE Chemistry/2016/s/Paper 21/

2	**C**
3	**D**

Q# 13/ iGCSE Chemistry/2016/m/Paper 22/

2	**C**
3	**A**

T12 Paper 3/4 Exam Questions

iG Chem 12nw P6 Q3 17s to 16m 126marks

3 Two solutions, **Y** and **Z**, were analysed.
Solution **Y** was aqueous chromium(III) nitrate.
Tests were carried out on both solutions.

tests on solution Y

Complete the expected observations.

The solution was divided into two equal portions in two test-tubes.

(a) (i) A few drops of aqueous sodium hydroxide were added to the first portion of solution **Y** and the test-tube shaken to mix the solutions.

observations ..... [2]

(ii) An excess of aqueous sodium hydroxide was then added to the mixture.

observations ..... [1]

(iii) The mixture from **(a)(ii)** was poured into a boiling tube and a small piece of aluminium foil was added.
The mixture was heated and the gas produced was tested.

observations .....

..... [3]

(b) Identify the gas produced in **(a)(iii)**.

..... [1]

tests on solution Z

Tests were carried out and the following observations made.

tests on solution **Z**	observations
Solution **Z** was divided into three equal portions in three test-tubes. **test 1** The pH of the first portion of solution **Z** was tested.	pH 10
test 2 A few drops of aqueous copper(II) sulfate were added to the second portion of solution **Z**. An excess of aqueous copper(II) sulfate was then added to the mixture.	dark blue solution formed light blue precipitate formed
test 3 The second portion of solution **Y** was added to the third portion of solution **Z**.	grey-green precipitate formed

(c) Identify solution **Z**.

..... [1]

3 Two solid salts, **U** and **W**, were analysed. Solid **U** was sodium carbonate.
Tests were carried out on each solid.

tests on solid U

Complete the expected observations.

(a) Describe the appearance of solid **U**.

..... [1]

About half of solid **U** was dissolved in distilled water to produce solution **U**. Solution **U** was divided into two equal portions in two test-tubes.

(b) Dilute hydrochloric acid was added to the first portion of solution **U**.
The gas produced was tested.

observations .....

..... [3]

(c) Name the gas produced in **(b)**.

..... [1]

(d) A flame test was carried out on solid **U**.

observations ..... [1]

tests on solid W

Tests were carried out and the following observations made.

tests on solid **W**	observations
Appearance of solid **W**.	white crystals
Solid **W** was dissolved in distilled water to produce solution **W**. The solution was divided into two equal portions in two test-tubes. **test 1** Dilute nitric acid and aqueous silver nitrate were added to the first portion of solution **W**.	white precipitate formed
test 2 The second portion of solution **U** was added to the second portion of solution **W**. An excess of dilute hydrochloric acid was then added to the mixture.	white precipitate formed rapid effervescence white precipitate dissolved

(e) What conclusions can you draw about solid **W**?

..... [2]

3 Two solid salts, **F** and **G**, were analysed. Solid **F** was iron(III) nitrate.
Tests were carried out on each solid.

tests on solid F

Complete the expected observations.

Solid **F** was dissolved in distilled water to produce solution **F**. Solution **F** was divided into three equal portions in three test-tubes.

(a) (i) A few drops of aqueous sodium hydroxide were added to the first portion of solution **F** until a change was seen.

observations ..... [2]

(ii) An excess of aqueous sodium hydroxide was then added to the mixture from **(a)(i)**.

observations ..... [1]

(b) An excess of aqueous ammonia was added to the second portion of solution **F** until a change was seen.

observations ..... [1]

(c) Aluminium foil and aqueous sodium hydroxide were added to the third portion of solution **F**. The mixture was heated and the gas which was produced was tested.

test for gas .....

test result .....
[2]

(d) Identify the gas produced in **(c)**.

..... [1]

tests on solid G

Tests were carried out and the following observations made.

tests on solid **G**	observations
test 1 A flame test was carried out on solid **G**.	red colour
test 2 Dilute nitric acid was added to solid **G**. The gas produced was passed through limewater.	rapid effervescence limewater turned milky

(e) Identify solid **G**.

..... [2]

3 Two substances, solid **J** and solution **K**, were analysed. Solution **K** was hydrogen peroxide. Tests on each substance were carried out. The observations are shown.

tests	observations
tests on solid J Appearance of solid **J**.	black solid
test 1 Dilute hydrochloric acid was added to solid **J**. The mixture was heated and the gas given off was tested with damp litmus paper.	blue litmus turned white
tests on solution K Solution **K** was divided into two equal portions in two test-tubes. **test 2** Iron(II) sulfate crystals were added to the first portion of the solution. The mixture was shaken and aqueous sodium hydroxide was added to the mixture.	red-brown precipitate formed
test 3 Solid **J** was added to the second portion of the solution. The gas given off was tested with a splint.	glowing splint relit solid **J** was unchanged

(a) Name the gas given off in **test 1**.

..... [1]

(b) (i) Name the precipitate formed in **test 2**.

..... [2]

(ii) A new **test 2** was carried out. Iron(II) sulfate crystals were added to **water**, the mixture was shaken and then aqueous sodium hydroxide was added.

What would be observed?

..... [2]

3 Two solids, **E** and **F**, were analysed. Solid **F** was potassium iodide. Tests were carried out on each solid. Some of the observations on solid **E** are shown.

tests on solid **E**	observations
Appearance of solid **E**.	green solid
test 1 Solid **E** was heated gently then strongly.	the solid turned black
test 2 Dilute sulfuric acid was added to solid **E**. The gas given off was tested. Excess aqueous ammonia was then added to the mixture in the test-tube.	rapid effervescence limewater turned milky a pale blue precipitate formed, which then dissolved to form a dark blue solution
test 3 A flame test was carried out on solid **E**.	blue-green colour

(a) **Test 1** states that the solid should be heated gently then strongly.

In terms of safety, explain why it is necessary to heat gently at first.

.....

..... [1]

(b) Identify the gas given off in **test 2**.

..... [1]

(c) Identify solid **E**.

..... [2]

tests on solid F

Complete the expected observations.

(d) Describe the appearance of solid **F**.

..... [1]

Distilled water was added to solid **F** in a test-tube and shaken to dissolve solid **F**.

(e) (i) To the first portion of the solution, an excess of aqueous sodium hydroxide was added.

observations ..... [1]

(ii) To the second portion of the solution, dilute nitric acid and aqueous silver nitrate were added.

observations ..... [2]

(f) A flame test was carried out on solid **F**.

observations ..... [1]

(g) Describe how you would carry out a flame test.

.....

.....

..... [2]

3 Two solids, **Q** and **R**, which are both salts, were analysed. Solid **Q** was zinc bromide.
Tests were carried out on each solid.

tests on solid Q

Solid **Q** was dissolved in distilled water.
The solution was divided into three equal portions in three test-tubes, and the following tests were carried out.

Complete the expected observations.

(a) (i) Drops of aqueous sodium hydroxide were added to the first portion of the solution until a change was seen.

observations ..... [2]

(ii) Excess aqueous sodium hydroxide was then added to the mixture.

observations ..... [1]

(b) (i) Drops of aqueous ammonia were added to the second portion of the solution until a change was seen.

observations ..... [1]

(ii) Excess aqueous ammonia was then added to the mixture.

observations ..... [1]

(c) Dilute nitric acid and aqueous silver nitrate were added to the third portion of the solution.

observations ..... [2]

tests on solid R

Tests were carried out and the following observations made.

tests on solid **R**	observations
test 1 A flame test was carried out on solid **R**.	yellow colour
Solid **R** was dissolved in distilled water. The solution was divided into two equal portions in two test-tubes. **test 2** Dilute nitric acid and aqueous barium nitrate were added to the first portion of the solution.	no change
test 3 Dilute nitric acid and aqueous silver nitrate were added to the second portion of the solution.	yellow precipitate formed

(d) Identify solid **R**.

..... [2]

3 Two solutions, solution **Q** and solution **R**, were analysed. Solution **Q** was aqueous sulfuric acid.

tests on solution Q

(a) Solution **Q** was divided into four equal portions in four test-tubes. The following tests were carried out.

Complete the observations for **tests 1–4**.

(i) test 1

The pH of the first portion of solution **Q** was measured.

pH ..... [1]

(ii) test 2

Magnesium ribbon was added to the second portion of solution **Q**. The gas given off was tested.

observations .....

..... [3]

(iii) test 3

Sodium carbonate was added to the third portion of solution **Q**. The gas given off was tested.

observations .....

..... [3]

(iv) test 4

Dilute nitric acid and aqueous barium nitrate were added to the fourth portion of solution **Q**.

observations ..... [1]

tests on solution R

Solution **R** was divided into three equal portions in three test-tubes.
The following tests were carried out.

tests	observations
test 5 The pH of the first portion of solution **R** was measured.	pH = 10
test 6 Drops of aqueous sodium hydroxide were added to the second portion of solution **R** and the test-tube shaken. Excess aqueous sodium hydroxide was then added to the test-tube.	white precipitate no visible change
test 7 Aqueous iron(II) sulfate was added to the third portion of solution **R** and the mixture shaken.	green precipitate formed

(b) Identify solution **R**.

.....

..... [2]

3 Two solutions, solution **S** and solution **T**, were analysed. Solution **S** was dilute hydrochloric acid. The tests on solution **S** and solution **T**, and some of the observations, are shown.

tests on solution S

(a) Solution **S** was divided into four equal portions in four test-tubes. The following tests were carried out.

Complete the observations for **tests 1–4**.

(i) test 1

The pH of the first portion of solution **S** was tested.

pH ..... [1]

(ii) test 2

Copper(II) oxide was added to the second portion of the solution. The mixture was heated.

observations .....

.....

..... [2]

(iii) test 3

Solid sodium carbonate was added to the third portion of the solution. The gas given off was tested.

observations .....

..... [3]

(iv) test 4

Dilute nitric acid and aqueous silver nitrate were added to the fourth portion of the solution.

observations ..... [1]

tests on solution T

(b) Tests were carried out on solution **T** and the following observations made.

tests	observations
Solution **T** was divided into three equal portions in three test-tubes. Appearance of the solution.	 yellow solution
Drops of aqueous sodium hydroxide were added to the second portion of the solution and the test-tube shaken. Excess aqueous sodium hydroxide was then added to the test-tube.	red-brown precipitate no visible change
Aqueous sodium hydroxide and aluminium foil were added to the third portion of the solution and the mixture heated. The gas given off was tested with pH indicator paper.	pungent gas formed, pH 10

Identify solution **T**.

.....

..... [2]

3 Solid **P**, which is an aluminium salt, was analysed.
The tests on solid **P**, and some of the observations, are shown.

tests on solid P

(a) test 1

Solid **P** was divided into three portions. The first portion of solid **P** was heated.

observations *condensation formed on the sides of the test-tube*

Any gases given off were tested with cobalt(II) chloride paper.

observations *cobalt(II) chloride paper turned from blue to pink*

What does **test 1** tell you about solid **P**?

..... [1]

(b) test 2

A flame test was carried out on the second portion of solid **P**.

observations ..... [1]

tests on a solution of P

Distilled water was added to the rest of solid **P** in a test-tube and shaken to dissolve.

(c) The solution was divided into four equal portions in four test-tubes. The following tests were carried out.

(i) test 3

Several drops of aqueous sodium hydroxide were added to the first portion of the solution.

Excess aqueous sodium hydroxide was then added to the mixture.

observations .....

.....

..... [3]

(ii) test 4

Several drops of aqueous ammonia were added to the second portion of the solution.

Excess aqueous ammonia was then added to the mixture.

observations .....

..... [2]

Two further tests were carried out and the following observations made.

tests on a solution of **P**	observations
test 5 Dilute nitric acid and aqueous silver nitrate were added to the third portion of the solution.	no visible reaction
test 6 Dilute nitric acid and aqueous barium nitrate were added to the fourth portion of the solution.	white precipitate formed

(d) What does **test 5** tell you about solid **P**?

..... [1]

(e) Identify solid **P**.

..... [1]

(f) Describe the appearance of solid **P**.

..... [1]

3 A mixture of two solids, **G** and **H**, was analysed. Solid **G** was zinc nitrate, which is water soluble, and solid **H** is insoluble in water.
The tests on the mixture, and some of the observations, are shown.

Distilled water was added to the mixture in a boiling tube and shaken. The contents of the boiling tube were filtered keeping the filtrate and the residue.

tests on filtrate

(a) The filtrate was divided into four test-tubes and the following tests carried out.

(i) Drops of aqueous sodium hydroxide were added to the first portion of the solution. Excess aqueous sodium hydroxide was then added to the test-tube.

observations .....

.....

..... [3]

(ii) Using the second portion of the solution, the test in **(a)(i)** was repeated using aqueous ammonia instead of aqueous sodium hydroxide.

observations .....

..... [2]

(iii) Dilute nitric acid was added to the third portion of the solution followed by aqueous silver nitrate.

observations ..... [1]

(iv) Aqueous sodium hydroxide and aluminium foil were added to the fourth portion of the solution.
The mixture was warmed and the gas given off was tested.

observations .....

.....

..... [3]

tests on residue

Two tests are carried out and the following observations made.

tests	observations
A spatula was used to transfer some of the residue into a test-tube. Dilute hydrochloric acid was added to the residue. The gas given off was tested.	rapid effervescence, limewater turned milky
A flame test was carried out on the residue.	red flame colour

(b) Identify solid **H**.

.....

..... [2]

3 Two solids, **E** and **F**, were analysed. Solid **E** was sodium sulfite. Both solids were found to be water soluble.
The tests on the solids, and some of the observations, are shown below.

tests on solid E

(a) Describe the appearance of the solid.

..... [1]

(b) Distilled water was added to solid **E** in a test-tube and shaken to dissolve.

The solution was divided into two portions in two test-tubes and the following tests carried out.

(i) Aqueous sodium hydroxide was added to the first portion of the solution.

observations ..... [1]

(ii) Dilute hydrochloric acid was added to the second portion of the solution. The mixture was warmed. The gas given off was tested with a piece of filter paper soaked in aqueous acidified potassium manganate(VII) solution.

observations .....

..... [2]

(c) A flame test was carried out on solid **E**.

observations ..... [1]

tests on solid F

tests	observations
The solid was heated. The gas given off was tested with damp, red litmus paper.	pungent gas evolved red litmus paper turned blue
Aqueous sodium hydroxide was added to solid **F** and the mixture heated. The gas given off was tested.	pungent gas evolved Universal Indicator paper showed pH 10

(d) Identify the gas given off in the tests on solid **F**.

..... [1]

(e) Identify **one** of the ions in solid **F**.

..... [1]

3 Two substances, **C** and **D**, were analysed. Solid **C** was a salt and solution **D** was an aqueous solution of chromium(III) chloride.
The tests on solid **C**, and some of the observations, are in the following table.

tests	observations
<u>tests on solid **C**</u> Solid **C** was added to distilled water in a test-tube and shaken to dissolve. The solution was divided into two portions in test-tubes, and the following tests carried out. Appearance of the solution. The pH of the first portion of the solution was tested.	 colourless liquid pH = 7
Dilute nitric acid was added to the second portion of the solution followed by aqueous silver nitrate.	cream precipitate
A flame test was carried out on solid **C**.	yellow flame colour

(a) Identify solid **C**.

..... [2]

(b) Describe the appearance of solution **D**.

..... [1]

(c) Tests were carried out on solution **D**.

Complete the observations for tests 1, 2 and 3.

(i) **test 1**

Drops of aqueous sodium hydroxide were added to solution **D**.

Excess aqueous sodium hydroxide was then added to the mixture.

observations .....

..... [3]

(ii) test 2

Excess aqueous ammonia was added to solution **D**.

observations ..... [2]

(iii) test 3

Dilute nitric acid was added to solution **D** followed by aqueous silver nitrate.

observations ..... [1]

(d) Chromium(III) can be converted to chromium(VI). Chromium(VI) is hazardous.

Suggest **one** safety precaution when using chromium(VI).

..... [1]

3 Two solids, **L** and **M**, were analysed. Solid **L** was copper(II) chloride and solid **M** was a different salt.
The tests on the solids, and some of the observations, are shown.

tests on solid L

(a) Describe the appearance of solid **L**.

observation ..... [1]

(b) Distilled water was added to solid **L** and shaken to dissolve.

The solution was divided into four equal portions in four test-tubes and the following tests carried out.

(i) Drops of aqueous ammonia were added to the first portion of the solution.

Excess ammonia solution was then added to the mixture and shaken.

observation .....

.....

.....

..... [4]

(ii) Excess aqueous sodium hydroxide was added to the second portion of the solution.

observation .....

..... [1]

(iii) Dilute nitric acid was added to the third portion of the solution followed by aqueous silver nitrate.

observation ..... [1]

(iv) Dilute nitric acid was added to the fourth portion of the solution followed by aqueous barium nitrate.

observation ..... [1]

tests on solid M

Tests are carried out and the following observations made.

tests on solid **M**	observations
Appearance of the solid.	white crystals
The solid was heated and the gas given off was tested with damp red litmus paper.	a sublimate formed on the sides of the test-tube litmus paper turned blue
Solid **M** was dissolved in water to form a solution. Aqueous sodium hydroxide was added to the solution and the mixture heated. The gas given off was tested.	pungent gas evolved pH paper showed pH 10
Dilute nitric acid was added to the solution followed by aqueous silver nitrate.	yellow precipitate

(c) Identify solid **M**.

.....

..... [2]

3 Two solids, **E** and **F**, which are both salts, were analysed. Solid **F** was lithium chloride.
Tests were carried out on each solid.
Some of the tests and observations are shown.

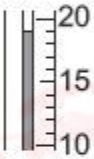
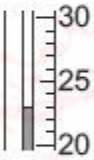
tests on solid E

tests on solid **E**	observations
test 1 A flame test was carried out on solid **E**.	yellow colour

test 2

10 cm^3 of distilled water were poured into a boiling tube. The initial temperature of the water was measured.
Solid **E** was added to the boiling tube and the boiling tube was shaken to dissolve solid **E**. The temperature of the solution was measured after 1 minute.

(a) Use the thermometer diagrams in the table to record the temperatures and complete the table.

temperature of the solution after 1 minute / °C		
initial temperature of the water / °C		
temperature difference / °C		

[2]

The solution was divided into two equal portions in two test-tubes and the following tests carried out.

tests on solid **E**	observations
test 3 Dilute hydrochloric acid was added to the first portion of the solution. The gas given off was tested with filter paper dipped into acidified aqueous potassium manganate(VII).	filter paper turned from purple to colourless
test 4 An excess of aqueous sodium hydroxide was added to the second portion of the solution.	no change

(b) What does the temperature change tell you about the process occurring in **test 2**?

..... [1]

(c) Name the gas given off in **test 3**.

..... [1]

(d) Identify solid **E**.

..... [2]

tests on solid F

Complete the expected observations.

(e) A flame test was carried out on solid **F**.

observations ..... [1]

Solid **F** was added to distilled water in a test-tube and the test-tube shaken to dissolve solid **F**.

(f) Dilute nitric acid and aqueous silver nitrate were added to the solution.

observations ..... [2]

T12 Paper 3/4 Mark Scheme

Mark Scheme iG Chem 7nw P6 Q3 17s to 16m 126marks

Q# 1/ iGCSE Chemistry/2017/w/Paper 63/

3(a)(i)	green	1
	precipitate	1
3(a)(ii)	green solution / precipitate dissolves	1
3(a)(iii)	bubbles / fizzing / effervescence	1
	(red) litmus paper / Universal Indicator paper	1
	(red litmus paper) turns blue / (Universal Indicator paper) turns purple	1
3(b)	ammonia / NH_3	1
3(c)	(aqueous) ammonia / NH_3	1

Q# 2/ iGCSE Chemistry/2017/w/Paper 62/

3(a)	white (crystals)	1
3(b)	bubbles / fizz	1
	limewater	1
	(turns) milky	1
3(c)	carbon dioxide	1
3(d)	yellow	1
3(e)	non-transition metal / Group II metal / barium / calcium / magnesium	1
3(e)	chloride	1

Q# 3/ iGCSE Chemistry/2017/w/Paper 61/

3(a)(i)	red-brown	1
	precipitate	1
3(a)(ii)	insoluble / no change	1
3(b)	red-brown precipitate	1
3(c)	(red) litmus paper	1
	turns blue	1
3(d)	ammonia	1
3(e)	lithium	1
	carbonate	1

Q# 4/ iGCSE Chemistry/2017/s/Paper 63/

3(a)	chlorine	1
3(b)(i)	iron(III)	1
	hydroxide	1
3(b)(ii)	green	1
	precipitate	1
3(c)	oxygen	1
3(d)	catalyst	1
	transition element compound / manganese oxide	1

Q# 5/ iGCSE Chemistry/2017/s/Paper 61/

3(a)	solid spits out of the tube / the tube might crack	1
3(b)	carbon dioxide	1
3(c)	copper / Cu^{2+}	1
	carbonate / CO_3^{2-}	1
3(d)	white	1
3(e)(i)	no reaction / change	1
3(e)(ii)	yellow	1
	precipitate	1
3(f)	lilac	1

Q# 6/ iGCSE Chemistry/2017/m/Paper 62/

3(a)(i)	white	1
	precipitate	1
3(a)(ii)	(white precipitate) dissolves	1
3(b)(i)	white precipitate	1
3(b)(ii)	(white precipitate) dissolves	1
3(c)	cream	1
	precipitate	1
3(d)	sodium	1
	iodide	1

Q# 7/ iGCSE Chemistry/2016/w/Paper 63/

3(a)(i)	pH 1–3	1
3(a)(ii)	effervescence / fizzing / bubbling / solid disappears / dissolves lighted splint 'pops'	1 1 1
3(a)(iii)	effervescence / fizzing / bubbling / solid disappears / dissolves limewater milky	1 1 1
3(a)(iv)	white precipitate	1
3(b)	calcium / Ca^{2+} hydroxide / OH^-	1 1

Q# 8/ iGCSE Chemistry/2016/w/Paper 62/

3(a)(i)	pH 1–3	1
3(a)(ii)	solid disappears / dissolves blue / green colour	1 1
3(a)(iii)	solid dissolves limewater turns milky	1 1 1
3(a)(iv)	white precipitate	1
3(b)	iron(III) nitrate	1 1

Q# 9/ iGCSE Chemistry/2016/w/Paper 61/

3(a)	water present / hydrated	1
3(b)	no change / colour	1
3(c)(i)	white precipitate dissolves	1 1 1
3(c)(ii)	white precipitate no change	1 1
3(d)	not a halide	1
3(e)	(aluminium) sulfate	1
3(f)	white (crystals)	1

Q# 10/ iGCSE Chemistry/2016/s/Paper 63/

3(a)(i)	white; precipitate; dissolves;	3 1 1 1
3(a)(ii)	white precipitate; dissolves;	2 1 1
3(a)(iii)	no reaction / change / precipitate;	1
3(a)(iv)	any 3 from: effervescence / fizz / bubbles; red litmus / pH paper; blue / pH > 7; pungent smell;	3
3(b)	lithium; carbonate;	2 1 1

Q# 11/ iGCSE Chemistry/2016/s/Paper 62/

3(a)	white (solid / crystals / powder);	1
3(b)(i)	no change;	1
3(b)(ii)	turns from purple / pink; to colourless / white;	2 1 1
3(c)	yellow / orange (flame);	1
3(d)	ammonia / NH_3;	1
3(e)	ammonium / NH_4^+;	1

Q# 12/ iGCSE Chemistry/2016/s/Paper 61/

3(a)	sodium; bromide;	2 1 1
3(b)	green;	1
3(c)(i)	green; precipitate; with excess, green solution / clear / dissolves;	3 1 1 1
3(c)(ii)	grey-green; precipitate;	2 1 1
3(c)(iii)	white precipitate;	1
3(d)	fume cupboard / protective clothing, e.g. gloves or goggles;	1

Q# 13/ iGCSE Chemistry/2016/m/Paper 62/

3(a)	blue / green (solid / crystals);	1
3(b)(i)	(pale) blue; precipitate; royal / deep blue; dissolves / solution;	4
3(b)(ii)	(pale) blue precipitate;	1
3(b)(iii)	white precipitate;	1
3(b)(iv)	no reaction / change / precipitate;	1
3(c)	ammonium; iodide;	2

Q# 14/ iGCSE Chemistry/2017/s/Paper 62/Q3

3(a)	initial temperature and final temperature recorded correctly: 19, 23	1
	temperature difference correctly calculated: 4	1
3(b)	endothermic	1
3(c)	sulfur dioxide	1
3(d)	sodium / Na^+	1
	sulfite / SO_3^{2-}	1
3(e)	red	1
3(f)	white	1
	precipitate	1

iG Chem 2 EQ P3 15w to 01s NEW 40marks

Q# 1/ iGCSE Chemistry/2014/s/Paper 31/ Q2

(b) In many regions, drinking water is obtained by the distillation of sea-water. Explain how distillation separates the water from sea-water.

