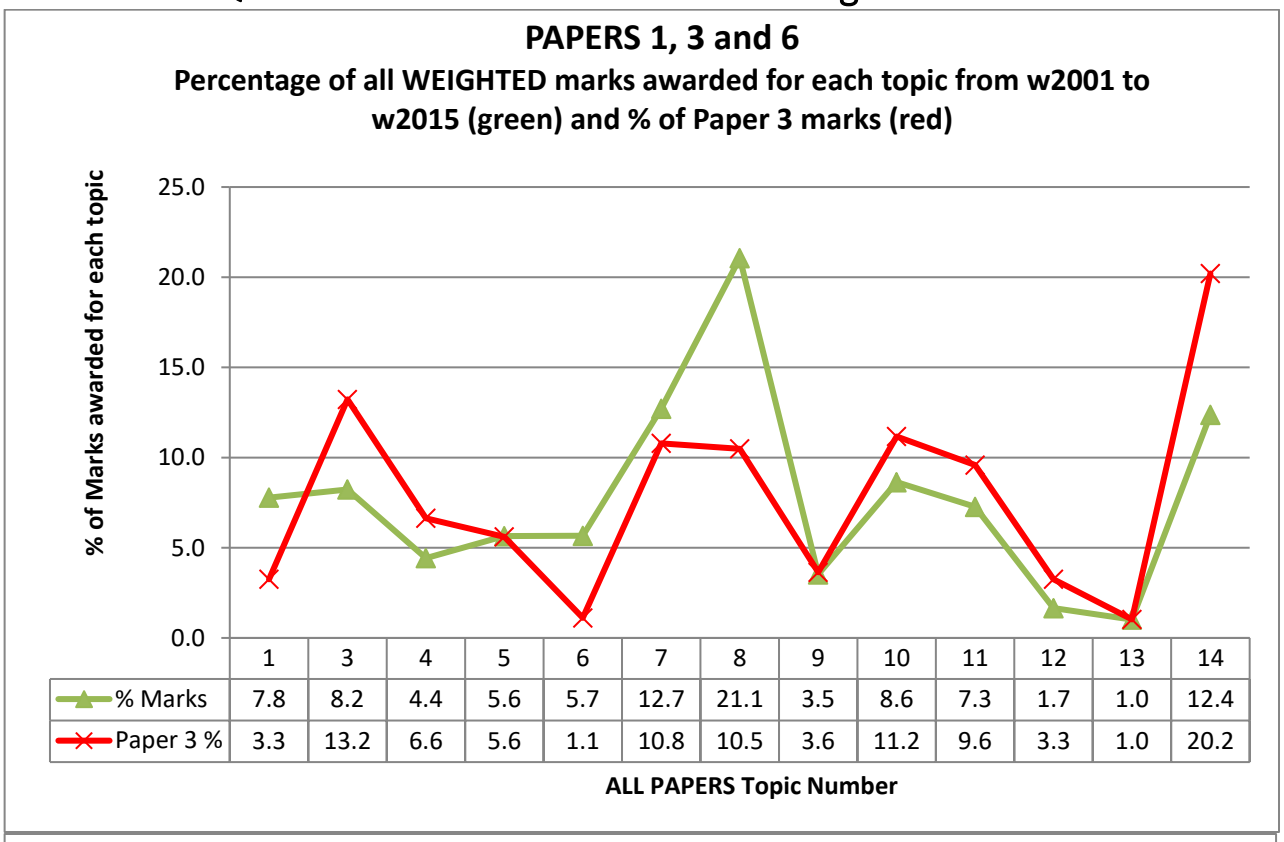
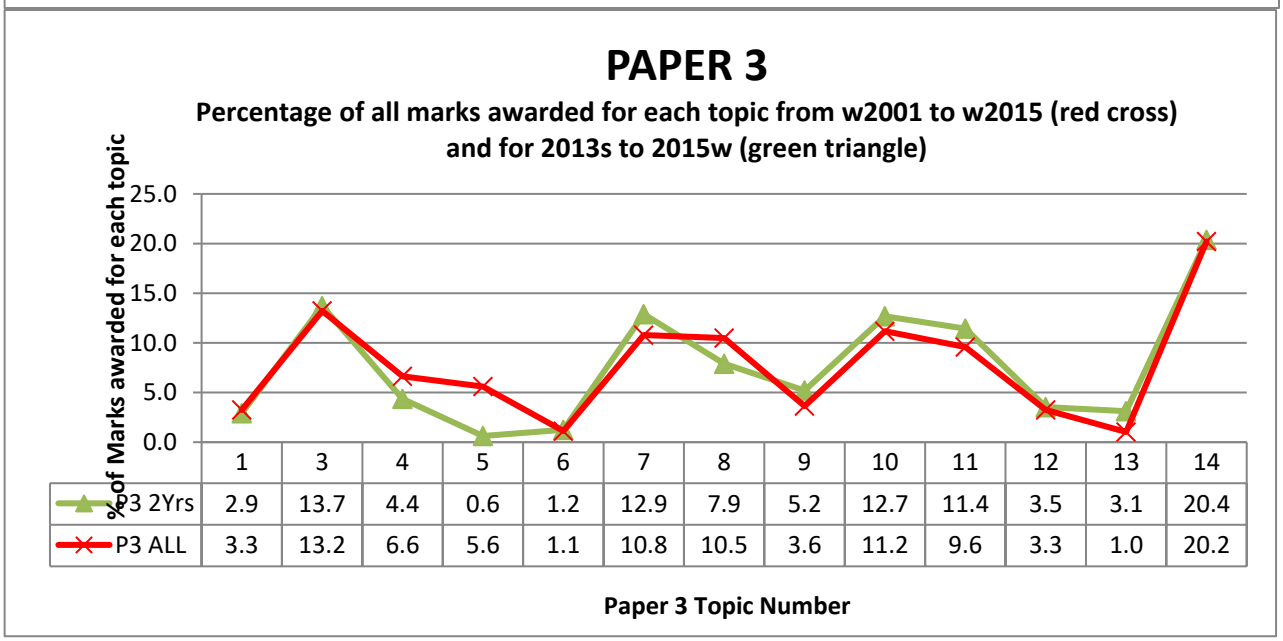
iG Chem 7 EQ P3 15w to 01s NEW 252marks 51Pgs