.....

.....

..... [2]

Q# 2/ iGCSE Chemistry/2012/w/Paper 31/

Butane and propane are both gases, silver chloride is a salt that is insoluble in water, glucose and maltose are both sugars.

1 A list of techniques used to separate mixtures is given below.

filtration

diffusion

fractional distillation

simple distillation

crystallisation

chromatography

From this list, choose the most suitable technique to separate the following mixtures.
A technique may be used once, more than once or not at all.

(a) butane from a mixture of propane and butane ..... [1]

(b) oxygen from liquid air ..... [1]

(c) water from aqueous magnesium sulfate ..... [1]

(d) potassium chloride from aqueous potassium chloride ..... [1]

(e) silver chloride from a mixture of silver chloride and water ..... [1]

(f) glucose from a mixture of glucose and maltose ..... [1]

[Total: 6]

Q# 3/ iGCSE Chemistry/2011/s/Paper 31/

1 The following techniques are used to separate mixtures.

A simple distillation	**B** fractional distillation	**C** evaporation
D chromatography	**E** filtration	**F** diffusion

From this list, choose the most suitable technique to separate the following.

(a) methane from a mixture of the gases, methane and ethane ..... [1]

(b) water from aqueous magnesium sulfate ..... [1]

(c) glycine from a mixture of the amino acids, glycine and lysine ..... [1]

(d) iron filings from a mixture of iron filings and water ..... [1]

(e) zinc sulfate crystals from aqueous zinc sulfate ..... [1]

(f) hexane from a mixture of the liquids, hexane and octane ..... [1]

[Total: 6]

Q# 4/ iGCSE Chemistry/2010/s/Paper 31/Q4 (b)

(iii) A protein can be hydrolysed to a mixture of amino acids which are colourless. Individual amino acids can be identified by chromatography. The R_f value of the amino acid glycine is 0.5. Describe how you could show that glycine was present on a chromatogram.

.....

.....

..... [3]

Q# 5/ iGCSE Chemistry/2009/w/Paper 3/

4 The distinctive smell of the seaside was thought to be caused by ozone, O_3.
Ozone is a form of the element oxygen.

(a) A mixture of oxygen and ozone is formed by passing electric sparks through oxygen.

$$3O_2 \rightleftharpoons 2O_3$$

Suggest a technique that might separate this mixture. Explain why this method separates the two forms of oxygen.

technique .....

explanation .....

.....

.....

..... [2]

Q# 6/ iGCSE Chemistry/2009/s/Paper 31/

1 Some grass is crushed and mixed with the solvent, propanone. The colour pigments are extracted to give a deep green solution.

(a) **(i)** Draw a labelled diagram to describe how you could show that there is more than one coloured pigment in the green solution.

[3]

(ii) Given a pure sample of chlorophyll, how could you show that the green solution from the grass contained chlorophyll?

.....

.....

.....

..... [2]

Q# 7/ iGCSE Chemistry/2007/w/Paper 3/ Q4

(b) Some of the zinc oxide was mixed with an excess of carbon and heated to 1000 °C. Zinc distils out of the furnace.

$$2ZnO + C \rightleftharpoons 2Zn + CO_2$$
$$C + CO_2 \rightarrow 2CO$$

(i) Name the **two** changes of state involved in the process of distillation.

..... [2]

Q# 8/ iGCSE Chemistry/2007/w/Paper 3/

Helium and argon are gases at room temperature.

Barium sulphate does not dissolve in water.

1 A list of techniques used to separate mixtures is given below.

fractional distillation	**simple distillation**	**crystallization**	**filtration**	**diffusion**

From the list choose the most suitable technique to separate the following.

water from aqueous copper(II) sulphate .....

helium from a mixture of helium and argon .....

copper(II) sulphate from aqueous copper(II) sulphate .....

ethanol from aqueous ethanol .....

barium sulphate from a mixture of water and barium sulphate ..... [5]

Q# 9/ iGCSE Chemistry/2007/s/Paper 3/ Q5

(iii) Suggest how you could separate the metal, titanium, from the soluble salt magnesium chloride.

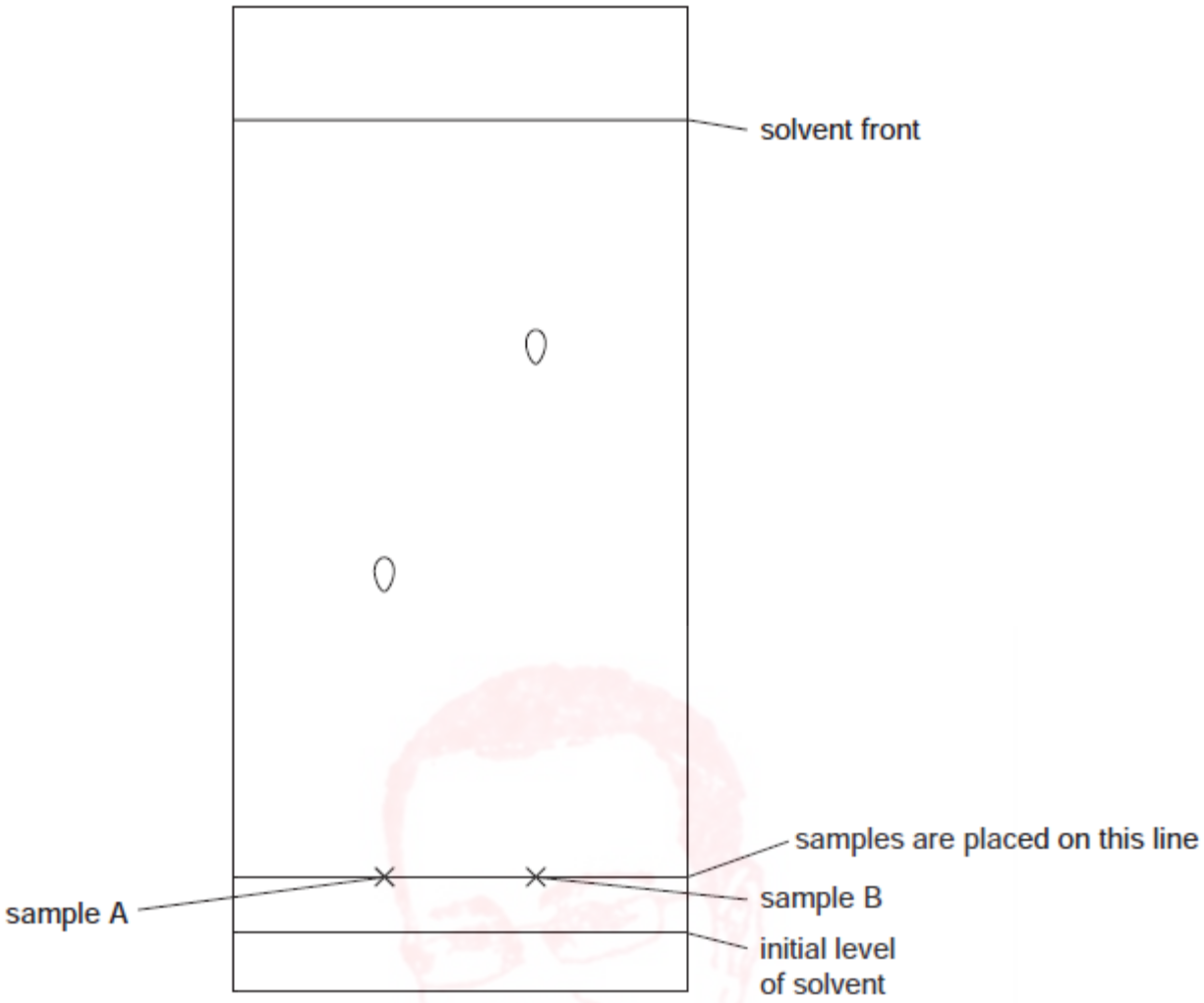
.....

..... [2]

Q# 10/ iGCSE Chemistry/2005/s/Paper 3/

5 Enzymes are biological catalysts. They are used both in research laboratories and in industry.

(a) Enzymes called proteases can hydrolyse proteins to amino acids. The amino acids can be separated and identified by chromatography. The diagram below shows a typical chromatogram.



(i) The R_f value of a sample = $\frac{\text{distance travelled by sample}}{\text{distance travelled by solvent front}}$

Some R_f values for amino acids are:

glutamic acid = 0.4 glycine = 0.5 alanine = 0.7 leucine = 0.9

Identify the two amino acids on the chromatogram.

A is ..... B is ..... [2]

(ii) Explain why the chromatogram must be exposed to a locating agent before R_f values can be measured.

..... [1]

(iii) Measuring R_f values is one way of identifying amino acids on a chromatogram. Suggest another.

..... [1]

Q# 11/ iGCSE Chemistry/2003/w/Paper 3/ Q3 (d)

(iii) Explain why the chromatogram must be sprayed with a locating agent before the amino acids can be identified.

.....

.....[1]

(iv) Explain how it is possible to identify the amino acids from the chromatogram.

.....

.....[2]

T12 Paper 6 Mark Scheme

Mark Scheme iG Chem 2 EQ P3 15w to 01s NEW 40marks

Q# 1/ iGCSE Chemistry/2014/s/Paper 31/ Q2

(b) boiling or turning to steam (1)

then condensing / condensation (1) [2]

Q# 2/ iGCSE Chemistry/2012/w/Paper 31/

1 **(a)** diffusion or fractional distillation;

(b) fractional distillation;

(c) simple distillation;

(d) crystallisation;

(e) filtration;

(f) chromatography;

Q# 3/ iGCSE Chemistry/2011/s/Paper 31/

1 **(a)**	F **or** B	diffusion / <u>fractional</u> distillation	[1]
(b)	A	simple distillation	[1]
(c)	D	chromatography	[1]
(d)	E	filtration	[1]
(e)	C	evaporation	[1]
(f)	B	<u>fractional</u> distillation	[1]

Q# 4/ iGCSE Chemistry/2010/s/Paper 31/ Q4 (b)

(iii) use locating agent [1]
measure distance travelled by sample / travelled by solvent front [1]
cond this is $R_f = 0.5$ [1]
for mark 3, either mark 1 or mark 2 must be awarded

accept run a chromatogram of glycine [1]
compare with sample
same position [1] max [2]

Q# 5/ iGCSE Chemistry/2009/w/Paper 3/

4 (a) diffusion [1]
different M_r **or** ozone molecules heavier than oxygen molecules
or different densities or oxygen molecules move faster than ozone molecules [1]
NOT oxygen is lighter **or** ozone heavier

OR fractional distillation [1]
they have different boiling points [1]

Q# 6/ iGCSE Chemistry/2009/s/Paper 31/

1 (a) (i) basic set up – container and chromatography paper [1]

sample clearly above level of solvent [1]
(original mark must be shown and not just the line)

indication that more than one "spot" either on diagram **or** as comment [1]

Allow MAX [2] for round filter paper with green spot at centre
two or more rings

(ii) run chromatogram of pure chlorophyll can be implied [1]
same position of green spot **or** same Rf [1]
NOT just a green spot

Q# 7/ iGCSE Chemistry/2007/w/Paper 3/ Q4

(b) (i) vaporisation **or** boiling **or** evaporation [1]
condensation **or** liquefaction [1]
NOTE order in which changes are given is not important
NOT liquid => gas => liquid

Q# 8/ iGCSE Chemistry/2007/w/Paper 3/

1 simple distillation [1]
diffusion **or** fractional distillation [1]
crystallisation [1]
fractional distillation [1]
filtration [1]
NOTE As the candidate are selecting from a list, the above are the only acceptable responses. **[Total: 5]**

Q# 9/ iGCSE Chemistry/2008/s/Paper 31/ Q5

(iii) add water (to dissolve salt) [1]
filter **or** centrifuge [1]

Q# 10/ iGCSE Chemistry/2005/s/Paper 3/

5 (a) (i) A is glutamic acid **[1]**
B is alanine **[1]**
Accept names only, **NOT** R_f values

(ii) because acids are colourless **or** to make them visible **[1]**
or to show positions of the samples **or** distance travelled

(iii) compare with known acids **or** reference samples **or** standards **[1]**
Accept from colours of samples

Q# 11/ iGCSE Chemistry/2003/w/Paper 3/ Q3 (d)

(iii) amino acids are colourless **or** become visible/coloured
or to develop it [1]
(iv) using colour **or** from position **ONLY** [1]
OR discussion of Rf [2]
OR compare with known amino acids [2]

T12 Essential End of Topic 12 Review and Reflection

This exercise will allow you to see all of your progress in every topic you complete. It will also help you become a more deliberate student, so that you are doing things like talking to a teacher that you might not at the start be comfortable with, but will build really important life skills to allow you to leave your comfort zone and talk to someone who might be interesting, or important, or helpful, even if it might feel easier and therefore better to do less and avoid new people. Try to be as honest and as detailed as possible. Sometimes you may think you have thought about an idea well, but when you talk with someone else, or write it out, it helps you better understand and allows you think more completely and more clearly.

Did you achieve more goals this topic than last topic (circle)? Yes/No

Fill in this table:

Level	Number of goals achieved at each level	Success rate (%)
FUNDAMENTAL	/5	
ESSENTIAL	/10	
EXTENSION	/13	
EXCEPTIONAL	/10	

Do you feel you tried harder this topic than the previous topic? If yes, how do you know? What helped you to do so? If not, why not?

What could you do differently next time? Try to avoid simply saying "more of *X*", be specific instead, think carefully about the problem, try to think creatively, so if you found your notes less helpful, look at the section at the back about the **Cornell Notetaking System** and write out things you did not do last topic that you would like to try next tropic:

What did you enjoy most about this topic? What was most interesting?

What did you find most difficult? What could you do to make success in this area more likely?

What did you find easiest? Why did you find it easy?

On a scale of 1 being hardest and 5 being most difficult, circle how challenging you found this topic relative to your other AS topics:

1 2 3 4 5

What could be done to make this topic easier to understand?

Do you have any questions about this topic? Is there anything you would like to follow up later?

Google: [topic name] news. **What is the most interesting news about this topic** you found out?

Looking at the goals you could have achieved and the goals you actually achieved try to reflect on your progress.

Try to be as honest and as detailed as possible. Sometimes you may think you have thought about an idea well, but when you talk with someone else, or write it out, it helps you better understand and allows you think more completely and more clearly.

Did you achieve more goals this topic than last topic?

Fill in this table

Level	Number of goals achieved at each level	Success rate, %
FUNDAMENTAL	/5	
ESSENTIAL	/10	
EXTENSION	/13	
EXCEPTIONAL	/10	

Do you feel you tried harder? If yes, what helped you to do so? If not, why not?

What could you do differently next time, in addition to what you are already doing to improve, not only your score in the end of topic tests and other assessed activities, but also in how you learn. How could you become a more effective student to get more learning out of the time you are investing in your studies?

What did you enjoy most about this topic?

What did you find most difficult?

What did you find easiest?

On a scale of 1 being hardest and 5 being most difficult, circle how challenging you found this topic

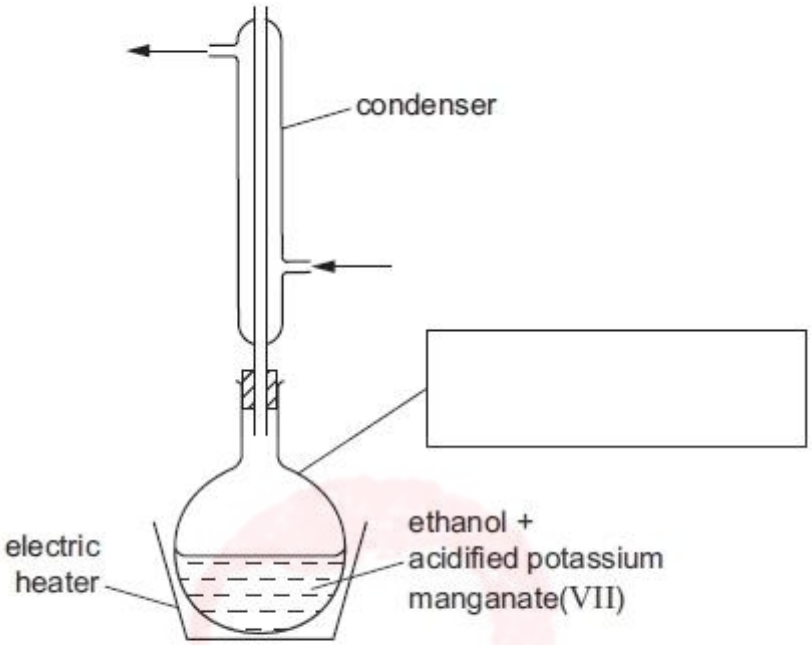
1 2 3 4 5

What could be done to make this topic easier to understand?

Do you have any questions about this topic?

Q# 1/ iGCSE Chem/2015s/Paper 6/

1 Ethanol was reacted with hot acidified potassium manganate(VII) solution using the apparatus below. Ethanoic acid was formed.

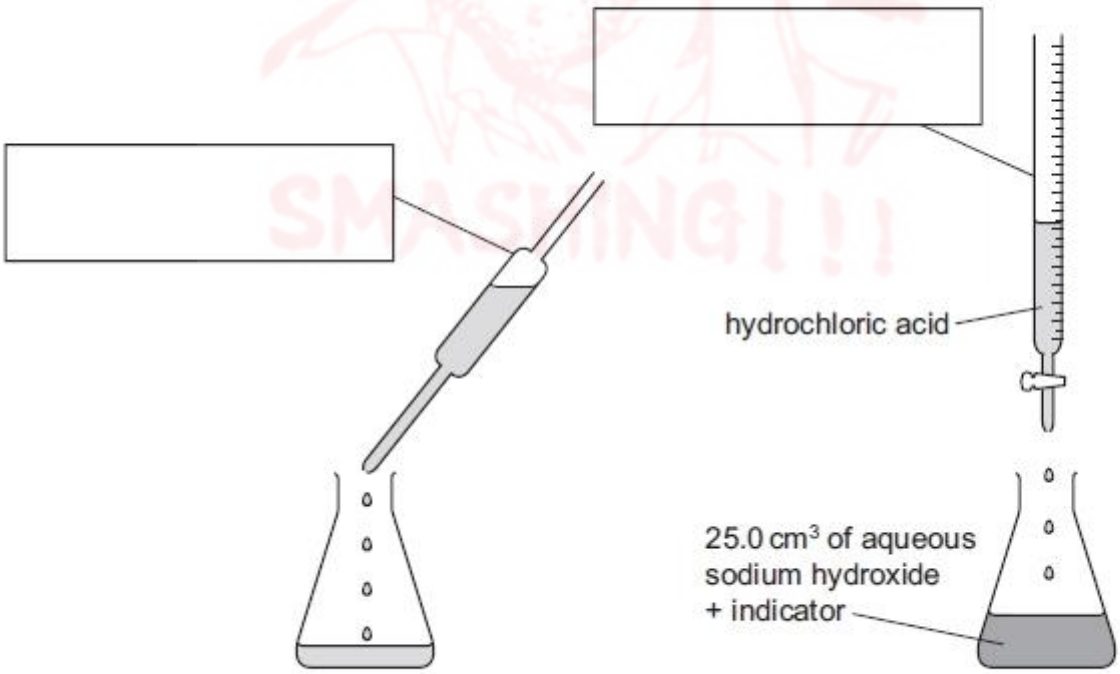


(a) (i) Complete the box to identify the piece of apparatus labelled. [1]

(ii) Label the arrows. [1]

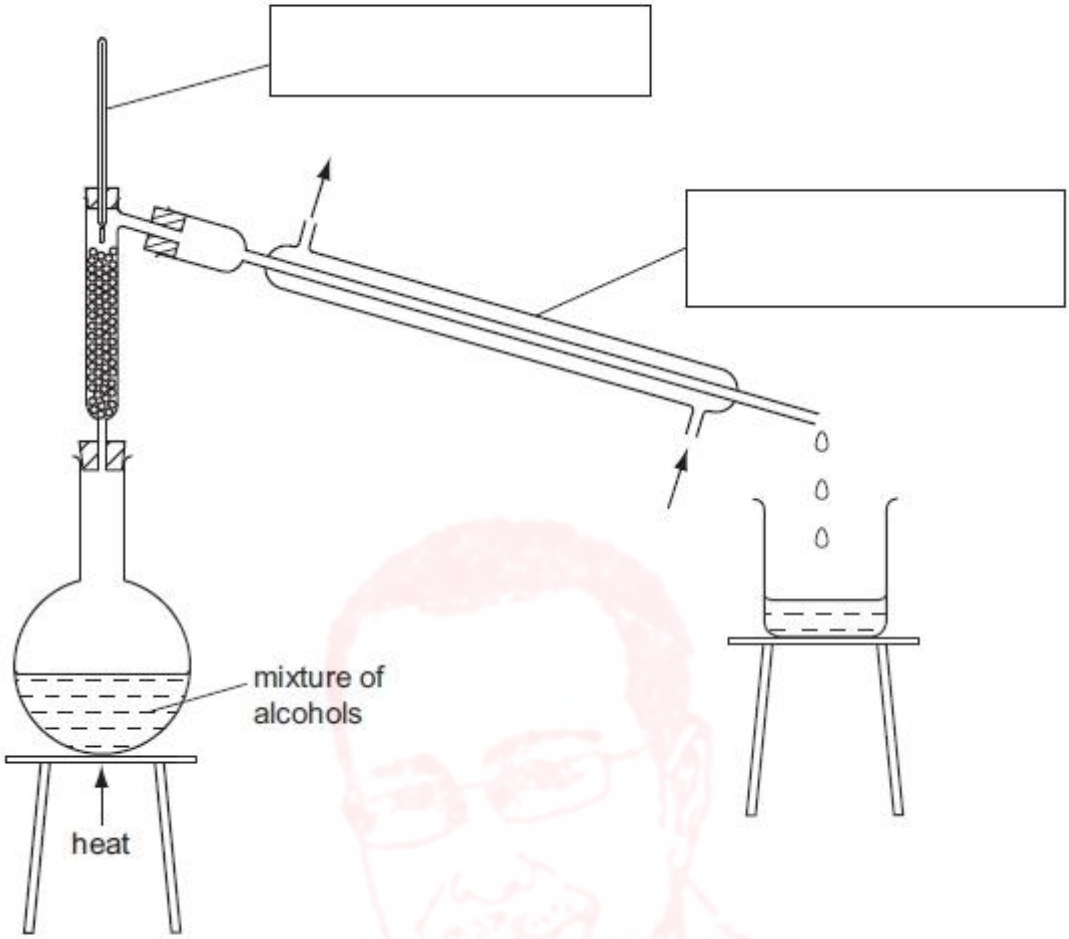
Q# 2/ iGCSE Chem/2015/w/Paper 62/

1 The volume of hydrochloric acid that reacts with 25.0 cm^3 of aqueous sodium hydroxide can be found using the apparatus below.



(a) Complete the boxes to identify the pieces of apparatus labelled. [2]

1 A student separated a mixture of two alcohols, ethanol (boiling point 78 °C) and butanol (boiling point 118 °C).
The apparatus used is shown below.



(a) Complete the boxes to identify the pieces of apparatus labelled. [2]

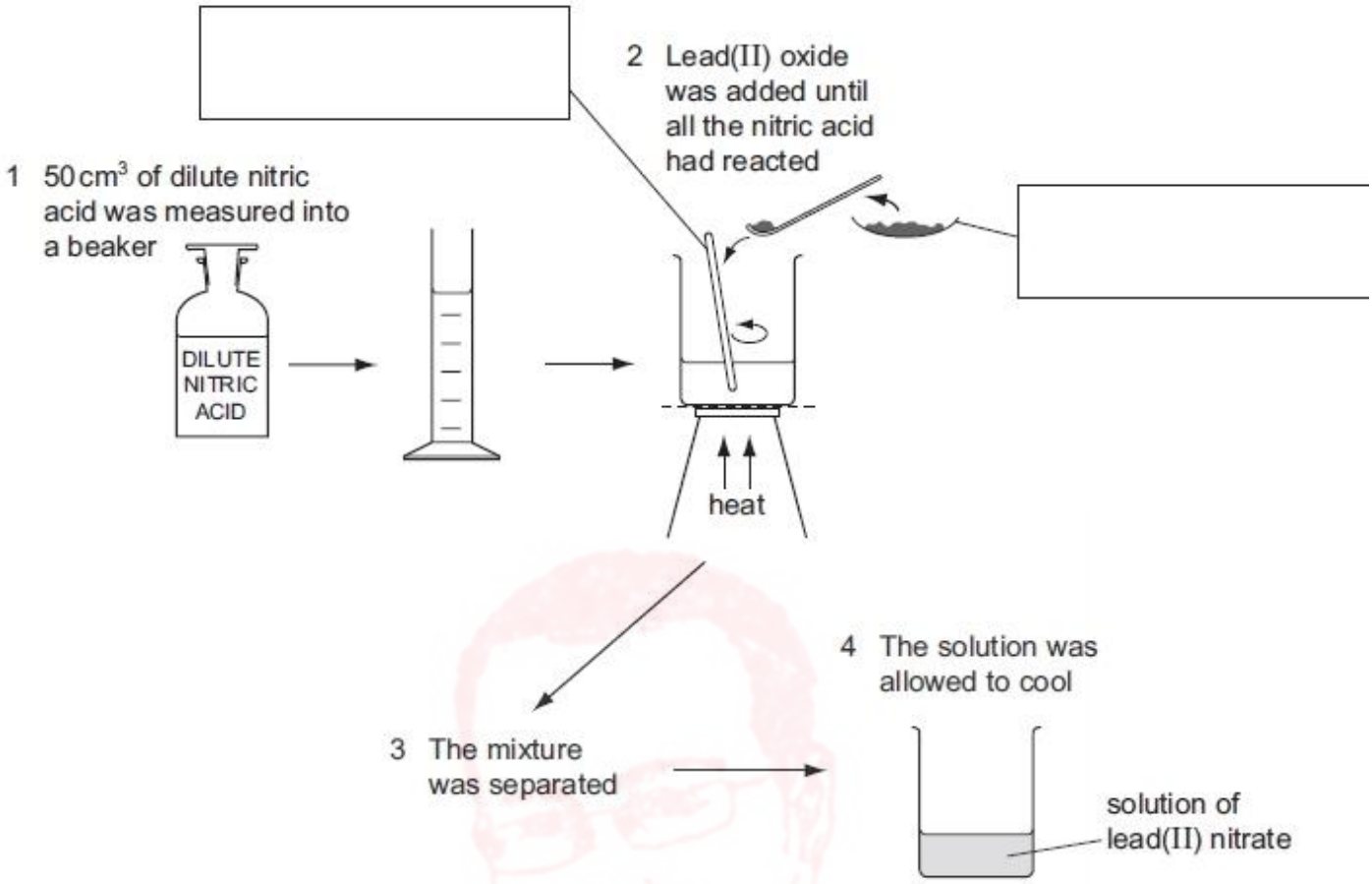
(b) Label the arrows. [1]

(e) Identify and explain a possible hazard in this experiment.

.....

..... [2]

1 A student reacted dilute nitric acid with lead(II) oxide to prepare lead(II) nitrate. The diagram shows the stages in the method used.



(a) Complete the boxes to identify the pieces of apparatus. [2]

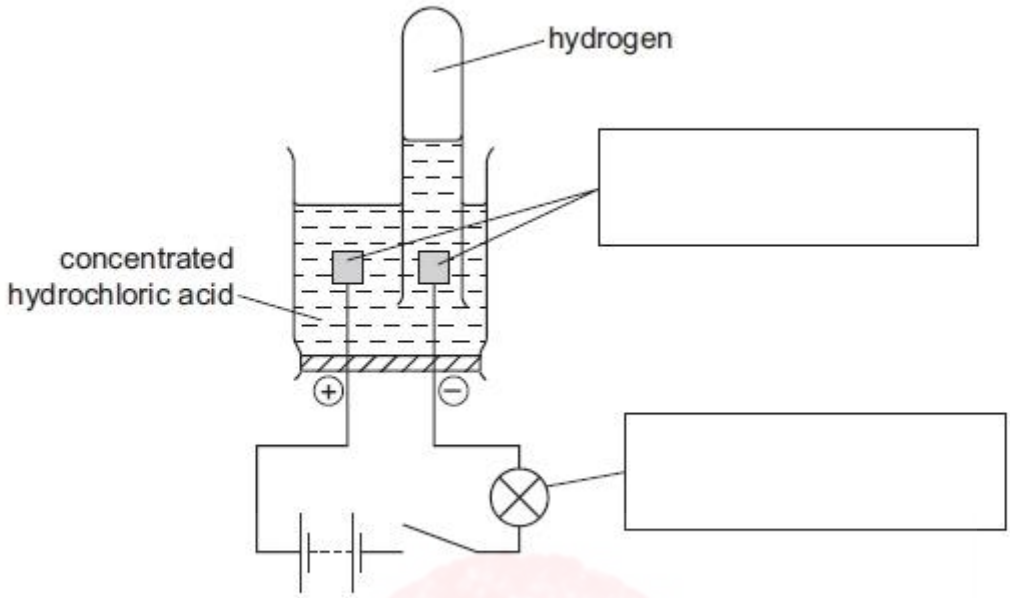
(c) The lead(II) oxide was weighed before and after the additions.

Use the balance diagrams to work out the mass of lead(II) oxide added to the dilute nitric acid.

..... [2]

Q# 5/ iGCSE Chem/2013s/Paper 6/

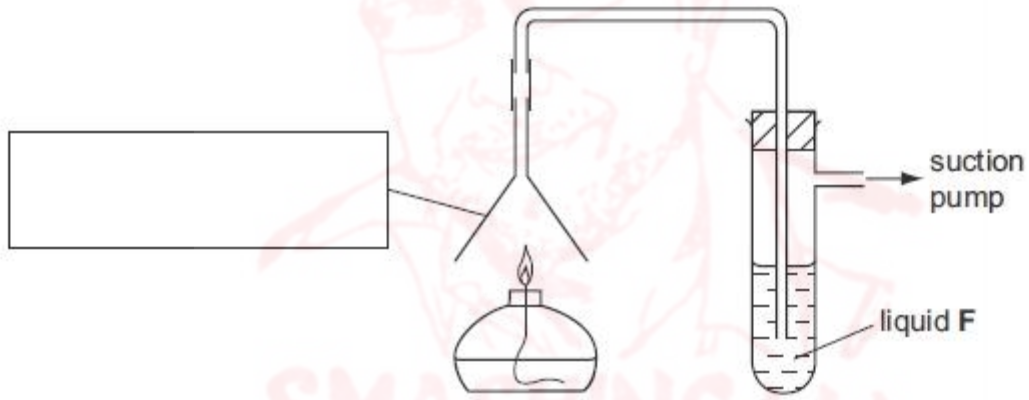
1 Electricity was passed through a solution of concentrated hydrochloric acid using the apparatus shown.



(a) Complete the boxes to identify the parts of the apparatus labelled. [2]

Q# 6/ iGCSE Chem/2013/w/Paper 6/

1 A student investigated the products formed when ethanol was burned using the apparatus shown.

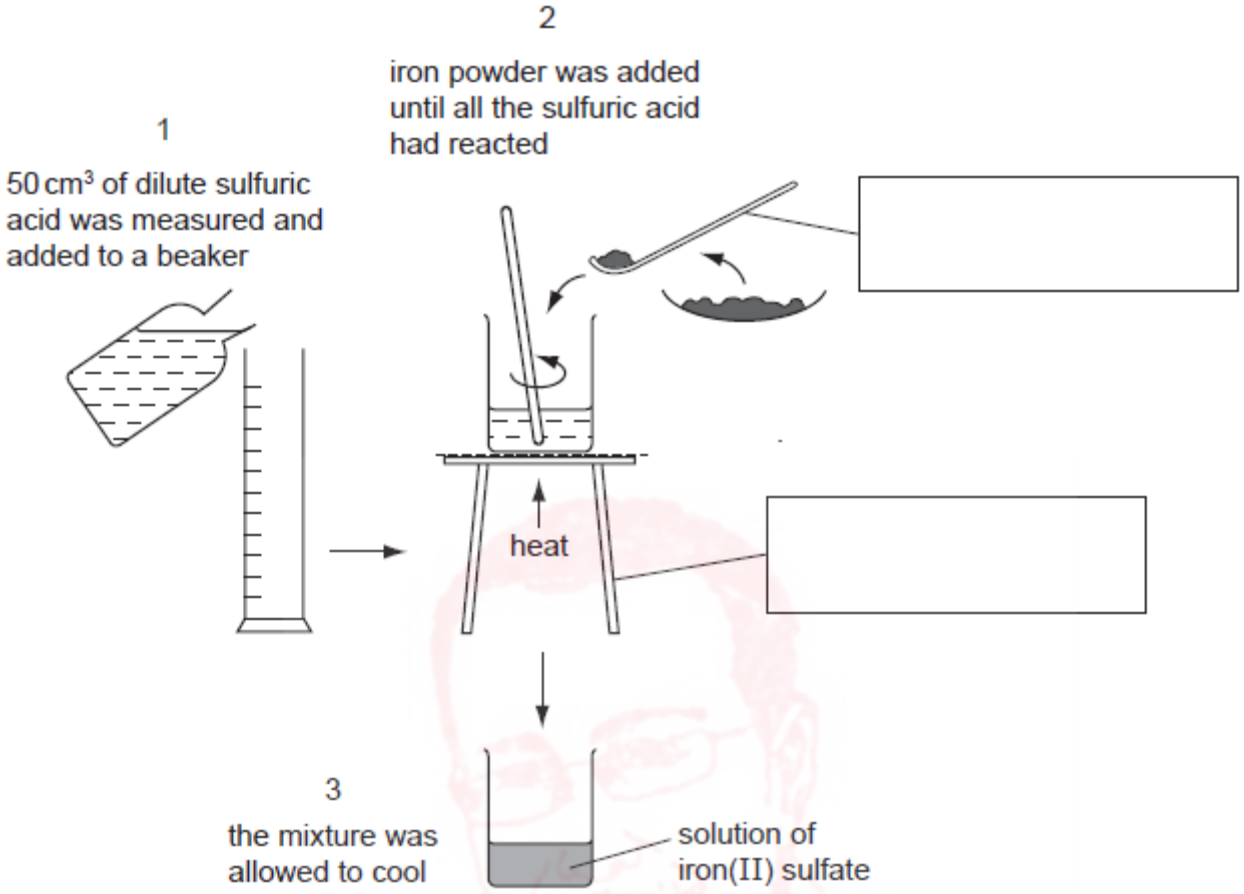


(a) Complete the box to identify the piece of apparatus. [1]

(b) Why is a suction pump used?

..... [1]

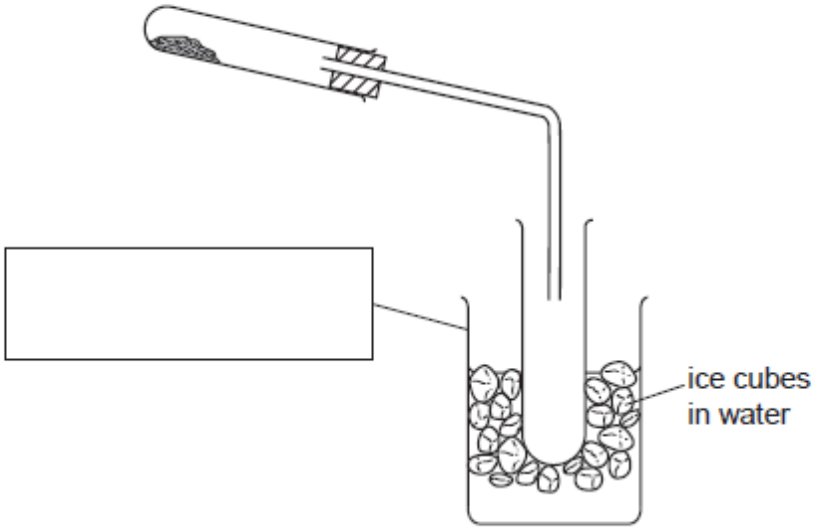
1 A student reacted excess iron powder with sulfuric acid to prepare a solution of iron(II) sulfate.
The diagram shows the procedure followed in three stages.



(a) Complete the boxes to identify the pieces of apparatus labelled. [2]

Q# 8/ iGCSE Chem/2011s/Paper 6/

1 A student heated hydrated zinc sulfate crystals, $ZnSO_4.7H_2O$, using the apparatus below to obtain a sample of water.



(a) Complete the box to identify the piece of apparatus labelled. [1]

(b) Use labelled arrows to indicate:

(i) where the heat is applied,

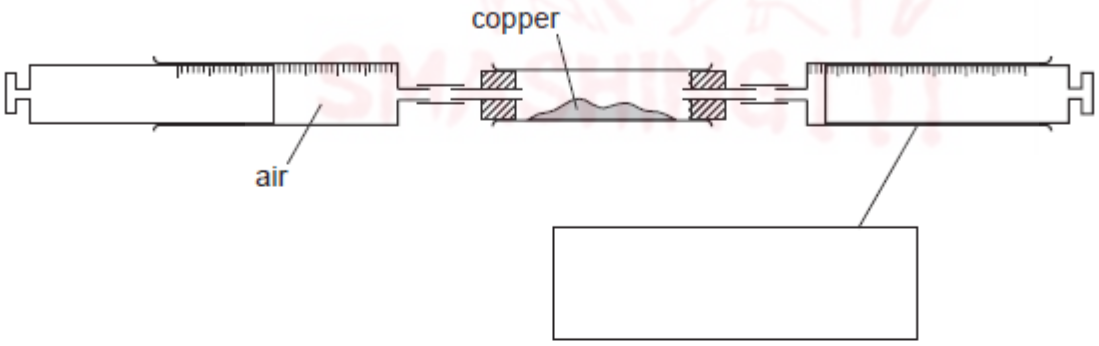
(ii) where the sample of water would collect. [2]

(c) State the purpose of the ice cubes.

..... [1]

Q# 9/ iGCSE Chem/2011/w/Paper 6/

1 A student investigated the reaction of air with copper. 100 cm^3 of air was passed continuously over heated copper using the apparatus below. When the volume remained constant, the apparatus was left to cool and the volume of gas was measured.

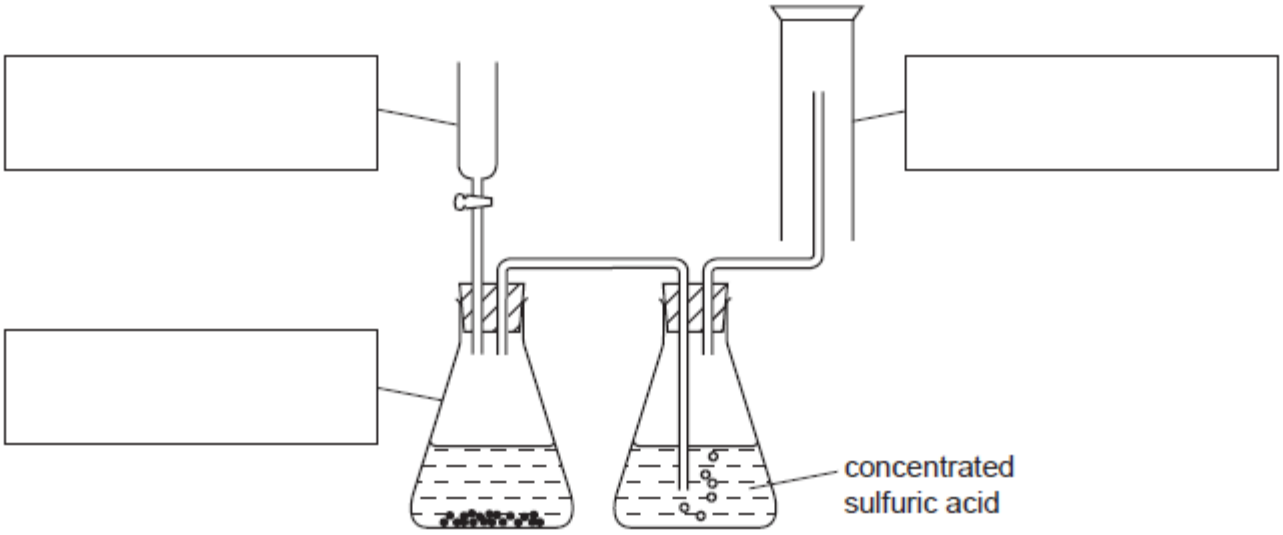


(a) **(i)** Complete the box to show the apparatus labelled. [1]

(ii) Indicate on the diagram, with an arrow, where heat is applied. [1]

Q# 10/ iGCSE Chem/2010s/Paper 6/

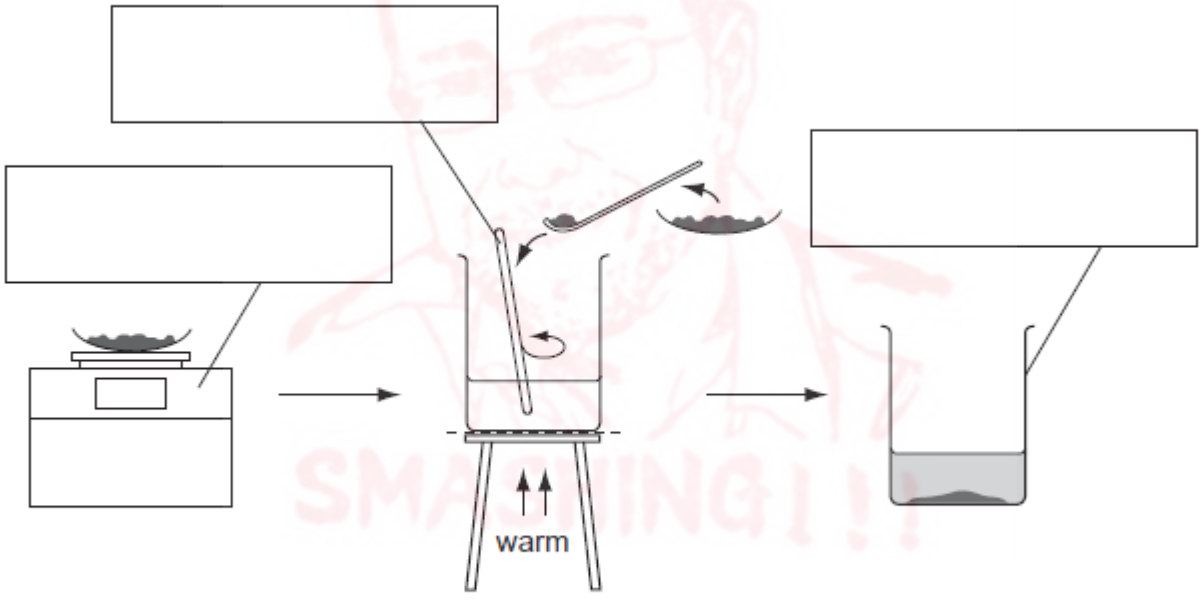
1 The diagram shows the apparatus used to prepare a gas. The gas is more dense than air.



(a) Complete the boxes to name the apparatus. [3]

Q# 11/ iGCSE Chem/2009s/Paper 6/

1 A student reacted nitric acid with magnesium oxide to prepare magnesium nitrate. The diagram shows the procedure followed in three stages.



1
magnesium oxide weighed

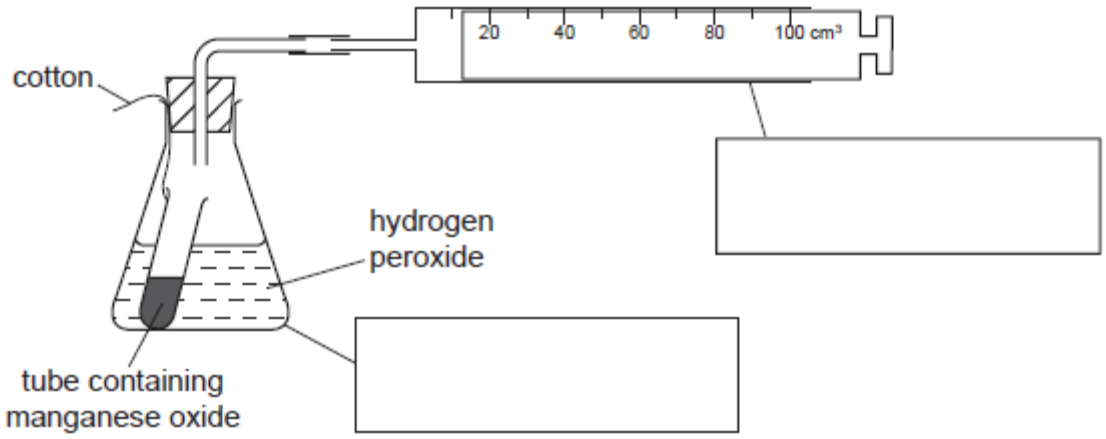
2
magnesium oxide added until all the nitric acid reacted

3
mixture allowed to cool

(a) Complete the boxes to identify the pieces of apparatus labelled. [3]

Q# 12/ iGCSE Chem/2009/w/Paper 6/

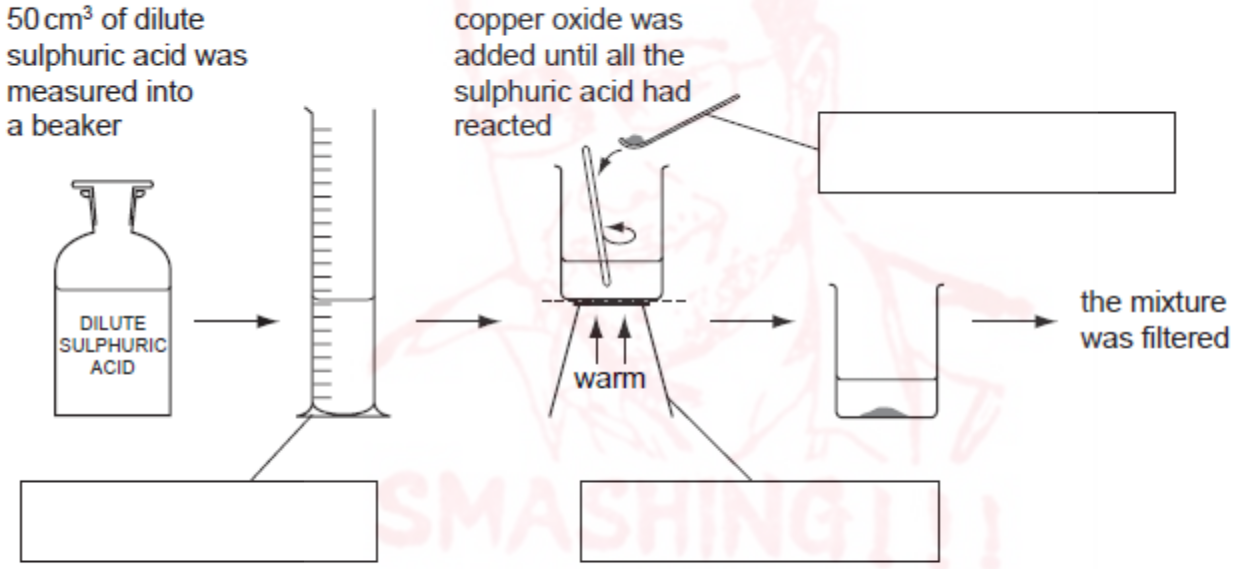
1 The apparatus below was used to make oxygen. The tube of manganese oxide was added to the hydrogen peroxide solution by releasing the cotton.