	1	3	4	5	6	7	8	9	10	11	12	13	14
% Marks	7.8	8.2	4.4	5.6	5.7	12.7	21.1	3.5	8.6	7.3	1.7	1.0	12.4
Paper 3 %	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



	1	3	4	5	6	7	8	9	10	11	12	13	14
P3 2Yrs	2.9	13.7	4.4	0.6	1.2	12.9	7.9	5.2	12.7	11.4	3.5	3.1	20.4
P3 ALL	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

	Total	Chem 1	Chem 3	Chem 4	Chem 5	Chem 6	Chem 7	Chem 8	Chem 9	Chem 10	Chem 11	Chem 12	Chem 13	Chem 14
Total Marks	2320	74	312	155	81	26	256	246	85	296	231	76	24	474
% of Marks	2336	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
# of Questions		19	59	39	18	6	47	54	19	58	48	14	5	80
Average marks per Q		**3.9**	**5.3**	**4.0**	**4.5**	**4.3**	**5.4**	**4.6**	**4.5**	**5.1**	**4.8**	**5.4**	**4.8**	**5.9**

	1st Paper	1st P rank	Last Paper	Last P rank	Total # Papers	Marks/ paper	Theor. All Papers	Actual All Marks	Difference	Weight per paper	Weight per mark
Paper 1	**2002s**	**5**	**2012w**	**26**	**22**	**40**	**880**	**869**	**-11**	**30**	**0.75**
Paper 3	**2001w**	**4**	**2015w**	**32**	**29**	**80**	**2320**	**2336**	**16**	**50**	**0.625**
Paper 6	**2001w**	**4**	**2015w**	**32**	**29**	**60**	**1740**	**1890**	**150**	**20**	**0.625**

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

CIE iGCSE Chemistry Syllabus Details

(syllabus code 0620)

The core material is examined in all three exam papers (papers 1,3 and 6) and is intended to assess understanding up to a grade C level. From 2016, the Supplement material is **examined in all three papers**, however, before 2016 papers 1 and 6 did not contain any Supplement material. If the number of marks that can be awarded above a C grade will remain the same, in practice this means that:

1. Paper 3 will contain fewer Supplement marks, so more core marks so will be easier (if you can answer the Paper 3 questions from before 2016 then you will be fine)
2. Papers 1 and 3 will contain Supplement marks, unlike in all papers before 2016, so will assess material they have not done before, so will be harder because of the questions and as there are no previous questions to practice on, will be harder because of the newness.