(a) Complete the boxes to identify the pieces of apparatus. [2]

Q# 13/ iGCSE Chem/2008s/Paper 6/

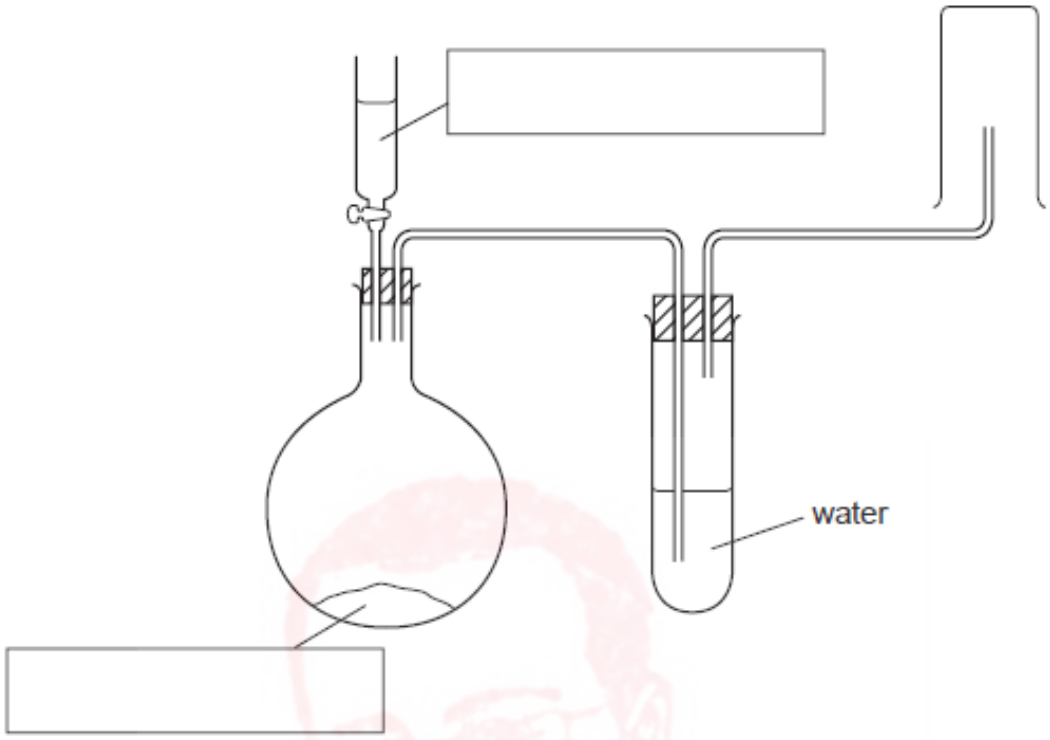
1 A solution of copper sulphate was made by reacting excess copper oxide with dilute sulphuric acid. The diagram shows the method used.



(a) Complete the empty boxes to name the pieces of apparatus. [3]

Q# 14/ iGCSE Chem/2008s/Paper 6/

3 Sulphur dioxide gas is denser than air and soluble in water. A sample of sulphur dioxide can be prepared by adding dilute hydrochloric acid to sodium sulphite and warming the mixture. Study the diagram of the apparatus used.

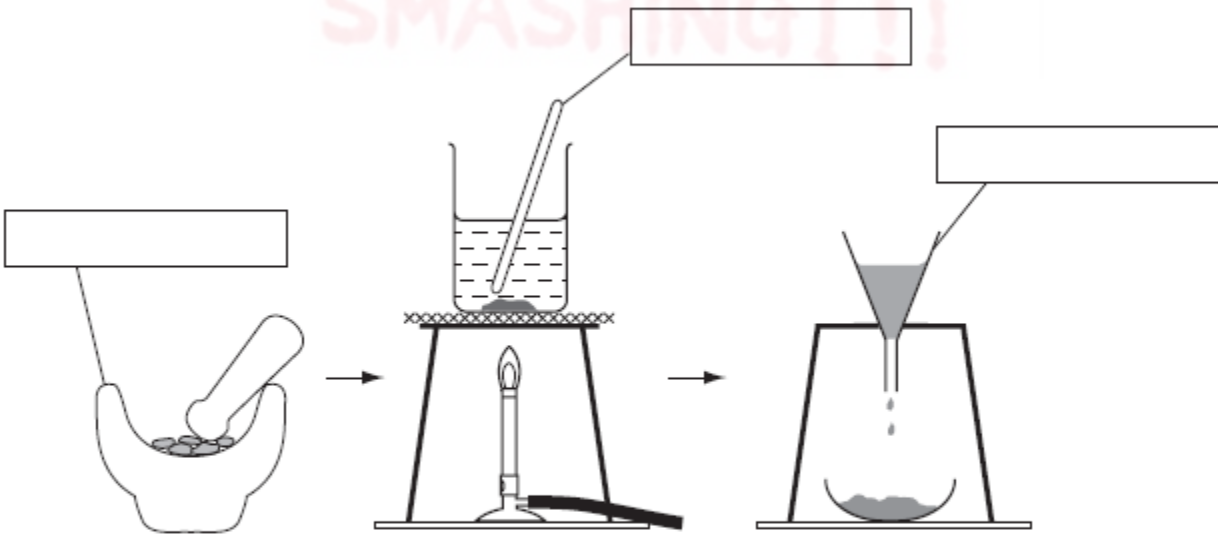


(a) Fill in the boxes to show the chemicals used. [2]

(b) Show by using an arrow, on the diagram, where heat is applied. [1]

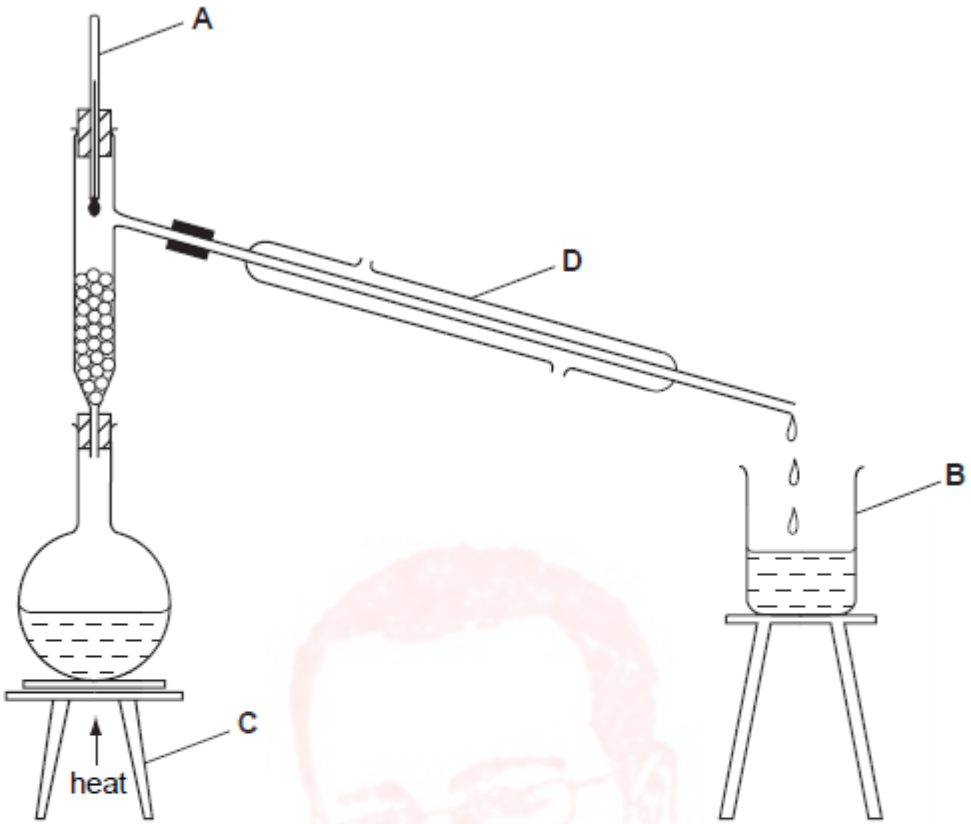
Q# 15/ iGCSE Chem/2008/w/Paper 6/

1 The colours present in some blackcurrant sweets can be separated by chromatography. The colours are water-soluble dyes.
The diagrams show how the colours can be extracted from the sweets.



(a) Complete the empty boxes to name the pieces of apparatus. [3]

1 A mixture of ethanol and water can be separated by fractional distillation. The apparatus below can be used to carry out such a separation in the laboratory.



(a) Name each piece of apparatus.

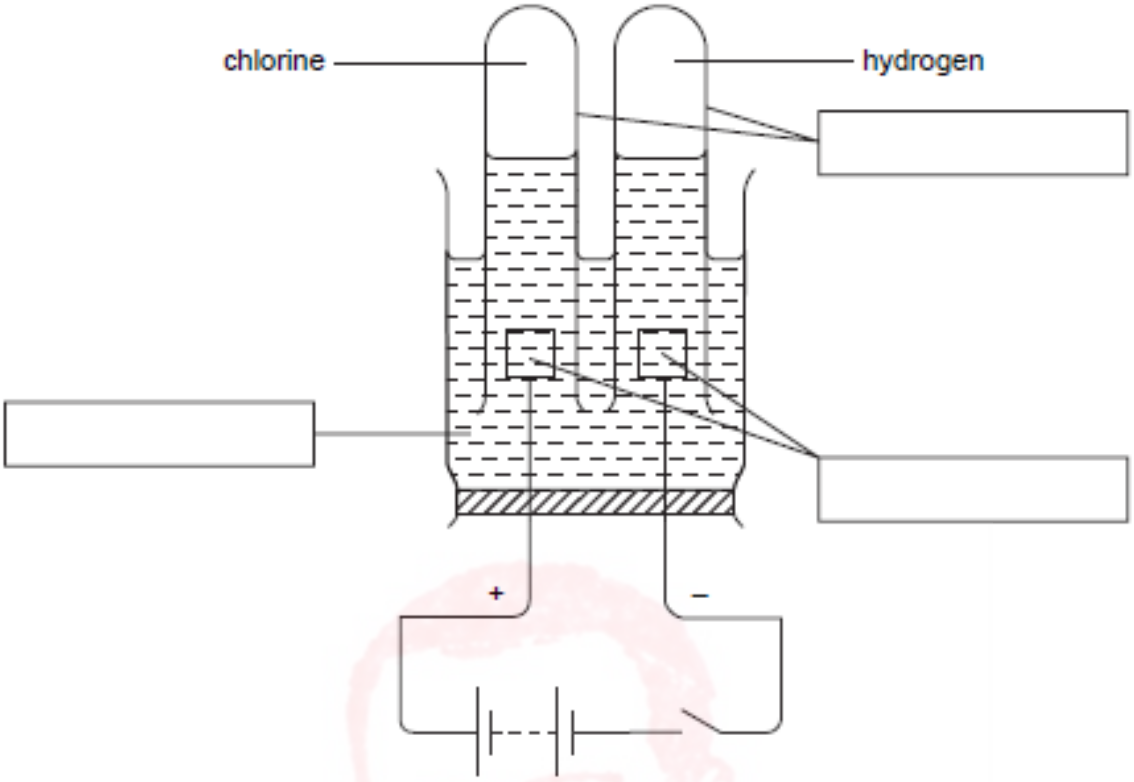
A .....

B .....

C ..... [3]

Q# 17/ iGCSE Chem/2006s/Paper 6/

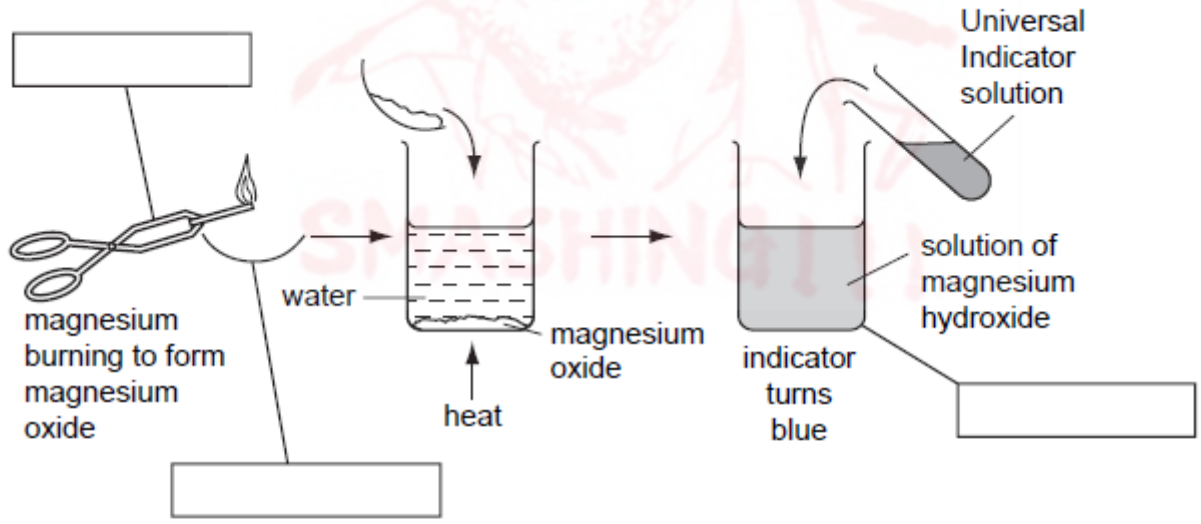
1 The diagram shows the effect of passing electricity through concentrated hydrochloric acid.



(a) Label the diagram by completing the boxes. [3]

Q# 18/ iGCSE Chem/2006/w/Paper 6/

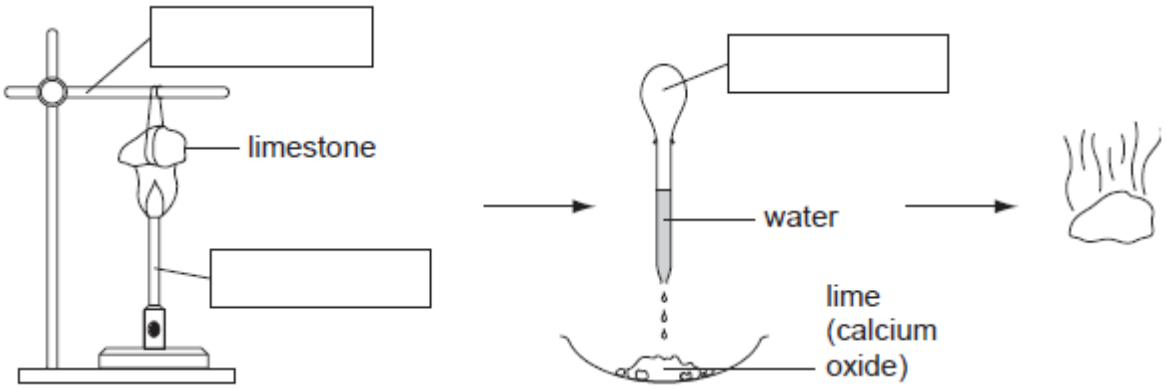
1 The diagram shows the formation of a solution of magnesium hydroxide from magnesium.



(a) Complete the empty boxes to name the pieces of apparatus. [3]

Q# 19/ iGCSE Chem/2005s/Paper 6/

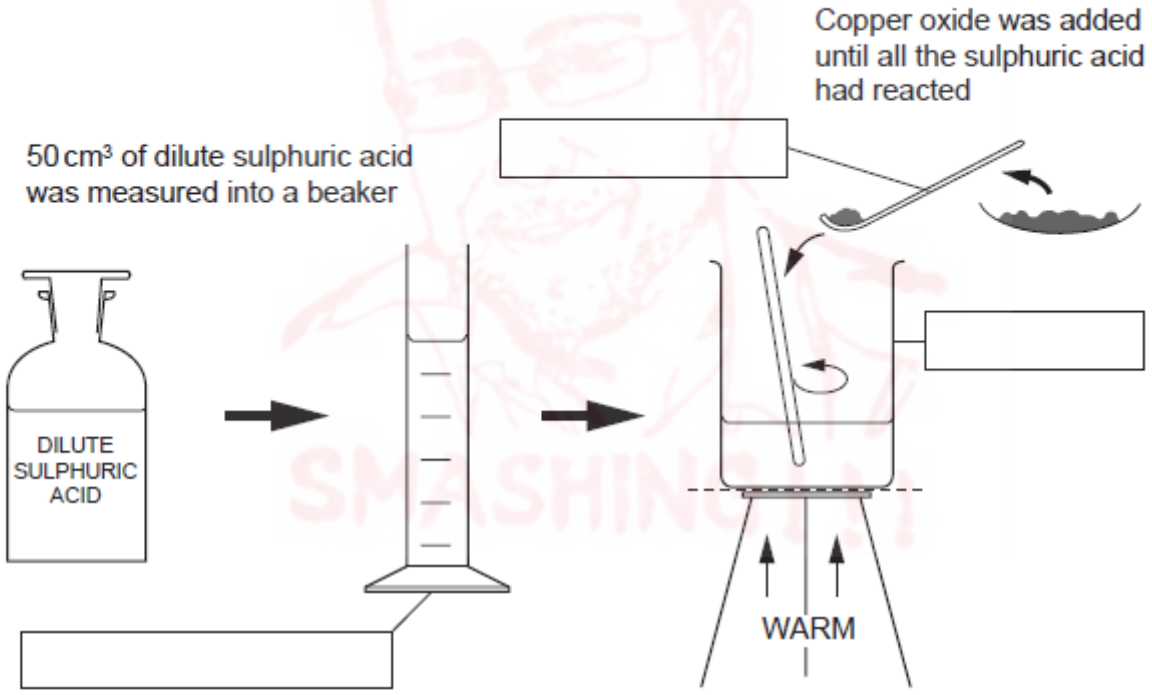
1 A small piece of limestone was heated strongly and left to cool. A few drops of cold water were added. The solid expanded and gave off steam.



(a) Complete the empty boxes to identify the pieces of apparatus labelled. [3]

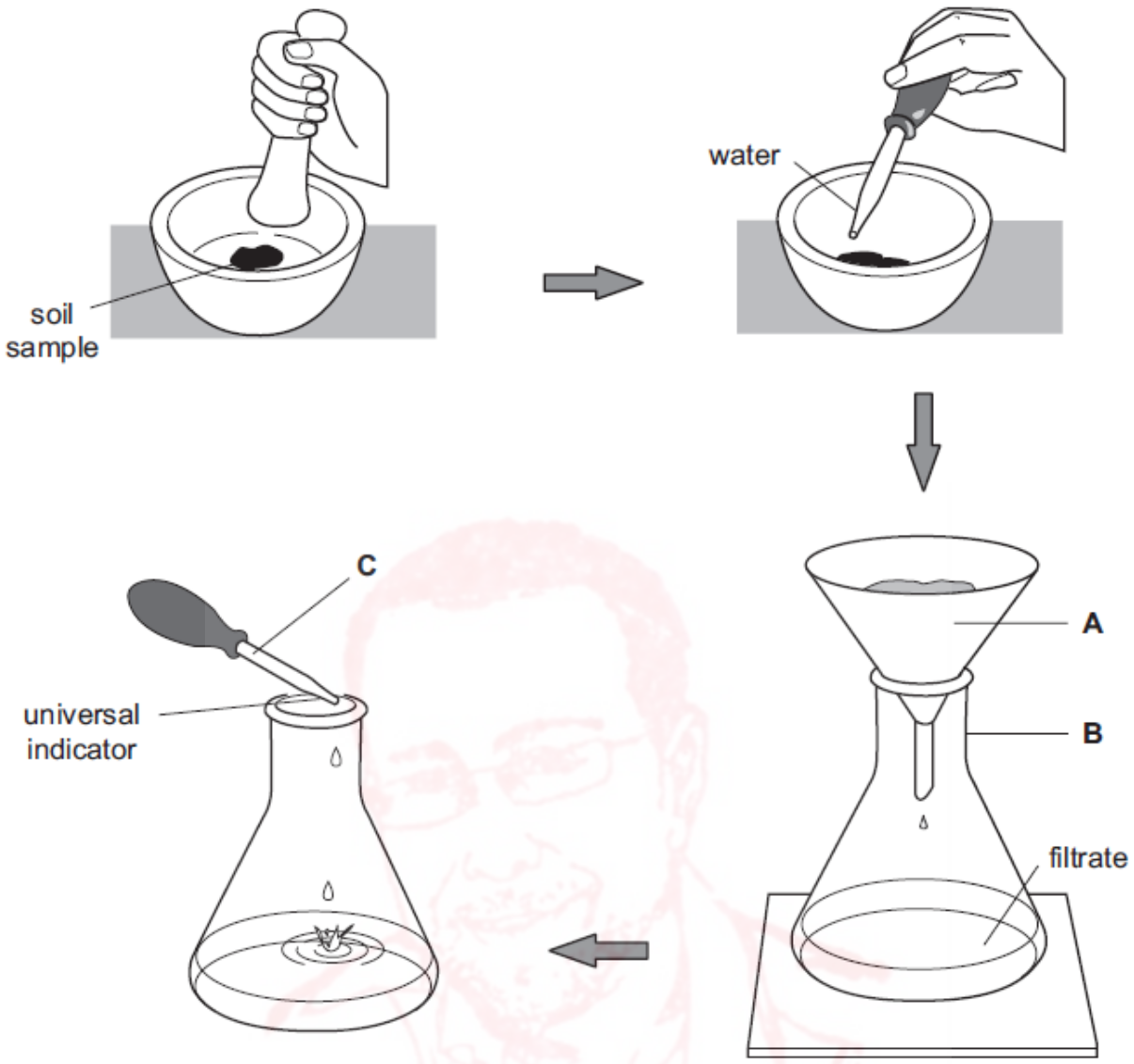
Q# 20/ iGCSE Chem/2005/w/Paper 6/

1 A student reacted sulphuric acid with copper(II) oxide. The diagram shows the procedure followed.



(a) Complete the boxes to identify the pieces of apparatus labelled. [3]

1 An experiment was carried out to find the pH of samples of soil from a farmer's field.



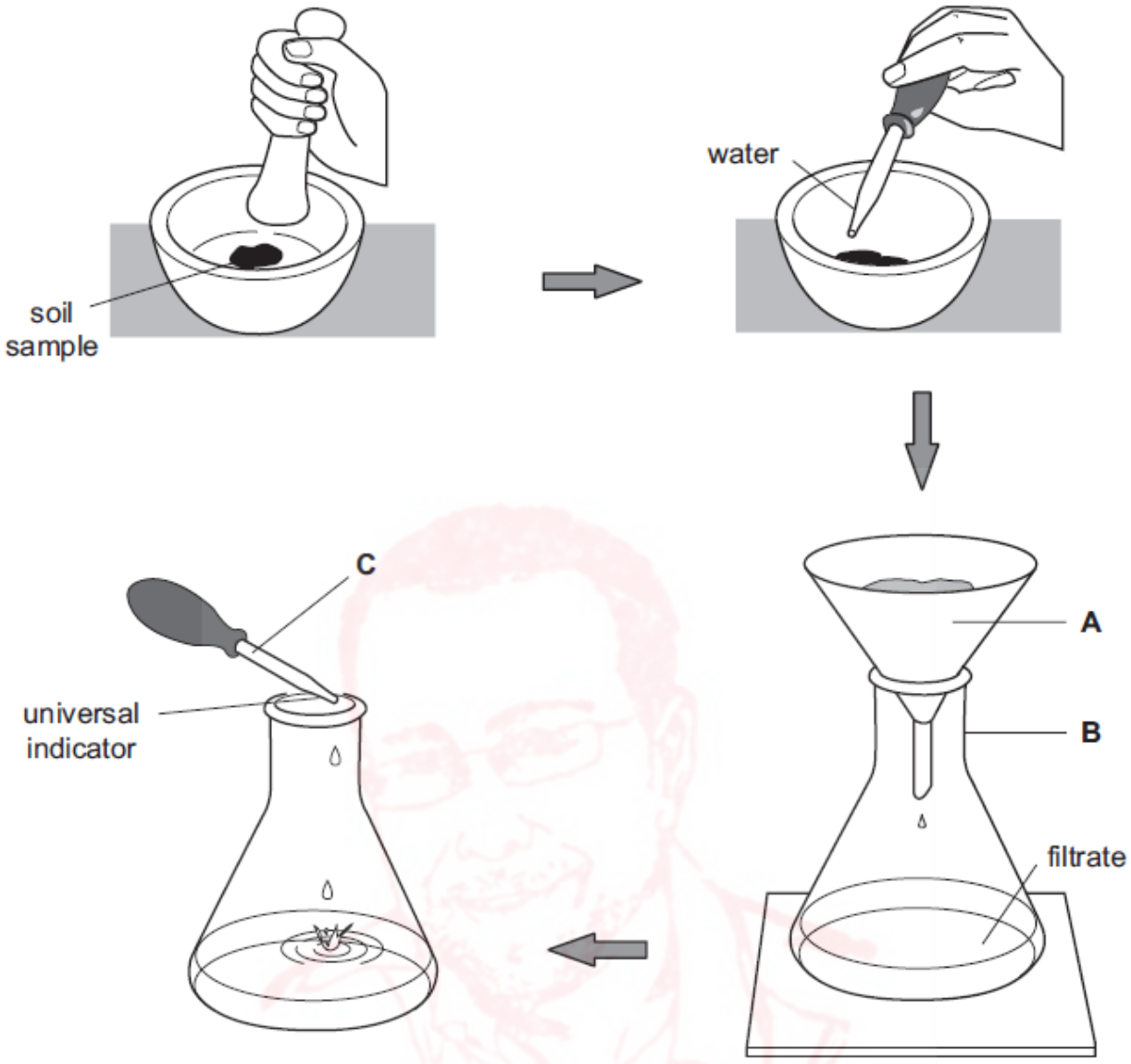
(a) Identify the pieces of apparatus labelled

A, ...

B, ...

C. ..... [3]

1 An experiment was carried out to find the pH of samples of soil from a farmer's field.



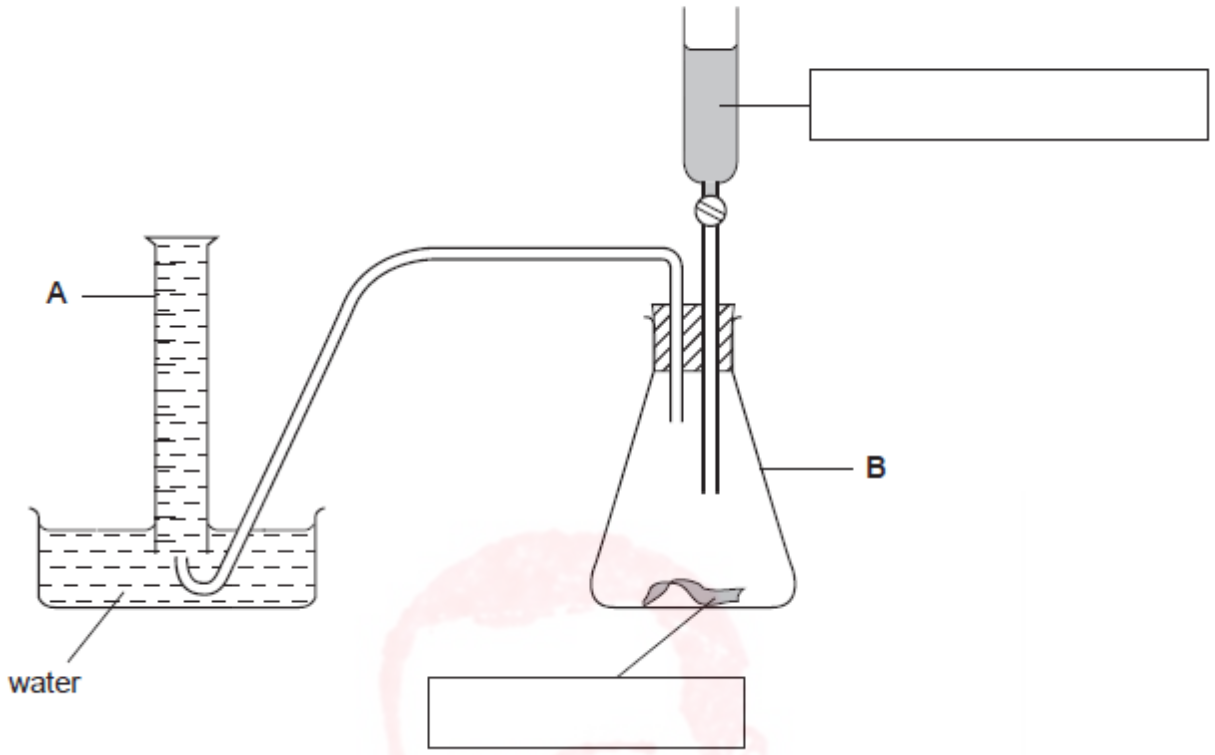
(a) Identify the pieces of apparatus labelled

A, ...

B, ...

C. ..... [3]

1 The apparatus below was used to make hydrogen. Dilute hydrochloric acid was added to zinc.



(a) Identify the pieces of apparatus labelled

A, ...

B. ..... [2]

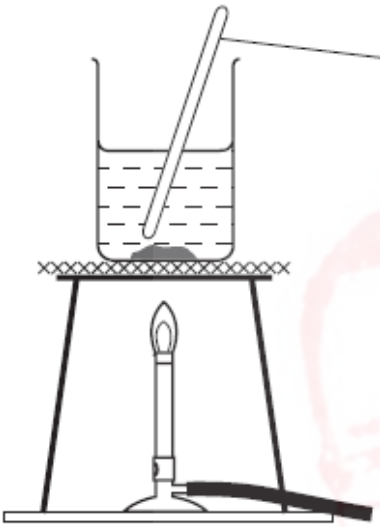
(b) Complete the boxes [1]

Q# 24/ iGCSE Chem/2003s/Paper 6/

1 Look at the diagrams of common laboratory apparatus.

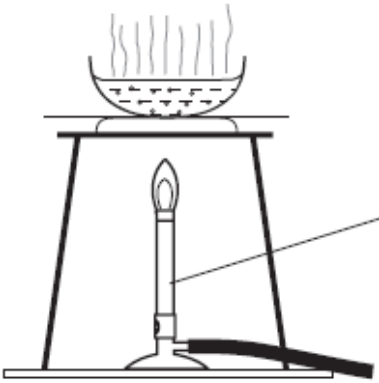
A

B



C

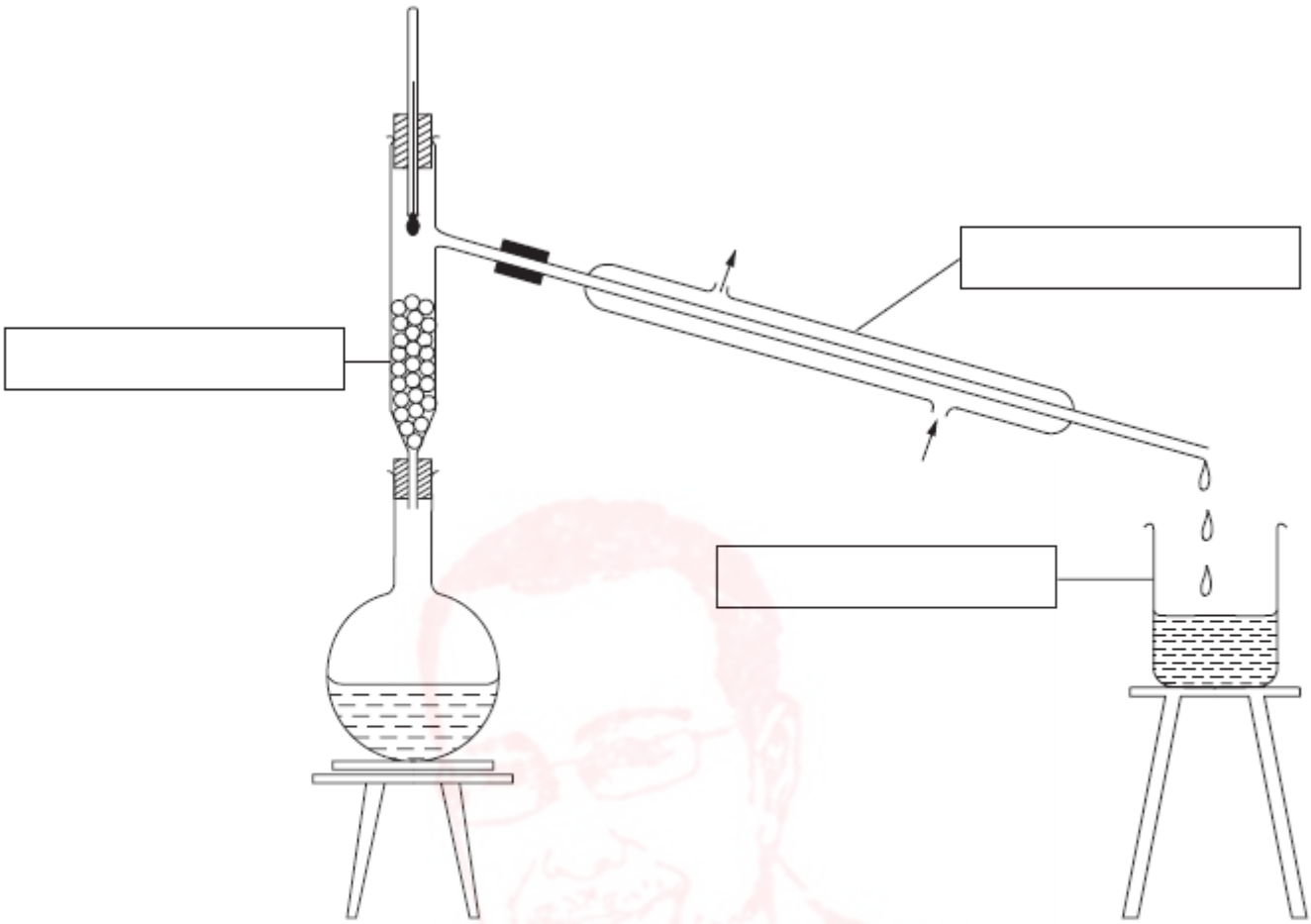
D



(a) Complete the empty boxes to identify the pieces of apparatus labelled. [4]

Q# 25/ iGCSE Chem/2003/w/Paper 6/

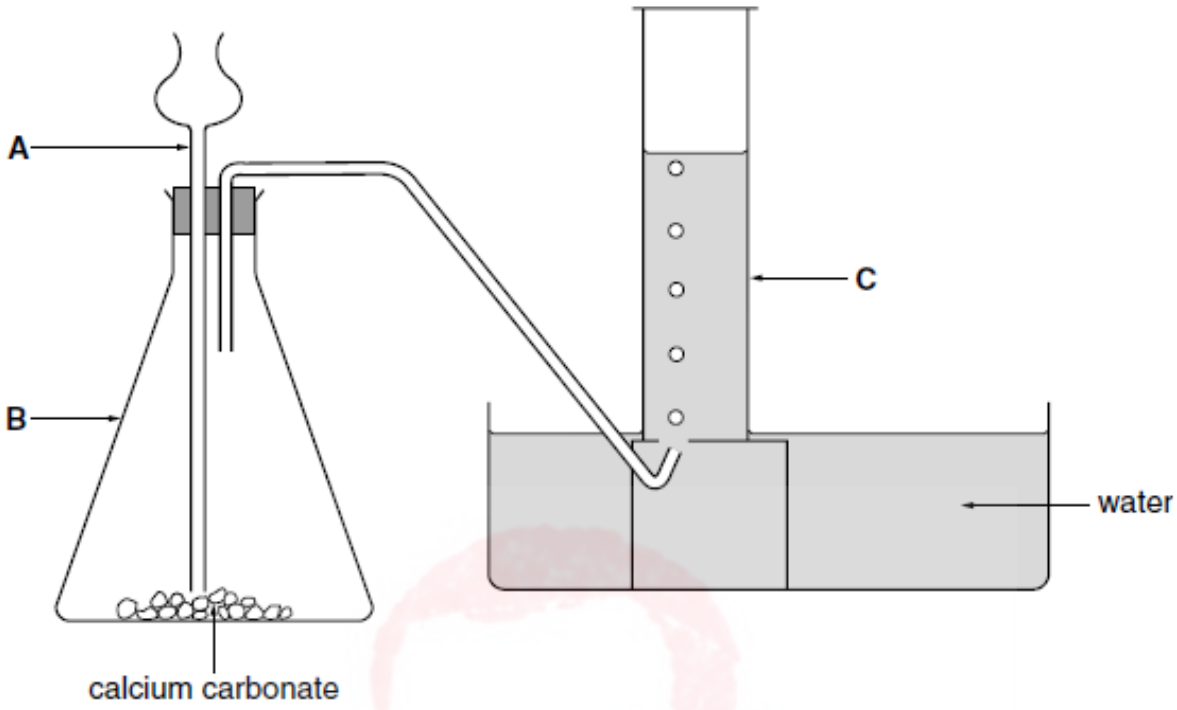
1 The apparatus below was used to separate ethanol from water.



(a) Complete the empty boxes to name the pieces of apparatus. [3]

(b) Indicate by an arrow where heat is applied. [1]

1 The apparatus below was used to make carbon dioxide. Dilute hydrochloric acid was added to calcium carbonate.



(a) Identify the pieces of apparatus labelled:

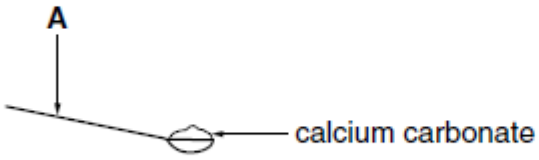
A .....

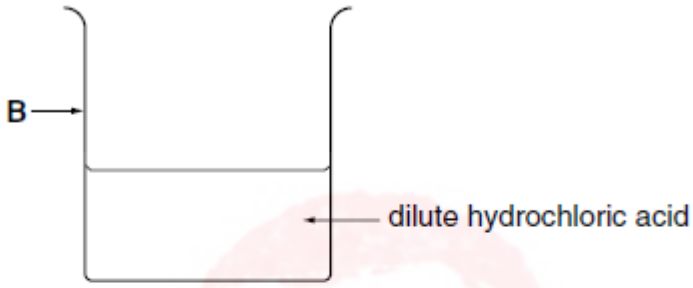
B .....

C .....

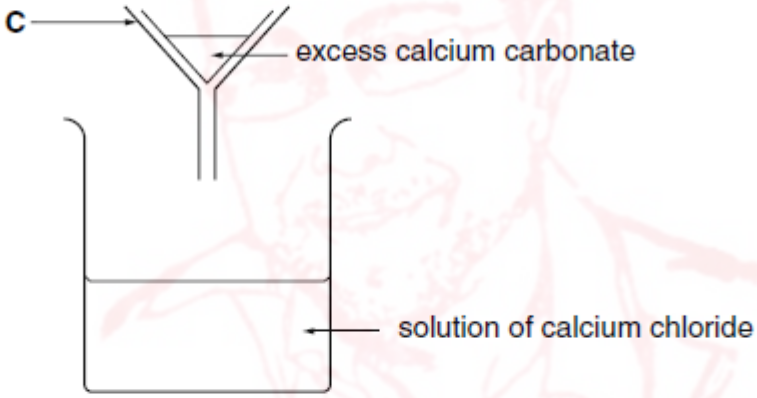
1 A student investigated the neutralisation of dilute hydrochloric acid, using an excess of calcium carbonate.

Step 1 Excess calcium carbonate was added to hydrochloric acid.





Step 2. Excess calcium carbonate was removed from the solution.



Step 3. The solution of calcium chloride was tested with indicator paper.

(a) Identify the pieces of apparatus labelled:

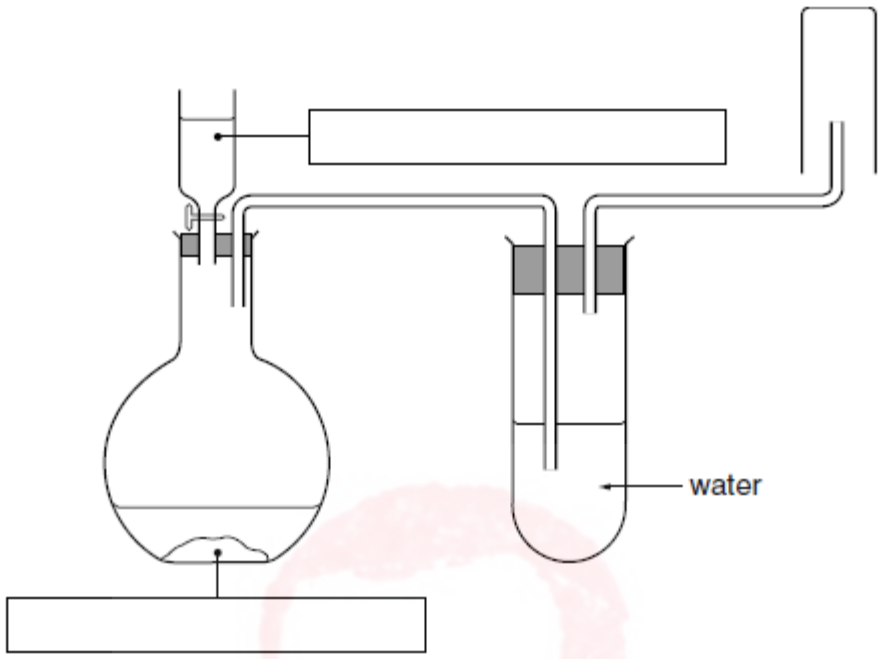
A.....

B.....

C.....[3]

Q# 28/ iGCSE Chem/2002/w/Paper 6/

2 Hydrogen chloride gas is strong-smelling, denser than air and soluble in water. A sample of hydrogen chloride gas can be prepared by adding concentrated sulphuric acid to sodium chloride. Study the diagram of the apparatus used.



(a) Fill in the boxes to show the chemicals used. [2]

(c) State **one** precaution that should be taken when carrying out this experiment.

.....

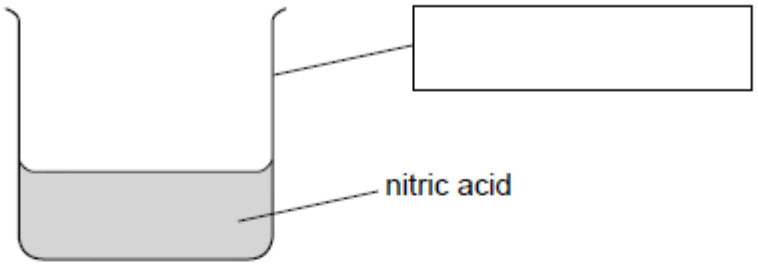
.....[1]

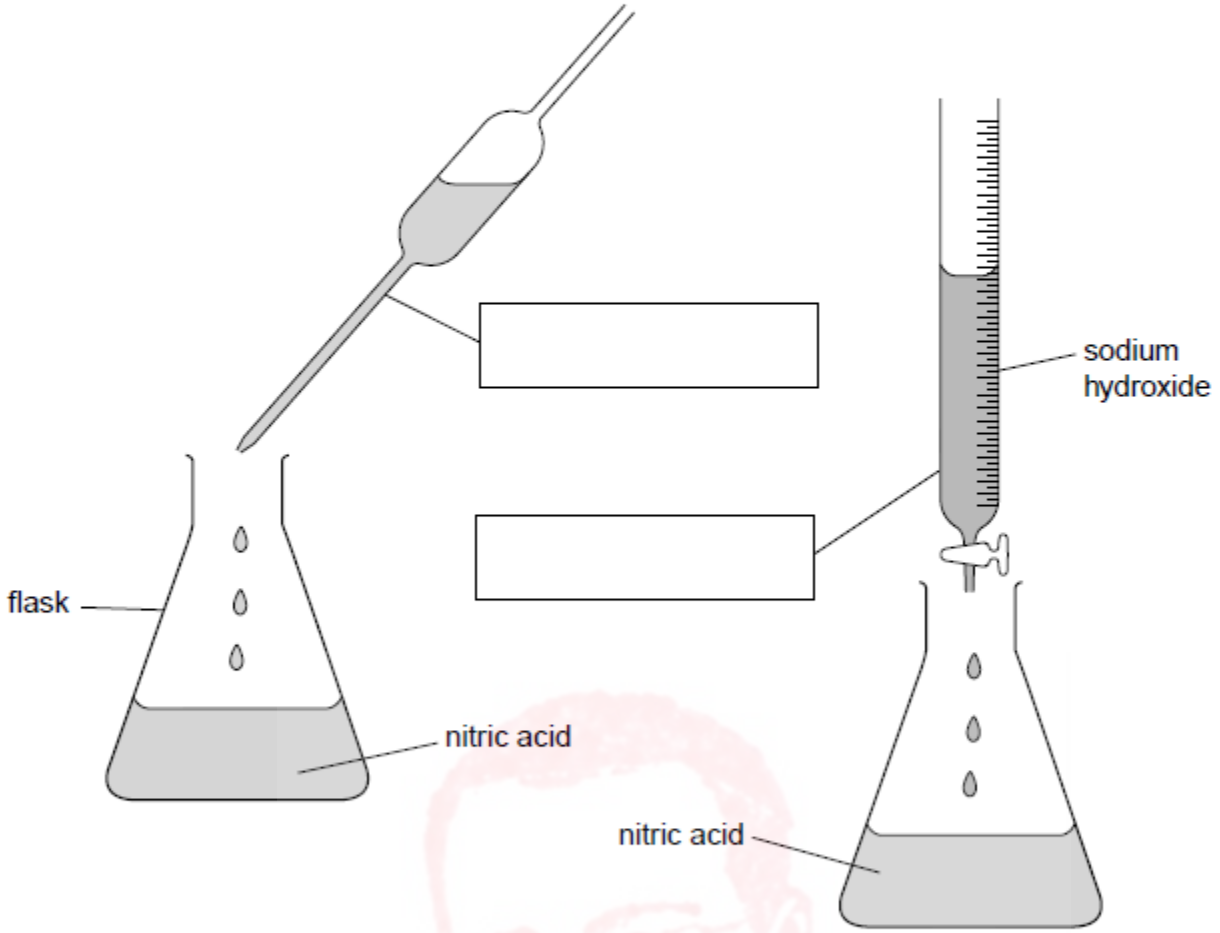
Q# 29/ iGCSE Chem/2001/w/Paper 6/

1 The diagrams show the apparatus used to find the concentration of a nitric acid solution.

25.0 cm^3 of nitric acid was added to a flask.

Sodium hydroxide was added to the acid until the solution was neutral. The volume of the sodium hydroxide was noted.