Material that is new or changed in 2016 is highlighted with BLACK LINES next to it.

7. Chemical reactions	
7.1 Physical and chemical changes **Core** • Identify physical and chemical changes, and understand the differences between them	
7.2 Rate (speed) of reaction **Core** • Describe and explain the effect of concentration, particle size, catalysts (including enzymes) and temperature on the rate of reactions • Describe the application of the above factors to the danger of explosive combustion with fine powders (e.g. flour mills) and gases (e.g. methane in mines) • Demonstrate knowledge and understanding of a practical method for investigating the rate of a reaction involving gas evolution • Interpret data obtained from experiments concerned with rate of reaction Note: Candidates should be encouraged to use the term *rate* rather than *speed*.	**Supplement** • Devise and evaluate a suitable method for investigating the effect of a given variable on the rate of a reaction • Describe and explain the effects of temperature and concentration in terms of collisions between reacting particles (An increase in temperature causes an increase in collision rate **and** more of the colliding molecules have sufficient energy (activation energy) to react whereas an increase in concentration only causes an increase in collision rate.) *cont.*

7.2 Rate (speed) of reaction continued	• Describe and explain the role of light in photochemical reactions and the effect of light on the rate of these reactions (This should be linked to section 14.4.) • Describe the use of silver salts in photography as a process of reduction of silver ions to silver; and photosynthesis as the reaction between carbon dioxide and water in the presence of chlorophyll and sunlight (energy) to produce glucose and oxygen
7.3 Reversible reactions **Core** • Understand that some chemical reactions can be reversed by changing the reaction conditions (Limited to the effects of heat and water on hydrated and anhydrous copper(II) sulfate and cobalt(II) chloride.) (Concept of equilibrium is **not** required.)	**Supplement** • Predict the effect of changing the conditions (concentration, temperature and pressure) on other reversible reactions • Demonstrate knowledge and understanding of the concept of equilibrium
7.4 Redox **Core** • Define *oxidation* and *reduction* in terms of oxygen loss/gain. (Oxidation state limited to its use to name ions, e.g. iron(II), iron(III), copper(II), manganate(VII).)	**Supplement** • Define *redox* in terms of electron transfer • Identify redox reactions by changes in oxidation state and by the colour changes involved when using acidified potassium manganate(VII), and potassium iodide. (Recall of equations involving $KMnO_4$ is **not** required.) • Define *oxidising agent* as a substance which oxidises another substance during a redox reaction. Define *reducing agent* as a substance which reduces another substance during a redox reaction. • Identify oxidising agents and reducing agents from simple equations

7 The rate of a photochemical reaction is affected by light.

(a) The decomposition of silver bromide is the basis of film photography. This is a redox reaction.

$$\underset{\text{cream}}{2AgBr} \rightarrow \underset{\text{black}}{2Ag} + Br_2$$

step 1 $2Br^- \rightarrow Br_2 + 2e^-$

step 2 $Ag^+ + e^- \rightarrow Ag$

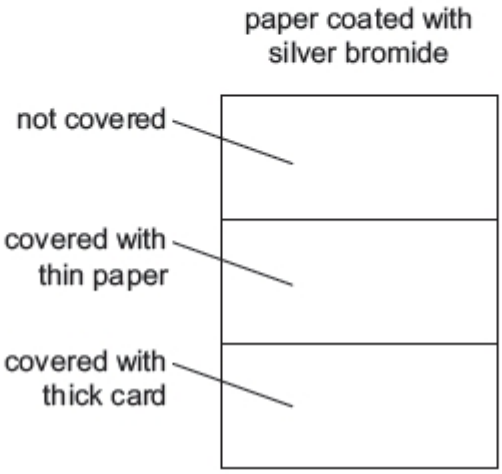
(i) Which step is reduction? Explain your answer.

..... [1]

(ii) Which ion is the oxidising agent? Explain your answer.

..... [1]

(b) A piece of white paper was coated with silver bromide and exposed to the light. Sections of the paper were covered as shown in the diagram.



Predict the appearance of the different sections of the paper after exposure to the light and the removal of the card. Explain your predictions.

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.....

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.....

.....

..... [4]

(c) Photosynthesis is another example of a photochemical reaction. Green plants can make simple carbohydrates, such as glucose. These can polymerise to make more complex carbohydrates, such as starch.

(i) Write a word equation for photosynthesis.

..... [2]

(ii) Name the substance which is responsible for the colour in green plants and is essential for photosynthesis.

..... [1]

Q# 2/ iGCSE Chemistry/2015/s/Paper 31/

3 **(a)** The reactions between metals and acids are redox reactions.

$$Zn + 2H^+ \rightarrow Zn^{2+} + H_2$$

(i) Which change in the above reaction is oxidation, Zn to Zn^{2+} or $2H^+$ to H_2? Give a reason for your choice.

.....

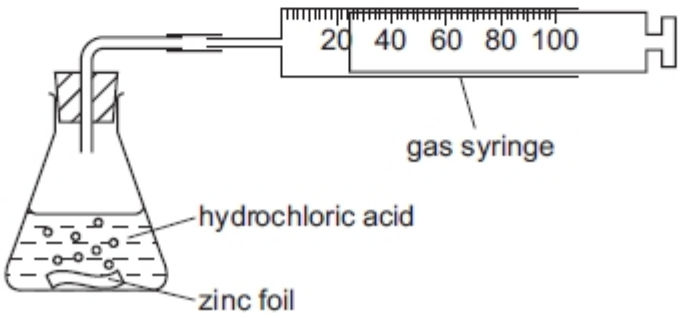
..... [2]

(ii) Which reactant in the above reaction is the oxidising agent? Give a reason for your choice.

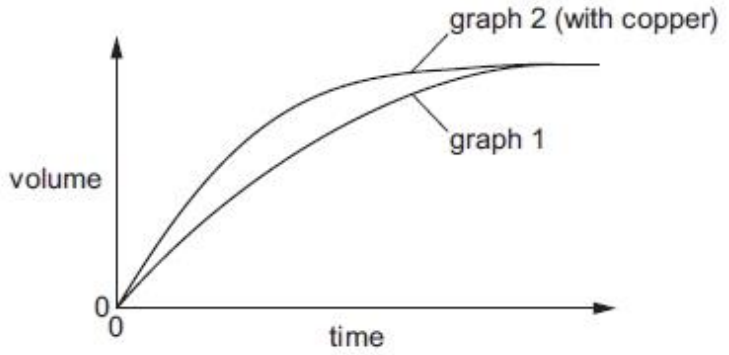
.....

..... [2]

(b) The rate of reaction between a metal and an acid can be investigated using the apparatus shown below.



A piece of zinc foil was added to 50 cm^3 of hydrochloric acid, of concentration 2.0 mol/dm^3. The acid was in excess. The hydrogen evolved was collected in the gas syringe and its volume measured every minute. The results were plotted and labelled as graph 1.



The experiment was repeated to show that the reaction between zinc metal and hydrochloric acid is catalysed by copper. A small volume of aqueous copper(II) chloride was added to the acid before the zinc was added. The results of this experiment were plotted on the same grid and labelled as graph 2.

(i) Explain why the reaction mixture in the second experiment contains copper metal. Include an equation in your explanation.

.....

..... [2]

(ii) Explain how graph 2 shows that copper catalyses the reaction.

.....

.....

..... [3]

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

3 A small piece of marble, $CaCO_3$, was added to 5.0 cm^3 of hydrochloric acid, concentration 1.0 mol/dm^3, at 25 °C. The time taken for the reaction to stop was measured. The experiment was repeated using 5.0 cm^3 of different solutions of acids. The acid was in excess in all of the experiments.