(a) Complete the boxes to name the apparatus used. [3]

P6 Labelling Equipment Mark Scheme

iG Chem EQ P6 2001w to 2015w Labelling Lab Equipment 86marks

Q# 1/ iGCSE Chem/2015s/Paper 6/

1(a)(i)	flask;	1	
1(a)(ii)	top arrow water **and** bottom arrow water;	1	

Q# 2/ iGCSE Chem/2015/w/Paper 62/

1(a)	pipette; burette;	1 1	**I:** dropper **R:** teat pipette

Q# 3/ iGCSE Chem/2014s/Paper 6/

1 **(a)** thermometer (1)

condenser (1)
allow condensing tube, condensating tube, etc. [2]

(b) arrows labelled – water (in) and water (out) (1) [1]

(c) fractional (1)

distillation (1) [2]

(d) **(i)** ethanol (1) [1]

(ii) temperature would rise (above 78°C) (1) [1]

(e) alcohols are (in)flammable / catch fire / burn (1)
ignore: explode

Bunsen burner / flame / heat (1) [2]

Q# 4/ iGCSE Chem/2014/w/Paper 6/

1 **(a)** boxes completed to show stirrer / glass rod (1)
watchglass / evaporating dish (1) [2]

(b) to speed up the reaction (1) [1]

(c) correct answer 4.2g (2)
if incorrect, evidence of 17.8 – 13.6 (1) [2]

Q# 5/ iGCSE Chem/2013s/Paper 6/

1 **(a)** electrode(s) / anode / cathode(either) (1)
allow: electrodes labelled wrong way round **not**: carbon/platinum

bulb / lamp / light (1) [2]

Q# 6/ iGCSE Chem/2013/w/Paper 6/

1 **(a)** funnel (1) [1]

(b) to move products through the apparatus / owtte e.g. let the gases go out (1) [1]

Q# 7/ iGCSE Chem/2012s/Paper 6/

1 **(a)** tripod (1) **accept**: stand spatula (1) not: spoon [2]

Q# 8/ iGCSE Chem/2011s/Paper 6/

1 **(a)** beaker (1) [1]

(b) **(i)** (arrow) labelled heat in correct position under shaded crystals (1)

(ii) arrow labelled water in test-tube at or below the level of the ice (1) [2]

(c) to cool/condense the water or steam/owtte (1) [1]

Q# 9/ iGCSE Chem/2011/w/Paper 6/

1 **(a)** **(i)** (gas) syringe (1) [1]

(ii) arrow indication under copper (1) [1]

Q# 10/ iGCSE Chem/2010s/Paper 6/

1 **(a)** flask (1)
tap/separating/dropping funnel (1) not burette
gas jar (1) accept measuring cylinder [3]

Q# 11/ iGCSE Chem/2009s/Paper 6/

1 **(a)** balance (1) stirring/(glass) rod/stirrer (1) not thermometer
beaker (1) [3]

Q# 12/ iGCSE Chem/2009/w/Paper 6/

1 **(a)** (conical) flask (1) (gas) syringe (1) [2]

Q# 13/ iGCSE Chem/2008s/Paper 6/

1 (a) boxes correctly completed

measuring cylinder (1)

spatula (1)

tripod (1) [3]

Q# 14/ iGCSE Chem/2008s/Paper 6/

3 (a) boxes completed correctly to show position of hydrochloric acid (1)
and sodium sulphite (1) [2]

(b) arrow underneath flask (1) [1]

Q# 15/ iGCSE Chem/2008/w/Paper 6/

1 (a) mortar (1)
stirrer/(glass) rod (1) not metal rod or thermometer
funnel (1) not filter or filter paper [3]

Q# 16/ iGCSE Chem/2007s/Paper 6/

1 (a) **A** thermometer (1)
B beaker (1)
C tripod (1) [3]

Q# 17/ iGCSE Chem/2006s/Paper 6/

1 (a) Boxes completed tubes (1)
hydrochloric acid (1)
electrodes (1) **[3]**

Q# 18/ iGCSE Chem/2006/w/Paper 6/

1 (a) Boxes filled in correctly to show
tongs(1)
watch glass/evaporating basin/dish(1)
beaker(1) **[3]**

Q# 19/ iGCSE Chem/2005s/Paper 6/

1 (a) boxes completed retort/clamp stand (1)
(teat) pipette/dropper (1)
Bunsen burner (1)
[3]

Q# 20/ iGCSE Chem/2005/w/Paper 6/

1 (a) boxes filled in correctly to show:

measuring cylinder (1)

spatula (1)

beaker (1) **[3]**

Q# 21/ iGCSE Chem/2004s/Paper 6/

1 (a) **A** Funnel 1
B Flask 1
C (Teat) Pipette/dropper 1 **[3]**

Q# 22/ iGCSE Chem/2004s/Paper 6/

1 (a) **A** Funnel 1
B Flask 1
C (Teat) Pipette/dropper 1 **[3]**

Q# 23/ iGCSE Chem/2004/w/Paper 6/

1 (a) **A** measuring cylinder (1)

B flask (1) **(2)**

(b) boxes completed correctly, zinc and hydrochloric acid (1) **(1)**

Q# 24/ iGCSE Chem/2003s/Paper 6/

1 (a) **A** = mortar (1)
B = stirrer/stirring rod (1) not thermometer
C = tripod (1)
D = Bunsen Burner (1) [4]

Q# 25/ iGCSE Chem/2003/w/Paper 6/

1 (a) Boxes labelled clockwise:
Condenser (1)
Beaker (1)
Fractionating column (1) 3

(b) ↑ underneath flask (1) 1

Q# 26/ iGCSE Chem/2002s/Paper 6/

1 (a) A – (thistle) funnel (1)
B – (conical) flask (1)
C – gas jar (1) 3

Q# 27/ iGCSE Chem/2002/w/Paper 6/

1 (a) A – spatula only (1)
B – beaker only (1)
C – funnel (1) not filter 3

Q# 28/ iGCSE Chem/2002/w/Paper 6/

2 (a) top box – sulphuric acid (1)
bottom box – sodium chloride (1) 2

(c) fume cupboard / goggles (1) 1
or well-ventilated room / gloves

Q# 29/ iGCSE Chem/2001/w/Paper 6/

1 (a) Boxes completed to show
beaker (1), pipette (1), burette (1) [3]

iG Chem 1 to 7 EQ 18w to 16m P6 Q4 Only 91Marks

Q# 1/ iGCSE Chemistry/2018/w/Paper 63/Q4

4 Some cleaning products are mixtures. The three substances present in a cleaning product are listed in the table.

substance	state at room temperature	physical property
sodium carbonate	solid	melts at 858 °C
ethanol	liquid	boils at 78 °C
limonene	liquid	boils at 176 °C

Use the information in the table to plan an experiment to obtain a sample of each substance from a mixture of the three substances.

You are provided with a mixture of the three substances and common laboratory apparatus.

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Q# 2/ iGCSE Chemistry/2018/w/Paper 61/Q4

4 Propanone and ethyl ethanoate are both solvents which can be used to remove paint.

Plan an investigation to determine which of these **two** solvents is better to use to remove paint.

You are provided with glass slides, paint, the two solvents and common laboratory apparatus.

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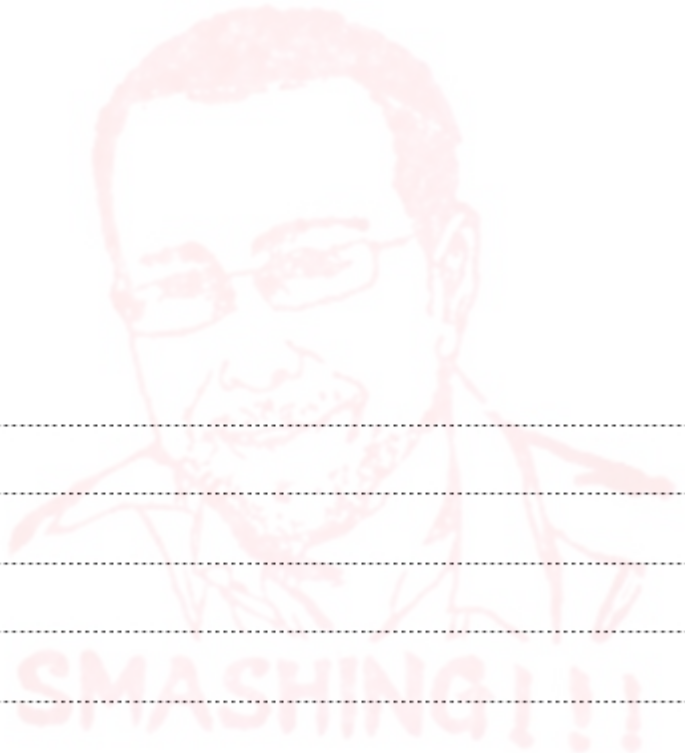
Q# 3/ iGCSE Chemistry/2018/s/Paper 63/Q4

4 Some trees have purple leaves. The purple colour is a mixture of coloured pigments.

Plan an experiment to extract and separate the coloured pigments present in the purple leaves.

You are provided with some purple leaves, sand, ethanol and common laboratory apparatus.
You may draw a diagram to help you answer the question.



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Q# 4/ iGCSE Chemistry/2018/s/Paper 61/Q4

4 Potassium chloride is a salt that dissolves in water.
The solubility of a salt is the mass in grams of the salt that dissolves in 100 cm^3 of water at a particular temperature.

Plan an investigation to determine the solubility of potassium chloride in water at 40 °C.

You are provided with potassium chloride and common laboratory apparatus.

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Q# 5/ iGCSE Chemistry/2017/s/Paper 61/Q4

4 A sample of furniture cleaner contains aqueous sodium chloride, aqueous ammonia and sand.

(b) Plan an investigation to obtain a sample of

(i) pure water from the mixture, ...

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..... [2]

(ii) pure sand from the mixture. .....

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..... [3]

4 A liquid cleaner is a mixture of three substances. These substances are shown in the table.

name of substance	properties of substance
water	liquid, boiling point 100 °C
sodium carbonate	solid, soluble in water
silica	solid, insoluble in water

Plan an experiment to obtain separate pure samples of each substance from the mixture in the liquid cleaner. You are provided with common laboratory apparatus.

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Q# 7/ iGCSE Chemistry/2016/m/Paper 62/Q4

4 The label on a bottle of orange drink stated 'contains no artificial colours'. A scientist thought that the orange colour in the drink was a mixture of two artificial colours:

- Sunset Yellow E110
- Allura Red E129

Plan an investigation to show that the orange colour in the drink did **not** contain these two artificial colours.
You are provided with samples of E110, E129 and the orange colouring from the drink. You are also provided with common laboratory apparatus.
You may draw a diagram to help answer the question.

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Q# 8/ iGCSE Chemistry/2017/w/Paper 63/Q4

4 Washing soda crystals are crystals of hydrated sodium carbonate, $Na_2CO_3.10H_2O$. When exposed to the air, some of the water is lost from the crystals and a new substance is formed. This process occurs faster in hotter climates.

Plan an experiment to determine the percentage of water by mass present in the new substance.

You are provided with common laboratory apparatus.

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Q# 9/ iGCSE Chemistry/2017/s/Paper 62/Q4

4 Calcium carbonate and kaolinite are both white solids found in sedimentary rocks.

Calcium carbonate reacts with dilute hydrochloric acid to form aqueous calcium chloride. Kaolinite does **not** react with dilute acids.

You are provided with a mixture of calcium carbonate and kaolinite and access to dilute hydrochloric acid.

Plan an experiment to determine the percentage by mass of calcium carbonate in the mixture.

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..... [6]

Q# 10/ iGCSE Chemistry/2016/s/Paper 61/Q4

4 Calcium burns in air to form calcium oxide. The reaction is vigorous and some of the calcium oxide can be lost as smoke.
Plan an investigation to determine the maximum mass of oxygen that combines to form calcium oxide when 2 g of calcium granules are burnt in air.
You are provided with common laboratory apparatus and calcium granules.

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Q# 11/ iGCSE Chemistry/2016/w/Paper 62/Q4

4 Metal rings can be coated with a layer of copper using electricity.
Plan an experiment to electroplate a small metal ring with copper.
You are provided with common laboratory apparatus, a copper rod, copper(II) sulfate crystals, water and a small metal ring.
Include a labelled diagram in your answer.

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Q# 12/ iGCSE Chemistry/2018/w/Paper 62/Q4

4 When solid **C** and solid **D** separately react with dilute hydrochloric acid, one reaction is exothermic and one reaction is endothermic.

Plan an investigation to determine:

- which reaction is exothermic and which reaction is endothermic
- which energy change is greater.

You are provided with solid **C** and solid **D**, dilute hydrochloric acid and common laboratory apparatus.

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[Total: 6]

Q# 13/ iGCSE Chemistry/2017/m/Paper 62/Q4

4 When solid barium hydroxide is added to solid ammonium chloride a reaction takes place.

(a) Describe an experiment to show that this reaction is endothermic.

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..... [4]

Q# 14/ iGCSE Chemistry/2019/m/Paper 62/Q4

4 The rate of reaction between magnesium and dilute hydrochloric acid can be followed by measuring the volume of hydrogen produced.

Plan an experiment to investigate the effect of decreasing the temperature on the rate of this reaction by measuring the volume of hydrogen produced.

You are provided with magnesium ribbon, dilute hydrochloric acid and common laboratory apparatus.
You are advised to draw a labelled diagram of the apparatus you would use in the space provided.

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Q# 15/ iGCSE Chemistry/2018/m/Paper 62/Q4

4 Magnesium reacts with dilute sulfuric acid at room temperature to form hydrogen gas.

Plan an experiment to find the rate of reaction between magnesium ribbon and dilute sulfuric acid.

In your answer:

- include a diagram
- indicate how you could use the results obtained to find the rate of reaction.

You are provided with common laboratory apparatus, magnesium ribbon and dilute sulfuric acid.

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Q# 16/ iGCSE Chemistry/2016/s/Paper 63/Q4

4 Nickel sulfate-6-water, $NiSO_4.6H_2O$, is a blue crystalline salt.

Plan an experiment to obtain a sample of pure water from this salt. Your answer should include a diagram of the apparatus, any expected observations and a test to show the presence of pure water.
You are provided with common laboratory apparatus.

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Q# 1/ iGCSE Chemistry/2018/w/Paper 63/Q4

4	marks may be awarded from labelled diagrams **Ignore any process done to single substances.** If candidates make the mixture up for themselves then carry on marking. **Method 1** 1 heat the mixture 2 using a Bunsen / electric heater / oil bath 3 in a suitable container (flask / boiling tube / test-tube) 4 ethanol boils / evaporates first / at 78 °C 5 limonene boils next / at 176 °C (and collects / condenses) 6 use of the term (fractional) distillation 7 use of a condenser 8 sodium carbonate residue left	**max 6**
	Method 2 (assuming sodium carbonate does not dissolve 1 filter (to obtain sodium carbonate) 2 heat the filtrate 3 using a Bunsen / electric heater / oil bath 4 in a suitable container (flask / boiling tube / test-tube) 5 ethanol boils / evaporates first / at 78 °C 6 limonene boils next / at 176 °C (and collects / condenses) / is the residue 7 use of the term (fractional) distillation 8 use of a condenser	**max 6**
	Method 3 (assuming sodium carbonate does not dissolve and liquids do not mix). 1 filter (to obtain sodium carbonate) 2 use of separating funnel 3 run / let one liquid out 4 by opening the tap 5 leave other liquid in separating funnel	**max 5**

Q# 2/ iGCSE Chemistry/2018/w/Paper 61/Q4

4	**Method 1** □ Coat/paint glass slide(or any suitable inert material) □ With same amount / thickness of paint □ (leave to) dry □ Add controlled amount / drops of propanone □ Until paint / coating removed □ Count drops / measure volume □ Repeat with ethyl ethanoate □ Comparison / conclusion	**Max 6**
	Method 2 □ Weigh slides □ Add equal mass of paint to both □ Leave to dry □ Immerse each slide in 2 containers with each of solvents □ Fixed volume of solvent / excess solvent □ For set time interval / time □ Dry and reweigh slides / to dissolve □ Conclusion e.g. solvent causing greater mass loss is better or shortest time to dissolve is better	**Max 6**

Q# 3/ iGCSE Chemistry/2018/s/Paper 63/Q4

3(e)	organic / fuel / flammable	**1**

Question	Answer	Marks
4	any **6** from: □ cut leaves into small pieces □ grind / crush with sand / ethanol □ using pestle/mortar □ decant / pour-off / filter liquid □ chromatography □ apply extract to paper (in correct location) □ description of separating colours	**Max 6**

Q# 4/ iGCSE Chemistry/2018/s/Paper 61/Q4

4	any **6** from one method: evaporation □ measured volume of water □ using measuring cylinder / pipette / burette □ heat to 40 □C / heat to >40 □C □ add KC*l* until no more dissolves / add excess KC*l* □ stir □ filter mixture (if heated to >40 □C then need to cool and filter) □ evaporate filtrate to dryness □ weigh solid mass not used □ measured volume of water □ using measuring cylinder / pipette / burette □ heat to 40 □C □ add KC*l* until no more dissolves □ stir □ weigh KC*l* not added □ weigh KC*l* before adding any to water – only awarded if weighed mass not used after □ difference in mass of KC*l* is mass dissolved mass undissolved □ measured volume of water □ using measuring cylinder / pipette / burette □ heat to 40 □C □ stir □ filter □ weigh residue (do not award if residue washed) □ add weighed (excess) KC*l* to water – only awarded if mass of residue measured □ mass KC*l* dissolved = initial mass – final mass	**max 6**

Q# 5/ iGCSE Chemistry/2017/s/Paper 61/

4(b)	heat / boil the mixture	1
	condense the vapour	1
4(c)	filter / decant	1
	wash residue (with water)	1
	dry	1

Q# 6/ iGCSE Chemistry/2016/w/Paper 63/

4	**silica** filter (the cleaner) wash the residue dry the residue **water** heat (the filtrate / cleaner) condense the vapour **sodium carbonate** heat to dryness / no liquid left (then solid) sodium carbonate is left **OR** heat until saturated then cool to crystallise / leave to crystallise	6

Q# 7/ iGCSE Chemistry/2016/m/Paper 62/

4	any **6** from: chromatography; (pencil) baseline / origin; apply orange colour to paper; and samples of both E110 and E129; solvent / named solvent; check heights of spots of E colours against orange drink; conclusion / allow comparison to known R_f values;	6

Q# 8/ iGCSE Chemistry/2017/w/Paper 63/

4	*heating to dryness method* max [6]: **M1** weigh (any) sample of washing soda **M2** heat (to remove water of crystallisation) **M3** in named container **M4** cool **M5** reweigh **M6** repeat heating **M7** to constant mass **M8** appropriate calculation suggested for the percentage of water *mass of water method* max [6]: **M1** weigh (any) sample of washing soda **M2** heat to remove water of crystallisation **M3** in named container **M4** using apparatus capable of collecting water (vapour) **M5** cool / condense (water vapour) **M6** continue until no more collects **M7** weigh water **M8** appropriate calculation suggested for the percentage of water	6

Q# 9/ iGCSE Chemistry/2017/s/Paper 62/

4		6
	the filtration method any 6 from: • weigh mixture (of calcium carbonate and kaolinite) • add (dilute) hydrochloric acid • in excess / continue adding until there is no more fizzing / add until no more gas is evolved • filter • wash residue / kaolinite • dry • weigh residue / kaolinite • (change in mass / initial mass) × 100 (%)	
	the gas collection / loss of mass method any 6 from: • weigh mixture (of calcium carbonate and kaolinite) • add (dilute) hydrochloric acid • in excess / continue adding until there is no more fizzing / add until no more gas is evolved • collect gas in a syringe / measure final total mass • measure volume of gas / mass loss • calculate moles of $CaCO_3$ / CO_2 • calculate mass of $CaCO_3$ • (mass of $CaCO_3$ / initial mass) × 100 (%)	
	the calcium chloride method any 4 from: • weigh mixture (of calcium carbonate and kaolinite) • add (dilute) hydrochloric acid • in excess / continue adding until there is no more fizzing / add until no more gas is evolved • filter	1

Q# 10/ iGCSE Chemistry/2016/s/Paper 61/

4	any 6 from: weigh calcium; with lid / cover; heat / burn; allow air to enter / lift lid; cool; reweigh CaO; reheat to constant mass; calculate / find the difference;	6

Q# 11/ iGCSE Chemistry/2016/w/Paper 62/

4	clean / sandpaper the metal ring dissolve copper(II) sulfate in water / copper(II) sulfate solution set up circuit / switch on electricity / complete circuit copper rod anode(+ ve electrode) metal ring cathode(– ve electrode) rotate the metal ring / agitate remove the metal ring, wash and dry	6

Q# 12/ iGCSE Chemistry/2018/w/Paper 62/Q4

4	Any 4 from □ Measured volume of dilute hydrochloric acid □ Use of suitable container (e.g. test tube / beaker / flask / plastic cup) □ Initial temperature of acid □ Add known mass of solid C □ Final temperature of mixture / Calculate temperature change □ Repeat with (same mass / moles of) solid D **And** □ Bigger temperature change is bigger energy change □ Temperature increase is exothermic / temperature decrease is endothermic process	**Max 6**

Q# 13/ iGCSE Chemistry/2017/m/Paper 62/

4(a)	any 4 from: **M1** measure initial temperature of (solid) ammonium chloride / barium hydroxide **M2** add barium hydroxide / ammonium chloride / other solid **AND** mix / stir **M3** use a thermometer **M4** measure the temperature of the mixture / final temperature **M5** temperature decreases / test-tube feels cold	**4**

Q# 14/ iGCSE Chemistry/2019/m/Paper 62/Q4

4	6 from: □ Weighed amount / x gram of magnesium □ Add known volume of dilute hydrochloric acid □ gas syringe / measuring cylinder over water □ Use of stop-clock / timer □ Measure volume of hydrogen at fixed time or time for a fixed volume to be made □ Repeat using different temperatures □ Compare results / conclusion	**6**

Q# 15/ iGCSE Chemistry/2018/m/Paper 62/Q4

4			**max 6**
		gas volume	*mass loss*
	M1	Mg added to sulfuric acid	Mg added to sulfuric acid
	M2	in a suitable container with ability to have a bung	in a suitable container
	M3	methods of measuring gas volume (gas syringe, downward displacement of water using a measuring cylinder)	on a balance
	M4	start timer / timing (when added together)	start timer / timing (when added together)
	M5	measure volume of gas	measure mass loss
	M6	at set time / at end of experiment / at (regular) known intervals	at set time / time to end of experiment / at (regular) known intervals
	M7	rate = volume ÷ time	rate = mass loss ÷ time

Q# 16/ iGCSE Chemistry/2016/s/Paper 63/

4	**method** heat the salt; condenser shown on diagram; drops of water / condensation; colour change / blue solid becomes paler; **test pure water** boiling point; 100 °C;	**6**

Your Notes

Questions & Translations *Fill this in AFTER lesson*	**Date:**

Summary Section- *Do this a week later* and write, in your own words, only one or two sentences that sums up the important points on this page

For a whole variety of different formats and types of paper: https://incompetech.com/graphpaper/cornelllined/

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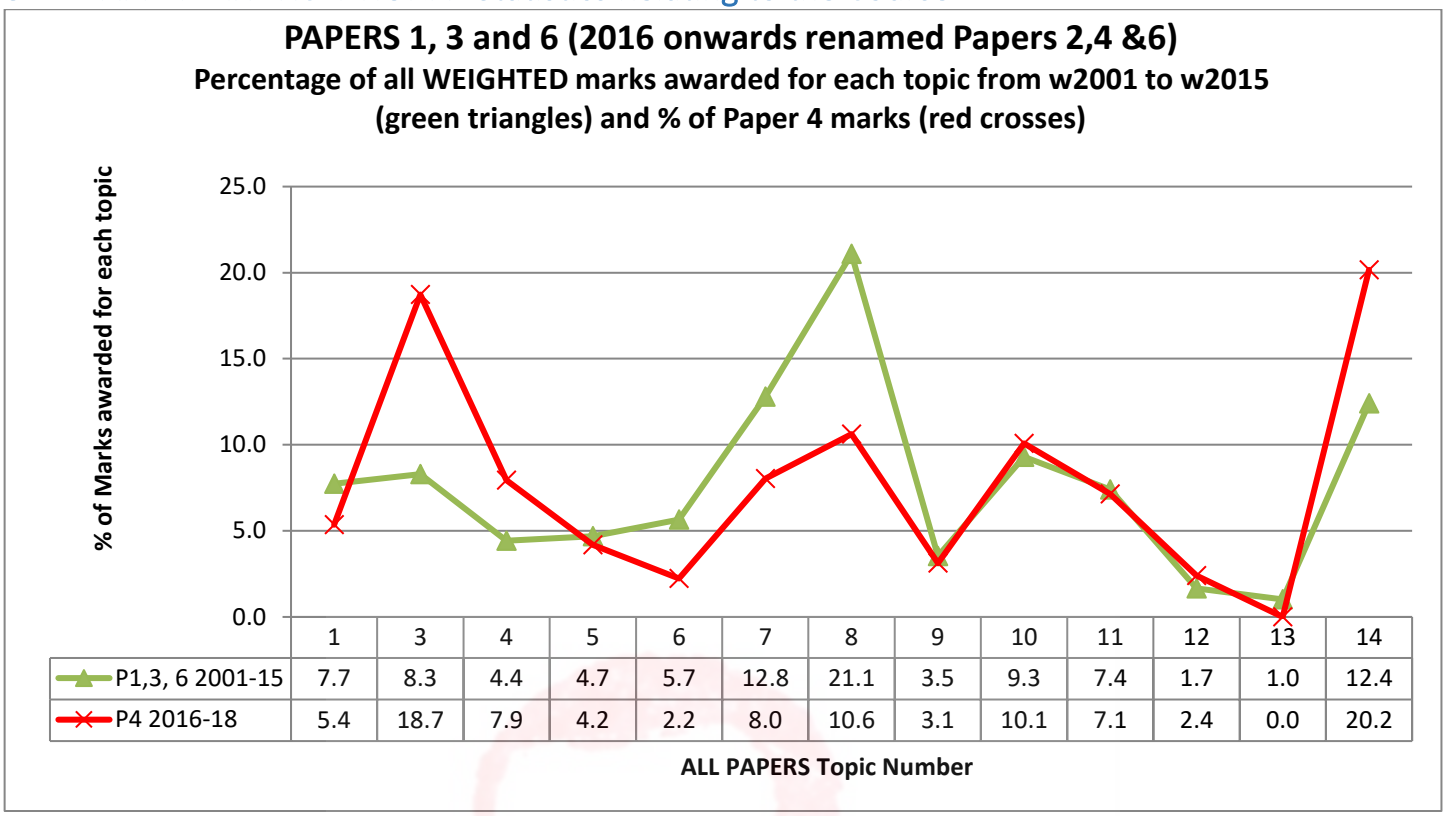
2 Fundamental Command Terms used inExams taken from CAIE iGCSE Chemistry

Command word	Meaning
Define	(the term(s) …) is intended literally, only a formal statement or the same idea in slightly different language is acceptable. Often these questions lose marks over time, so the same answer is expected, but will carry fewer marks making it more difficult to get full marks.
What do you understand by/ What is meant by	(the term(s) …) normally suggests that a definition should be given, together with some relevant comment on the significance or context of the term(s) concerned, especially where two or more terms are included in the question. The amount of supplementary comment intended should be interpreted in the light of the indicated mark value.
State	implies a short and complete answer with little or no supporting information (e.g. a numerical answer that can readily be obtained 'by looking at it').
List	requires a number of points, generally each of one word, with no further information. Where a given number of points is specified only that number of points should be given, so don't give more answers than is required or they may not be counted, or they may, if they are incorrect, be used to deduct marks from your total.
Explain	may require reasoning or some reference to theory, depending on the context. It is another way of asking candidates to give reasons. The candidate needs to leave the examiner in no doubt why something happens. **These questions will usually include the hardest mark, which is normally the 2nd or 3rd mark that will differentiate between A and A* students.**
Give a reason/Give reasons	is another way of asking candidates to explain why something happens.
Describe	requires the candidate to state in words (using diagrams where appropriate) the main points. *Describe* and *explain* may be given in the same command, as may *state* and *explain*. Usually much easier than the Explain aspect of the question.
Discuss	requires the candidate to give the essential information of the points involved.
Outline	implies brevity, so a short response (i.e. limiting the answer to giving just the essentials).
Predict	implies that the candidate is expected to make a prediction not by remembering a fact (recall) but by making a logical connection between other pieces of information. For instance, predict the properties of a compound with unfamiliar elements, based on understanding lighter elements in the same group in the periodic table.
Deduce	implies that the candidate is not expected to produce the required answer by recall but by making a logical connection between other pieces of information. Normally in chemistry this involves being shown a compound that contains unfamiliar elements, but which belong to a group of familiar elements, e.g. Deduce the formula of hydrogen selenide. Answer: Selenium is in the same group as oxygen, and hydrogen oxide is H_2O, so H_2Se is the expected response.
Suggest	is used in two main contexts, i.e. either to imply that there is no unique answer (e.g. in chemistry, two or more substances may satisfy the given conditions describing an 'unknown'), or to imply that candidates are expected to apply their general knowledge of the subject to a 'novel' situation, one that may be formally 'not in the syllabus' – many data response (for instance where information is given in a table about different substances) and problem solving questions are of this type.
Find	is a general term that may interpreted as *calculate, measure, determine*, etc.
Calculate	is used when a numerical answer is required. In general, working should be shown and clearly labelled especially where more than one step is involved.
Measure	implies that the quantity concerned can be directly obtained from a suitable measuring instrument (e.g. length using a rule, or mass using a balance).
Determine	often implies that the quantity concerned cannot be measured directly but can be worked out from a graph or by calculation.
Estimate	suggests that a statement that is only very roughly close to the real value (within a factor of 10) or calculation of the quantity concerned. Normally assumptions will need to be made based on points of principle and values of amounts not given in the question.
Sketch	when applied to graph work, implies that the shape and/or position of the curve need only be roughly (or qualitatively) correct, but candidates should be aware that, depending on the context, some quantitative aspects may be looked for (e.g. passing through the origin, having an intercept). In diagrams, *sketch* implies that simple, freehand drawing is acceptable; nevertheless, care should be taken over proportions and the clear labelling of important details or equipment.

3 APPENDIX EXCEPTIONAL Statistics Relating to the Course



	1	3	4	5	6	7	8	9	10	11	12	13	14
P1,3, 6 2001-15	7.7	8.3	4.4	4.7	5.7	12.8	21.1	3.5	9.3	7.4	1.7	1.0	12.4
P4 2016-18	5.4	18.7	7.9	4.2	2.2	8.0	10.6	3.1	10.1	7.1	2.4	0.0	20.2

	Paper 2	Paper 4	Paper 6	Totals	Average
Relative value %	30	50	20	100	
Number of marks	40	80	40	160	
Value of each mark/% of iGCSE	0.75	0.63	0.50		0.63
Time/min	45	75	60	180	60
Time per mark/sec	68	56	60		61
Portion of syllabus examined	C & S	C & S	Core		
	C = Core	S = Supplement			

4 Topics in Rank Order

Topic	14	3	10	7	8	11	4	5	9	1	12	6	13
Rank ALL Papers	2	4	5	3	1	6	9	8	11	7	12	10	13
Rank P3: A* Focus	1	2	3	4	5	6	7	8	9	10	10	12	13
All Syllabus Word Count RANK	1	2	5	3	6	4	9	7	10	8	12	11	13

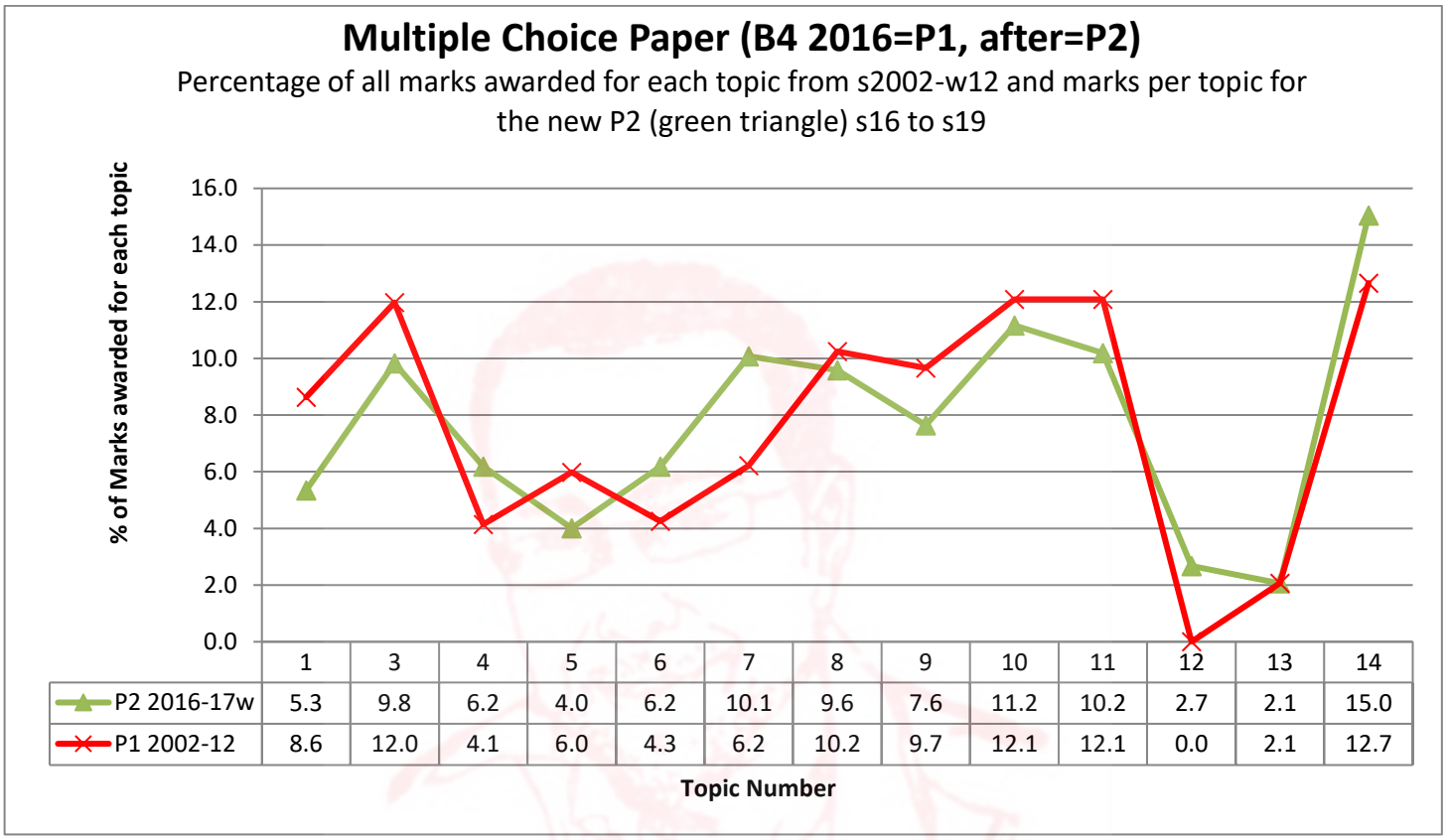
Greener = Better; "Words per %..." refers to the words in the syllabus versus weighted marks awarded since w2001

5 Key Points about these graphs and data

- **To do well, you must learn T8 (40 and 10.5% of P6 & P3) but to get an A* T14 is essential (20.2% of P3).**
- Paper 3 (after 2016renamed Paper 4) is easily the most important paper, it has gotten more challenging over the last 5 years with the same questions being asked, but with less help with the answer that is required (so more 5 or 6 marks questions), also the same questions are being asked but have fewer marks attached meaning that you not only need to know the answer, but you need to better understand the priority (e.g. many sources of sulfur, but the main source, from petroleum, is the only acceptable answer).
- ***However, these changes only make it harder for the less well prepared student, if you have not only answered these questions before, and checked your answers, but also looked at how some questions change with time.***

(ANALYSIED the trends) then it is in fact easier than ever before. There are fewer new questions than ever before!

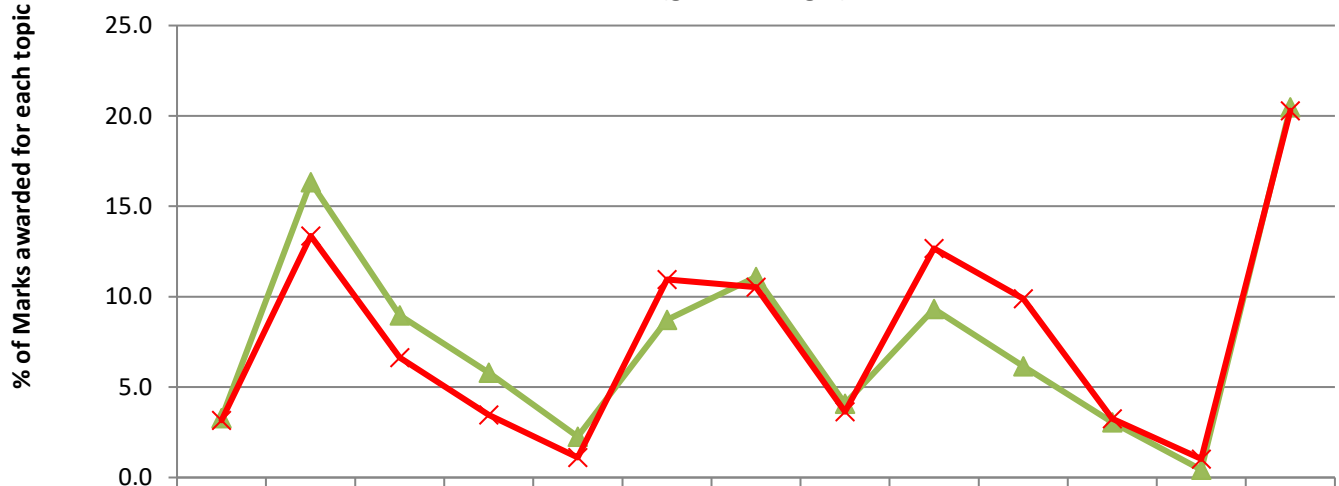
- These are just averages, so for instance T13 is not often examined, so appears less relevant, but when it is in a paper (P3) it will be on average 5 marks, and because it is all supplement material, these will be a lot of the higher marks. This data should hopefully allow you to prioritise topics in your revision.
- T4 is the most efficient topic to learn (least to learn per mark awarded), provided you are good at maths (predicted to get at least a B grade), otherwise it is by far the least worthwhile topic (which these numbers don't show but has been my experience in teaching) if you struggle with maths. You can still get an A* withoutthis topic, but you'll not be able to drop many marks in any other topic.
- If there was a fire and you had to leave one topic behind, T5 would be the one taking a hit for the team.
- Most important topics to your grades are 14, 8, 3, 10, 7 and 11, in that order.



	1	3	4	5	6	7	8	9	10	11	12	13	14
P2 2016-17w	5.3	9.8	6.2	4.0	6.2	10.1	9.6	7.6	11.2	10.2	2.7	2.1	15.0
P1 2002-12	8.6	12.0	4.1	6.0	4.3	6.2	10.2	9.7	12.1	12.1	0.0	2.1	12.7

0620 PAPER 4 (pre2016 called Paper 3)

Percentage of all marks awarded for each topic from s2013 to w2015 (red cross) and for 2016m to 2018w (green triangle)

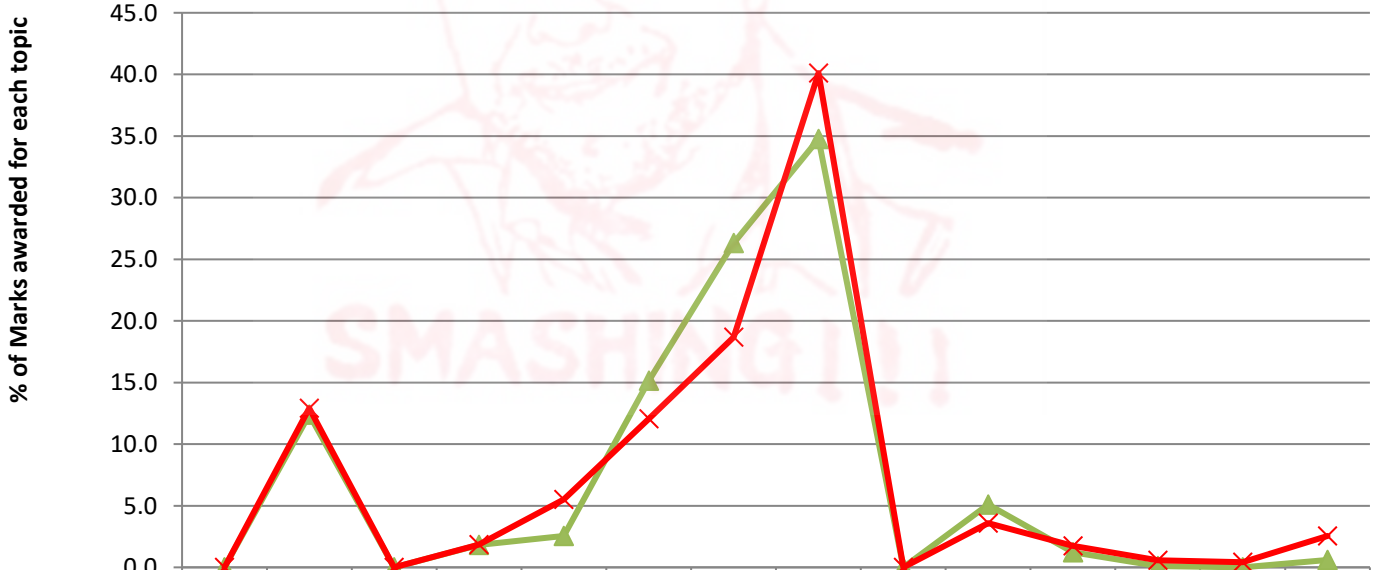


	1	3	4	5	6	7	8	9	10	11	12	13	14
P4 2016m-18w	3.3	16.3	9.0	5.8	2.3	8.7	11.1	4.1	9.3	6.2	3.0	0.4	20.5
P3 2001-15	3.2	13.4	6.6	3.5	1.1	11.0	10.5	3.6	12.7	9.9	3.3	1.0	20.3

Topic Number

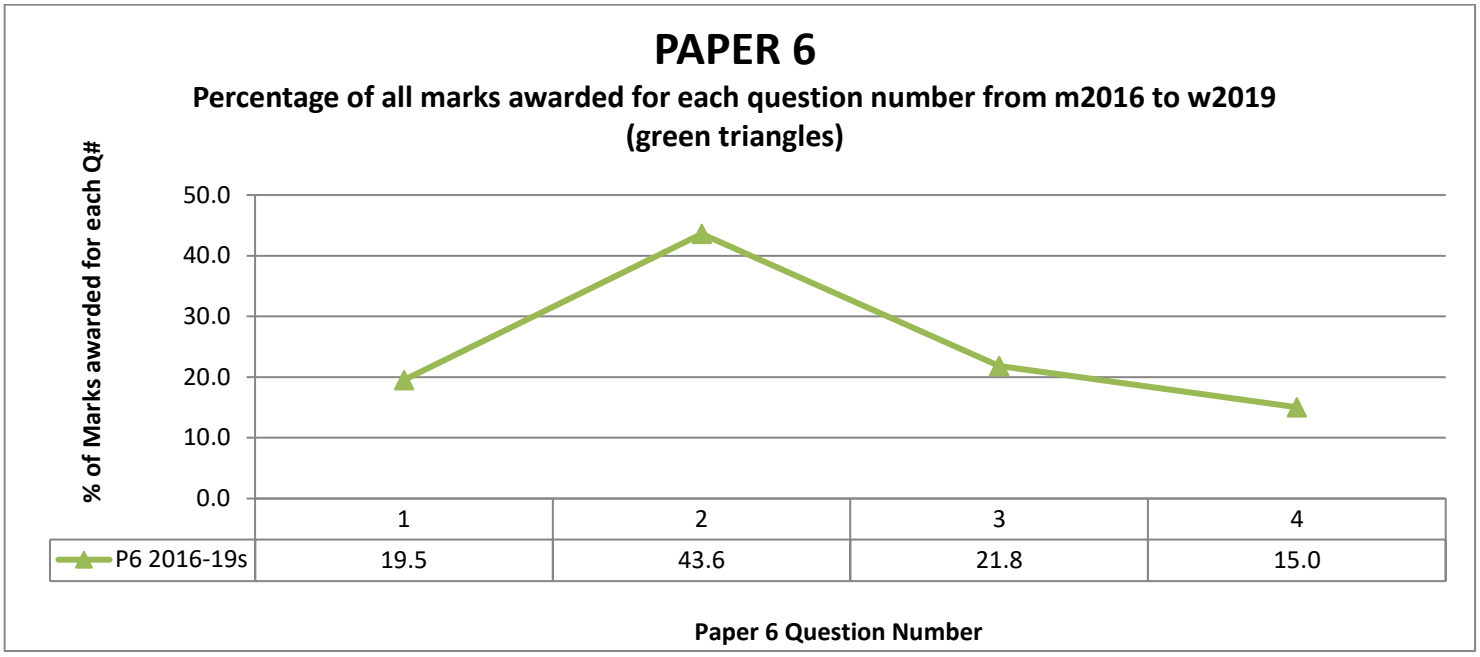
PAPER 6

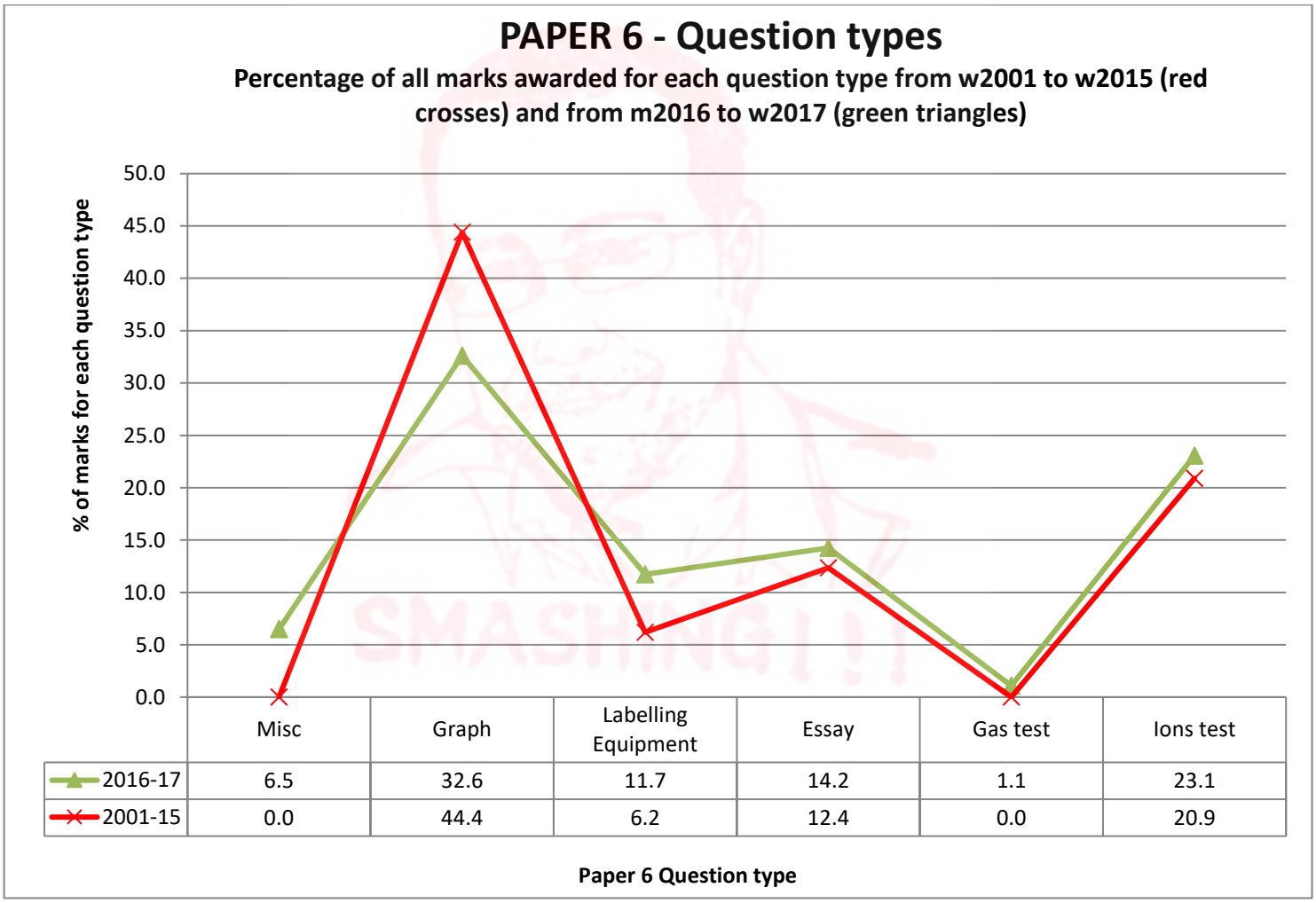
Percentage of all marks awarded for each topic from w2001 to w2015 (red crosses) and from m2016 to s2019 (green triangles)



	1	2	3	4	5	6	7	8	9	10	11	12	13	14
P6 2016-19s	0.0	12.4	0.0	1.8	2.5	15.1	26.3	34.8	0.0	5.1	1.2	0.1	0.0	0.6
P6 2001-15	0.0	12.9	0.0	1.9	5.5	12.1	18.7	40.1	0.0	3.6	1.7	0.6	0.4	2.5

Paper 6 Topic Number





Above are the main experiments and the main question types in Paper 6. Word files broken down by these categories are available on my website

		Topic													Averages
		1	3	4	5	6	7	8	9	10	11	12	13	14	
P1	% of Marks	8.6	12.0	4.1	6.0	4.3	6.2	10.2	9.7	12.1	12.1	0.0	2.1	12.7	7.7
P1	# of Questions	27.0	44.0	25.0	28.0	27.0	32.0	45.0	36.0	41.0	39.0	0.0	16.0	39.0	30.7
P1	Average marks per Q	2.8	2.4	1.4	1.9	1.4	1.7	2.0	2.3	2.6	2.7	0.0	1.1	2.8	1.9
P3	% of Marks	3.3	13.2	6.6	5.6	1.1	10.8	10.5	3.6	11.2	9.6	3.3	1.0	20.2	7.7
P3	# of Questions	20.0	58.0	39.0	25.0	6.0	46.0	53.0	19.0	54.0	46.0	14.0	5.0	79.0	35.7
P3	Average marks per Q	3.8	5.3	4.0	5.2	4.3	5.5	4.6	4.5	4.8	4.9	5.4	4.8	6.0	4.9
P6	% of Marks	12.9	0.0	1.9	5.5	12.1	18.7	40.1	0.0	3.6	1.7	0.6	0.4	2.5	7.7
P6	# of Questions	40.0	0.0	4.0	17.0	17.0	32.0	93.0	0.0	7.0	6.0	2.0	2.0	10.0	17.7
P6	Average marks per Q	6.1	0.0	8.8	6.1	13.4	11.0	8.2	0.0	9.7	5.5	5.5	4.0	4.8	6.4
ALL	% of Marks (Weighted)	6.8	9.9	4.9	5.7	4.4	11.5	17.2	4.2	9.6	8.4	1.9	1.1	14.4	7.7
ALL	# of Questions	87.0	102.0	68.0	70.0	50.0	110.0	191.0	55.0	102.0	91.0	16.0	23.0	128.0	84.1
ALL	Average marks per Q	2.1	2.7	2.0	2.2	2.4	2.9	2.5	2.1	2.6	2.5	3.2	1.4	3.1	2.4
Rank Order		7	4	9	8	10	3	1	11	5	6	12	13	2	

Comments

Yellow indicates the paper range for P1 is not the same as for the other papers, this is because P1 is changing, and taking apart that paper is particularly soul destroying, I can't justify the hours of mind-numbing tedium if the information is going to be increasingly irrelevant.