Typical results are given in the table.

experiment	temperature / °C	acid solution	time / min
1	25	hydrochloric acid 1.0 mol/dm^3	3
2	25	hydrochloric acid 0.5 mol/dm^3	7
3	25	ethanoic acid 1.0 mol/dm^3	10
4	15	hydrochloric acid 1.0 mol/dm^3	8

(a) (i) Explain why it is important that the pieces of marble are the same size and the same shape.

.....

.....

..... [2]

(ii) How would you know when the reaction had stopped?

..... [1]

(c) (i) Explain why the reaction in experiment 1 is faster than the reaction in experiment 2.

.....

..... [1]

(ii) The acids used for experiment 1 and experiment 3 have the same concentration. Explain why experiment 3 is slower than experiment 1.

.....

.....

..... [2]

(iii) Explain in terms of collisions between reacting particles why experiment 4 is slower than experiment 1.

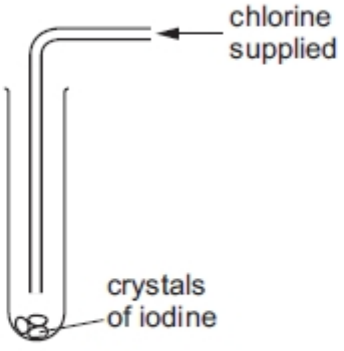
.....

.....

..... [3]

Q# 4/ iGCSE Chemistry/2015/s/Paper 31/

(c) Iodine reacts with chlorine to form a dark brown liquid, iodine monochloride.



$I_2(s) + Cl_2(g) \rightarrow 2ICl(l)$

dark brown

When more chlorine is added and the tube is sealed, a reversible reaction occurs and the reaction comes to equilibrium.

$$\underset{\text{dark brown}}{ICl(l)} + Cl_2(g) \rightleftharpoons \underset{\text{yellow}}{ICl_3(s)}$$

(i) Give another example of a reversible reaction.

..... [1]

(ii) Explain the term *equilibrium*.

.....

..... [2]

(d) Chlorine is removed from the tube and a new equilibrium is formed.

Explain why there is less of the yellow solid and more dark brown liquid in the new equilibrium mixture.

.....

.....

..... [2]

(e) A sealed tube containing the equilibrium mixture is placed in ice-cold water. There is an increase in the amount of yellow solid in the equilibrium mixture.

What can you deduce about the forward reaction in this equilibrium?

$$ICl(l) + Cl_2(g) \rightleftharpoons ICl_3(s)$$

Explain your deduction.

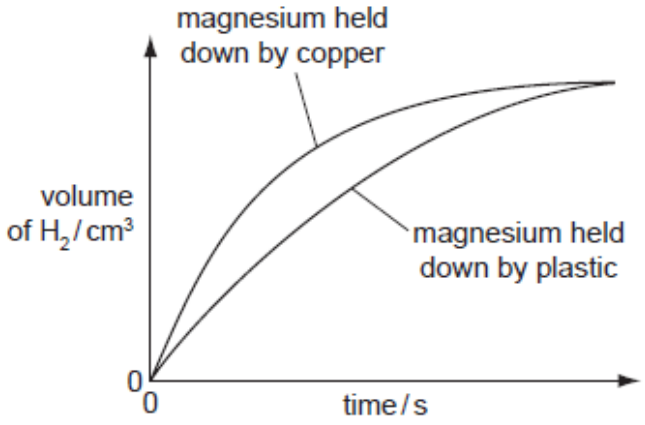
.....

.....

.....

..... [3]

(b) The only difference in the two experiments was the method used to hold down the magnesium. The results are shown below.



(i) In which experiment did the magnesium react faster?

..... [1]

(ii) Suggest a reason why the experiment chosen in **(i)** had the faster rate.

..... [1]

(c) The experiment was repeated using 1.0 mol / dm^3 propanoic acid instead of 1.0 mol / dm^3 hydrochloric acid. Propanoic acid is a weak acid.

(i) How would the graph for propanoic acid **differ** from the graph for hydrochloric acid?

..... [1]

(ii) How would the graph for propanoic acid be the **same** as the graph for hydrochloric acid?

..... [1]

(d) Give **two** factors which would alter the rate of this reaction.
For each factor explain why it alters the rate.

factor .....

explanation .....

.....

factor .....

explanation .....

..... [4]

7 **(a)** A small piece of marble, calcium carbonate, was added to 5 cm^3 of hydrochloric acid at 25 °C. The time taken for the reaction to stop was measured.

$$CaCO_3(s) + 2HCl(aq) \rightarrow CaCl_2(aq) + CO_2(g) + H_2O(l)$$

Similar experiments were performed always using 5 cm^3 of hydrochloric acid.

experiment	number of pieces of marble	concentration of acid in mol / dm^3	temperature / °C	time / min
1	1	1.00	25	3
2	1	0.50	25	7
3	1 piece crushed	1.00	25	1
4	1	1.00	35	2

Explain each of the following in terms of **collisions between reacting particles.**

(i) Why is the rate in experiment 2 slower than in experiment 1?

.....

..... [2]

(ii) Why is the rate in experiment 3 faster than in experiment 1?

.....

..... [2]

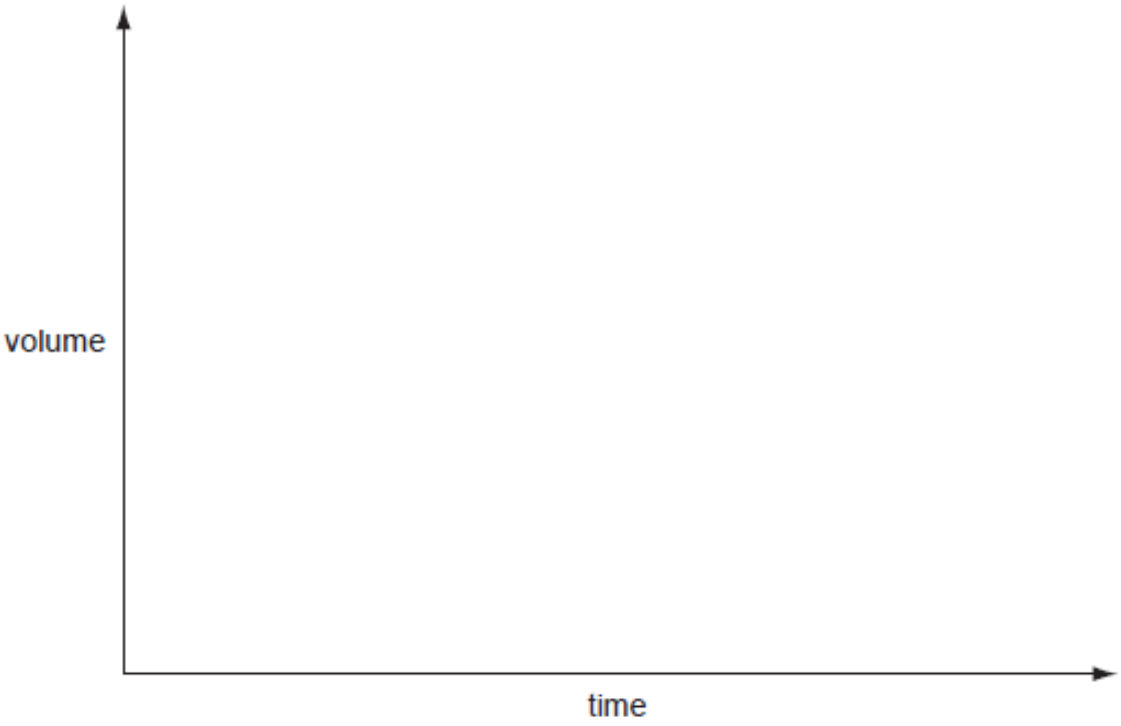
(iii) Why is the rate in experiment 4 faster than in experiment 1?

.....

..... [2]

(b) An alternative method of measuring the rate of this reaction would be to measure the volume of carbon dioxide produced at regular intervals.

(i) Sketch this graph



[2]

3 The simplest alcohol is methanol.

(a) It is manufactured by the following reversible reaction.

$$CO\,(g) + 2H_2\,(g) \rightleftharpoons CH_3OH\,(g)$$

300 °C
30atm

(i) Reversible reactions can come to equilibrium. Explain the term *equilibrium*.

.....

[1]

(ii) At 400 °C, the percentage of methanol in the equilibrium mixture is lower than at 300 °C. Suggest an explanation.

.....