Blue indicates the substantial difference in the total number of marks I should be able to account for (Total Marks All Papers) and the ones that have gone into the topic calculations. This is hopefully the result of a RANDOM error where some questions have had parts duplicated and I have not filtered these duplications out. Realistically, though it isn't. When I started to break this paper down by topic I was not systematic in my process; my intentions were disorganised and I wasn't thinking about being able to account for every mark, just for every question. So some topics were duplicated

7 Words per topic statistics from the syllabus

Topic	1	3	4	5	6	7	8	9	10	11	12	13	14	Totals	
Core Syllabus Word Count	218	344	131	130	58	183	273	209	241	287	44	56	363	2537	
Suppliment Syllabus Word Count	82	141	122	191	73	245	68	41	134	124	29	2	352	1604	
All Syllbus Word Count	300	485	253	321	131	428	341	250	375	411	73	58	715	4141	
Core Syllabus Word Count %	5.3	8.3	3.2	3.1	1.4	4.4	6.6	5.0	5.8	6.9	1.1	1.4	8.8		
Suppliment Syllabus Word Count %	2.0	3.4	2.9	4.6	1.8	5.9	1.6	1.0	3.2	3.0	0.7	0.0	8.5		
All Syllbus Word Count %	7.2	11.7	6.1	7.8	3.2	10.3	8.2	6.0	9.1	9.9	1.8	1.4	17.3		
All Syllabus Word Count RANK	8	2	9	7	11	3	6	10	5	4	12	13	1		
% Total ALL Papers	6.8	9.9	4.9	5.7	4.4	11.5	17.2	4.2	9.6	8.4	1.9	1.1	14.4		
% Total P3: A* Focus	3.3	13.2	6.6	5.6	1.1	10.8	10.5	3.6	11.2	9.6	3.3	1.0	20.2		
Words per % ALL Papers	44	49	51	57	30	37	20	59	39	49	39	51	49.8		
Words per % P3	25	11	18	34	66	23	6.5	11	12	13	9	2	17.4		

Although this is only one course so there is very little data at present to go on, a possible generalisation which might be of value when studying for other CIE subjects is that the more words there are in the syllabus, the more important that topic is to the exam. So to get an idea, count the words (can be done electronically: 1. Mark for redaction all of the section of the syllabus for supplement 2. Redact 3. Copy and past all of it to word 4. Do the same for supplement 5. Highlight the topic and word will give you the number of words). The actual results of this will not probably be too surprising, but outcome of this exercise and why it will help is it will force you to think objectively about the syllabus. Instead of thinking about the things that you didn't like or you didn't think you were good at, you will have the opportunity to get a different perspective on the subject. And hopefully, instead of thinking of the subject as a whole, you will start to break it down into more manageable chunks and begin the process of prioritisation, which when done well, is perhaps the most important principle in thought.

[Looking back on this project to count the words in the syllabus, which I did about 5 years ago, I cannot say it produced anything really interesting or useful. But it was super boring to do! Would not recommend doing it]

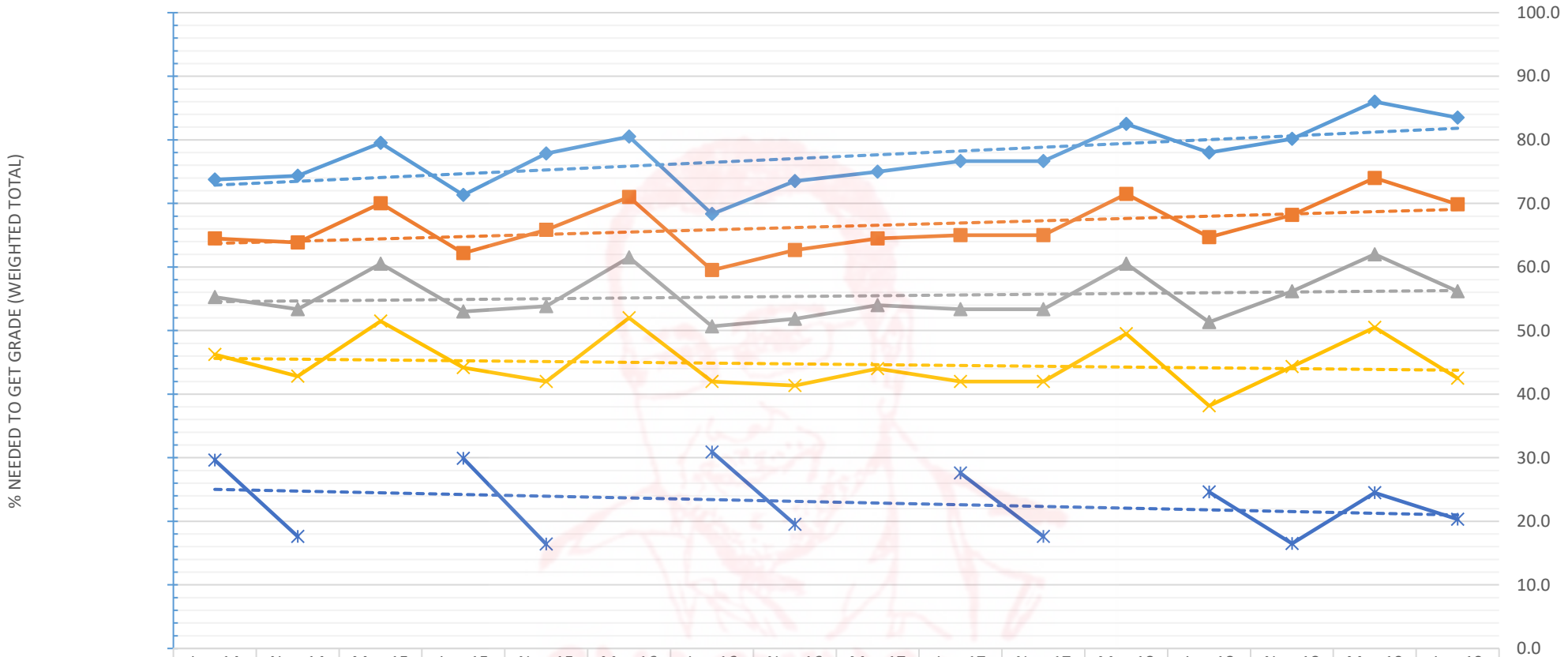
8 Papers Used to create the revision resources I use

Red is still to do					For paper 1, at 2011s none are identical but all have the same questions										Method for checking: Open all 3 timezone papers, display dise by side, compare first question, last page and scan through all, two or three pages at a time, and look for keywords and the same diagram, as well as how each question starts.											
Green is Done					Blue is not checked					Gray is when TZ2 and 3 are identical																
Session	m	m	m		s	s	s	s	s	s	s	s	s	s	w	w	w	w	w	w	w	w	w	w	
Paper	1	3	6		1	1	1	3	3	3	6	6	6		1	1	1	3	3	3	3	6	6	6	
Timezone	2	2	2		1	2	3	1	2	3	1	2	3		1	2	3	1	2	3	1	2	3		
Year																									
1997																									
1998																									
1999																									
2000																									
2001				1				2001s P3.1										2001w P3.1				2001w P6.1			
2002				2	2002s P1.1			2002s P3.1			2002s P6.1				2002w P1.1			2002w P3.1				2002w P6.1			
2003				3	2003s P1.1			2003s P3.1			2003s P6.1				2003w P1.1			2003w P3.1				2003w P6.1			
2004				4	2004s P1.1			2004s P3.1			2004s P6.1				2004w P1.1			2004w P3.1				2004w P6.1			
2005				5	2005s P1.1			2005s P3.1			2005s P6.1				2005w P1.1			2005w P3.1				2005w P6.1			
2006				6	2006s P1.1			2006s P3.1			2006s P6.1				2006w P1.1			2006w P3.1				2006w P6.1			
2007				7	2007s P1.1			2007s P3.1			2007s P6.1				2007w P1.1			2007w P3.1				2007w P6.1			
2008				8	2008s P1.1			2008s P3.1			2008s P6.1				2008w P1.1			2008w P3.1				2008w P6.1			
2009				9	2009s P1.1			2009s P3.1			2009s P6.1				2009w P1.1			2009w P3.1				2009w P6.1			
2010				10	2010s P1.1	2010s P1.2	2010s P1.3	2010s P3.1	2010s P3.2	2010s P3.3	2010s P6.1	2010s P6.2	2010s P6.3		2010w P1.1	2010w P1.2	2010w P1.3	2010w P3.1	2010w P3.2	2010w P3.3	2010w P6.1	2010w P6.2	2010w P6.3		
2011				11	2011s P1.1	2011s P1.2	2011s P1.3	2011s P3.1	2011s P3.2	2011s P3.3	2011s P6.1	2011s P6.2	2011s P6.3		2011w P1.1	2011w P1.2	2011w P1.3	2011w P3.1	2011w P3.2	2011w P3.3	2011w P6.1	2011w P6.2	2011w P6.3		
2012				12	2012s P1.1	2012s P1.2	2012s P1.3	2012s P3.1	2012s P3.2	2012s P3.3	2012s P6.1	2012s P6.2	2012s P6.3		2012w P1.1	2012w P1.2	2012w P1.3	2012w P3.1	2012w P3.2	2012w P3.3	2012w P6.1	2012w P6.2	2012w P6.3		
				13																					
2013				14	2013s P1.1	2013s P1.2	2013s P1.3	2013s P3.1	2013s P3.2	2013s P3.3	2013s P6.1	2013s P6.2	2013s P6.3		2013w P1.1	2013w P1.2	2013w P1.3	2013w P3.1	2013w P3.2	2013w P3.3	2013w P6.1	2013w P6.2	2013w P6.3		
2014				15	2014s P1.1	2014s P1.2	2014s P1.3	2014s P3.1	2014s P3.2	2014s P3.3	2014s P6.1	2014s P6.2	2014s P6.3		2014w P1.1	2014w P1.2	2014w P1.3	2014w P3.1	2014w P3.2	2014w P3.3	2014w P6.1	2014w P6.2	2014w P6.3		
2015	2015m P1.2	2015m P3.2	2015m P6.2	16	2015s P1.1	2015s P1.2	2015s P1.3	2015s P3.1	2015s P3.2	2015s P3.3	2015s P6.1	2015s P6.2	2015s P6.3		2015w P1.1	2015w P1.2	2015w P1.3	2015w P3.1	2015w P3.2	2015w P3.3	2015w P6.1	2015w P6.2	2015w P6.3		
New Syllabus	*Paper 1 was replaced with paper Paper 2 (including Supplement material in the syllabus, so harder). Paper 3 was renamed Paper 4, not other structurual changes. Paper 6 went from 60marks to 40marks, no other structural changes*																								
	m	m	m		s	s	s	s	s	s	s	s	s		w	w	w	w	w	w	w	w	w		
	1	3	6		2	2	2	4	4	4	6	6	6		2	2	2	4	4	4	6	6	6		
	2	2	2		1	2	3	1	2	3	1	2	3		1	2	3	1	2	3	1	2	3		
2016	2016m P1.2	2016m P3.2	2016m P6.2	17	2016s P2.1	2016s P2.2	2016s P2.3	2016s P4.1	2016s P4.2	2016s P4.3	2016s P6.1	2016s P6.2	2016s P6.3		2016w P2.1	2016w P2.2	2016w P2.3	2016w P4.1	2016w P4.2	2016w P4.3	2016w P6.1	2016w P6.2	2016w P6.3		
2017	2017m P1.2	2017m P3.2	2017m P6.2	18	2017s P2.1	2017s P2.2	2017s P2.3	2017s P4.1	2017s P4.2	2017s P4.3	2017s P6.1	2017s P6.2	2017s P6.3		2017w P2.1	2017w P2.2	2017w P2.3	2017w P4.1	2017w P4.2	2017w P4.3	2017w P6.1	2017w P6.2	2017w P6.3		
2018	2018m P1.2	2018m P3.2	2018m P6.2	19	2018s P2.1	2018s P2.2	2018s P2.3	2018s P4.1	2018s P4.2	2018s P4.3	2018s P6.1	2018s P6.2	2018s P6.3		2018w P2.1	2018w P2.2	2018w P2.3	2018w P4.1	2018w P4.2	2018w P4.3	2018w P6.1	2018w P6.2	2018w P6.3		
2019	2019m P1.2	2019m P3.2	2019m P6.2	20	2019s P2.1	2019s P2.2	2019s P2.3	2019s P4.1	2019s P4.2	2019s P4.3	2019s P6.1	2019s P6.2	2019s P6.3		2019w P2.1	2019w P2.2	2019w P2.3	2019w P4.1	2019w P4.2	2019w P4.3	2019w P6.1	2019w P6.2	2019w P6.3		
2020																									
2021																									
2022																									
2023																									
Total papers	5	5	5		19	4	4	20	9	7	19	8	8		19	4	4	20	9	9	20	9	9	216	
Papers done	4	4	4		18	3	3	19	5	5	3	3	3		18	3	3	19	5	5	3	3	3	136	167
P done OldP6											15	0	0								16	0	0	31	
Mark per Paper	40	80	40		40	40	40	80	80	80	40	40	40		40	40	40	80	80	80	40	40	40	1120	
MarksPerP Old P6			60								60	60	60								60	60	60	360	1260
Total marks	200	400	200		760	160	160	1600	720	560	760	320	320		760	160	160	1600	720	720	800	360	360	11800	
Total marks I have	160	320	160		720	120	120	1520	400	400	120	120	120		720	120	120	1520	400	400	120	120	120	7920	
															Proportion of marks represented in my revision resources						67	%		

This is an example of an Open Source resource, indicating exactly which exam papers I have used. Students are unlikely to learn anything about chemistry from it, but hopefully it is an introduction to the Open Source community (to find out more look here: https://opensource.org/history) It could be of use for teachers and also, if printed in colour or seen through the electronic version of this book, looks super sciency, very colourful and splendidly pretty

EXTENSION How grade thresholds have changed across the years

GRADE THRESHOLDS FOR EXTENDED CHEMISTRY 0620 FROM JUN2019 TO JUN2014 A*-C WITH THE PROPORTION OF STUDENTS AWARDED AN A*



	Jun-14	Nov-14	Mar-15	Jun-15	Nov-15	Mar-16	Jun-16	Nov-16	Mar-17	Jun-17	Nov-17	Mar-18	Jun-18	Nov-18	Mar-19	Jun-19
A*	73.8	74.3	79.5	71.3	77.8	80.5	68.3	73.5	75.0	76.7	76.7	82.5	78.0	80.2	86.0	83.5
A	64.5	63.8	70.0	62.2	65.8	71.0	59.5	62.7	64.5	65.0	65.0	71.5	64.7	68.2	74.0	69.8
B	55.3	53.3	60.5	53.0	53.8	61.5	50.7	51.8	54.0	53.3	53.3	60.5	51.3	56.2	62.0	56.2
C	46.3	42.8	51.5	44.2	42.0	52.0	42.0	41.3	44.0	42.0	42.0	49.5	38.2	44.3	50.5	42.5
% Stds w/ A*	29.6	17.6		29.9	16.4		30.9	19.5		27.6	17.6		24.6	16.5	24.5	20.3

Reflection

What do you think this graph shows? How can you use this information to make sure you achieve the A*?

iGCSE Chemistry New Syllabus Mapped to a Textbook

And the older syllabus numbering, which is still used by Smashing Science in 2025.

CAIE Topic ID OLD	CAIE Topic ID NEW	Textbook Chapter	PhysC OrgC?	OLD Topic name	New Topic Name	Your Notes
1	**1**			The particulate nature of matter	States of matter	
1.1	**1.1**	1	OrgC	The particulate nature of matter	Solids, liquids and gases	
1.1	**1.2**				Diffusion	
3	**2**			Atoms, elements and compounds	Atoms, elements and compounds	
	2.1				Elements, compounds and mixtures	
3.1	**2.2**	3	OrgC	Atomic structure and the Periodic Table	Atomic structure and the Periodic Table	
	2.3				Isotopes	
3.2	**x**			Structure and bonding		
3.2.1	**x**	4	OrgC	Bonding: the structure of matter		
3.2.2	**2.4**	4	OrgC	Ions and ionic bonds	Ions and ionic bonds	
3.2.3	**2.5**	4	OrgC	Molecules and covalent bonds	Simple molecules and covalent bonds	
3.2.4	**2.6**	4	OrgC	Macromolecules	Giant covalent structures	
3.2.5	**2.7**	4	OrgC	Metallic bonding	Metallic bonding	
4	**3**			Stoichiometry	Stoichiometry	
4.1	**3.1**	5	PhysC	Stoichiometry	Formulae	
	3.2				Relative masses of atoms and molecules	
4.2	**3.3**	6	OrgC	The mole concept	The mole and the Avogadro constant	
5	**4**			Electricity and chemistry	Electrochemistry	
5.1	**4.1**	8	PhysC	Electricity and chemistry	Electrolysis	
	4.2				Hydrogen–oxygen fuel cells	
6	**5**			Chemical energetics	Chemical energetics	
6.1	**5.1**	9	PhysC	Energetics of a reaction	Exothermic and endothermic reactions	
6.2	**5.1**	9	PhysC	Energy transfer		
7	**6**			Chemical reactions	Chemical reactions	
7.1	**6.1**	4	OrgC	Physical and chemical changes	Physical and chemical changes	
7.2	**6.2**	10	PhysC	Rate (speed) of reaction	Rate of reaction	
7.3	**6.3**	9	PhysC	Reversible reactions	Reversible reactions and equilibrium	
12	**6.3**			Sulfur		
12.1	**6.3**	16	PhysC	Sulfur		
7.4	**6.4**	7	PhysC	Redox	Redox	
8	**7**			Acids, bases and salts	Acids, bases and salts	
8.1	**7.1**	11	PhysC	The characteristic properties of acids and bases	The characteristic properties of acids and bases	
8.2	**7.2**	11	PhysC	Types of oxides	Oxides	
8.3	**7.3**	11	PhysC	Preparation of salts	Preparation of salts	

CAIE Topic ID OLD	CAIE Topic ID NEW	Textbook Chapter	PhysC OrgC?	OLD Topic name	New Topic Name	Your Notes
9	**8**			The Periodic Table	The Periodic Table	
9.1	**8.1**	12	OrgC	The Periodic Table	Arrangement of elements	
9.2	**8.1**	12	OrgC	Periodic trends		
9.3	**8.2**	12	OrgC	Group properties	Group I properties	
	8.3	12			Group VII properties	
9.4	**8.4**	12	OrgC	Transition elements	Transition elements	
9.5	**8.5**	12	OrgC	Noble gases	Noble gases	
10	**9**			Metals	Metals	
10.1	**9.1**	13	PhysC	Properties of metals	Properties of metals	
10.4	**9.2**	14	PhysC	Uses of metals	Uses of metals	
	9.3	13			Alloys and their properties	
10.2	**9.4**	13	PhysC	Reactivity series		
11.2	**9.5**				Corrosion of metals	
10.3	**9.6**	14	PhysC	Extraction of metals		
11	**10**			Air and water	Chemistry of the environment	
11.1	**10.1**	15	OrgC	Water	Water	
11.2	**10.3**	15	OrgC	Air	Air quality and climate	
11.3	**10.2**	16	OrgC	Nitrogen and fertilisers	Fertilisers	
11.4	**10.3**	16	OrgC	Carbon dioxide and methane		
14	**11**			Organic chemistry	Organic chemistry	
	11.1		OrgC		Formulae, functional groups and terminology	
14.1	**11.2**	17	OrgC	Names of compounds	Naming organic compounds	
14.2	**11.3**	17	OrgC	Fuels	Fuels	
14.3	**11.1**	17	OrgC	Homologous series		
14.4	**11.4**	17	OrgC	Alkanes	Alkanes	
14.5	**11.5**	17	OrgC	Alkenes	Alkenes	
14.6	**11.6**	17	OrgC	Alcohols	Alcohols	
14.7	**11.7**	17	OrgC	Carboxylic acids	Carboxylic acids	
14.8	**11.8**	18	OrgC	Polymers	Polymers	
2	**12**			Experimental techniques	Experimental techniques and chemical analysis	
2.1	**12.1**	19	PhysC	Measurement	Experimental design	
	12.2	11	PhysC		Acid–base titrations	
	12.3	2	PhysC		Chromatography	
2.2.1	**x**	2	PhysC	Criteria of purity		
2.2.2	**12.4**	2	PhysC	Methods of purification	Separation and purification	
8.4	**12.5**	19	PhysC	Identification of ions and gases	Identification of ions and gases	
2.2	**x**	2	PhysC	Purity	REMOVED as a Topic	
13	**x**			Carbonates	REMOVED as a Topic	
13.1	**x**	16	OrgC	Carbonates	REMOVED as a Topic [Mostly incorporated into Topic 10.3, 9.6; soil part removed]	

DATA SHEET
The Periodic Table of the Elements

Group I	Group II						Group III	Group IV	Group V	Group VI	Group VII	Group 0
					1 H Hydrogen 1							4 He Helium 2
7 Li Lithium 3	9 Be Beryllium 4						11 B Boron 5	12 C Carbon 6	14 N Nitrogen 7	16 O Oxygen 8	19 F Fluorine 9	20 Ne Neon 10
23 Na Sodium 11	24 Mg Magnesium 12						27 Al Aluminium 13	28 Si Silicon 14	31 P Phosphorus 15	32 S Sulfur 16	35.5 Cl Chlorine 17	40 Ar Argon 18
39 K Potassium 19	40 Ca Calcium 20	45 Sc Scandium 21	48 Ti Titanium 22	51 V Vanadium 23	52 Cr Chromium 24	55 Mn Manganese 25	56 Fe Iron 26	59 Co Cobalt 27	59 Ni Nickel 28	64 Cu Copper 29	65 Zn Zinc 30	70 Ga Gallium 31	73 Ge Germanium 32	75 As Arsenic 33	79 Se Selenium 34	80 Br Bromine 35	84 Kr Krypton 36
85 Rb Rubidium 37	88 Sr Strontium 38	89 Y Yttrium 39	91 Zr Zirconium 40	93 Nb Niobium 41	96 Mo Molybdenum 42	98 Tc Technetium 43	101 Ru Ruthenium 44	103 Rh Rhodium 45	106 Pd Palladium 46	108 Ag Silver 47	112 Cd Cadmium 48	115 In Indium 49	119 Sn Tin 50	122 Sb Antimony 51	128 Te Tellurium 52	127 I Iodine 53	131 Xe Xenon 54
133 Cs Caesium 55	137 Ba Barium 56	139 La Lanthanum 57 *	178 Hf Hafnium 72	181 Ta Tantalum 73	184 W Tungsten 74	186 Re Rhenium 75	190 Os Osmium 76	192 Ir Iridium 77	195 Pt Platinum 78	197 Au Gold 79	201 Hg Mercury 80	204 Tl Thallium 81	207 Pb Lead 82	209 Bi Bismuth 83	Po Polonium 84	At Astatine 85	Rn Radon 86
Fr Francium 87	226 Ra Radium 88	227 Ac Actinium 89 †															

140 Ce Cerium 58	141 Pr Praseodymium 59	144 Nd Neodymium 60	Pm Promethium 61	150 Sm Samarium 62	152 Eu Europium 63	157 Gd Gadolinium 64	159 Tb Terbium 65	162 Dy Dysprosium 66	165 Ho Holmium 67	167 Er Erbium 68	169 Tm Thulium 69	173 Yb Ytterbium 70	175 Lu Lutetium 71
232 Th Thorium 90	Pa Protactinium 91	238 U Uranium 92	Np Neptunium 93	Pu Plutonium 94	Am Americium 95	Cm Curium 96	Bk Berkelium 97	Cf Californium 98	Es Einsteinium 99	Fm Fermium 100	Md Mendelevium 101	No Nobelium 102	Lr Lawrencium 103

*58-71 Lanthanoid series
†90-103 Actinoid series

Key

a	a = relative atomic mass
X	X = atomic symbol
b	b = proton (atomic) number

The volume of one mole of any gas is 24 dm^3 at room temperature and pressure (r.t.p.).