[2]

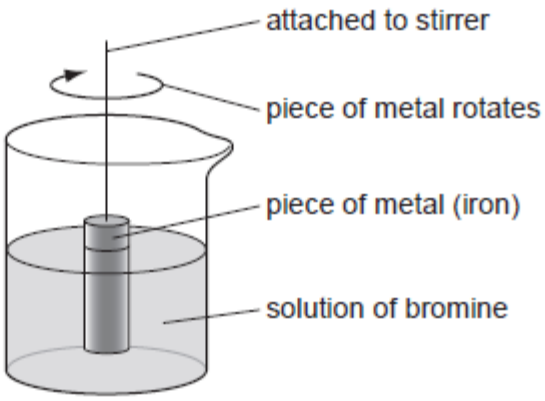
(iii) Suggest two advantages of using high pressure for this reaction.
Give a reason for each advantage.

advantage	.....
reason	.....

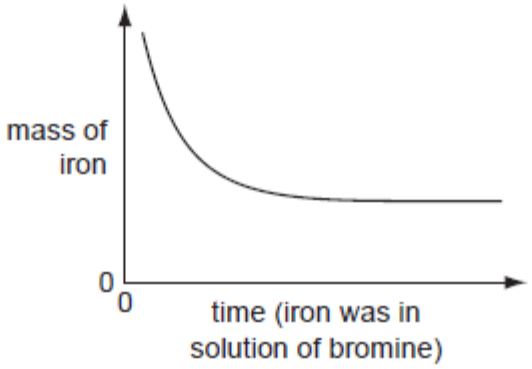
advantage	.....
reason	.....

[5]

5 The rate of the reaction between iron and aqueous bromine can be investigated using the apparatus shown below.



(a) A piece of iron was weighed and placed in the apparatus. It was removed at regular intervals and the clock was paused. The piece of iron was washed, dried, weighed and replaced. The clock was restarted.
This was continued until the solution was colourless.
The mass of iron was plotted against time. The graph shows the results obtained.



(i) Suggest an explanation for the shape of the graph.

.....

.....

..... [3]

(ii) Predict the shape of the graph if a similar piece of iron with a much rougher surface had been used.
Explain your answer.

.....

..... [2]

(iii) Describe how you could find out if the rate of this reaction depended on the speed of stirring.

.....

.....

..... [2]

6 Iodine reacts with chlorine to form dark brown iodine monochloride.

$$I_2 + Cl_2 \rightarrow 2ICl$$

This reacts with more chlorine to give yellow iodine trichloride.
There is an equilibrium between these iodine chlorides.

$$ICl(l) + Cl_2(g) \rightleftharpoons ICl_3(s)$$

dark brown — yellow

(a) Explain what is meant by *equilibrium*.

.....

.....

..... [2]

(b) When the equilibrium mixture is heated it becomes a darker brown colour.
Is the reverse reaction endothermic or exothermic? Give a reason for your choice.

.....

.....

..... [2]

(c) The pressure on the equilibrium mixture is decreased.

(i) How would this affect the position of equilibrium and why?

It would move to the ..... [1]

reason .....

..... [1]

(ii) Describe what you would observe.

.....

..... [1]

Q# 10/ iGCSE Chemistry/2005/w/Paper 3/

3 Reversible reactions can come to equilibrium. They have both a forward and a backward reaction.

(a) When water is added to an acidic solution of bismuth(III) chloride, a white precipitate forms and the mixture slowly goes cloudy.

$$\underset{\text{colourless}}{BiCl_3(aq)} + H_2O(l) \underset{\text{backward}}{\overset{\text{forward}}{\rightleftharpoons}} \underset{\text{white}}{BiOCl(s)} + 2HCl(aq)$$

(i) Explain why the rate of the forward reaction decreases with time.

.....

..... [2]

(ii) Why does the rate of the backward reaction increase with time?

.....

..... [1]

(iii) After some time why does the appearance of the mixture remain unchanged?

.....

..... [2]

(iv) When a few drops of concentrated hydrochloric acid are added to the cloudy mixture, it changes to a colourless solution. Suggest an explanation.

.....

..... [2]

Q# 11/ iGCSE Chemistry/2002/w/Paper 3/ Q2

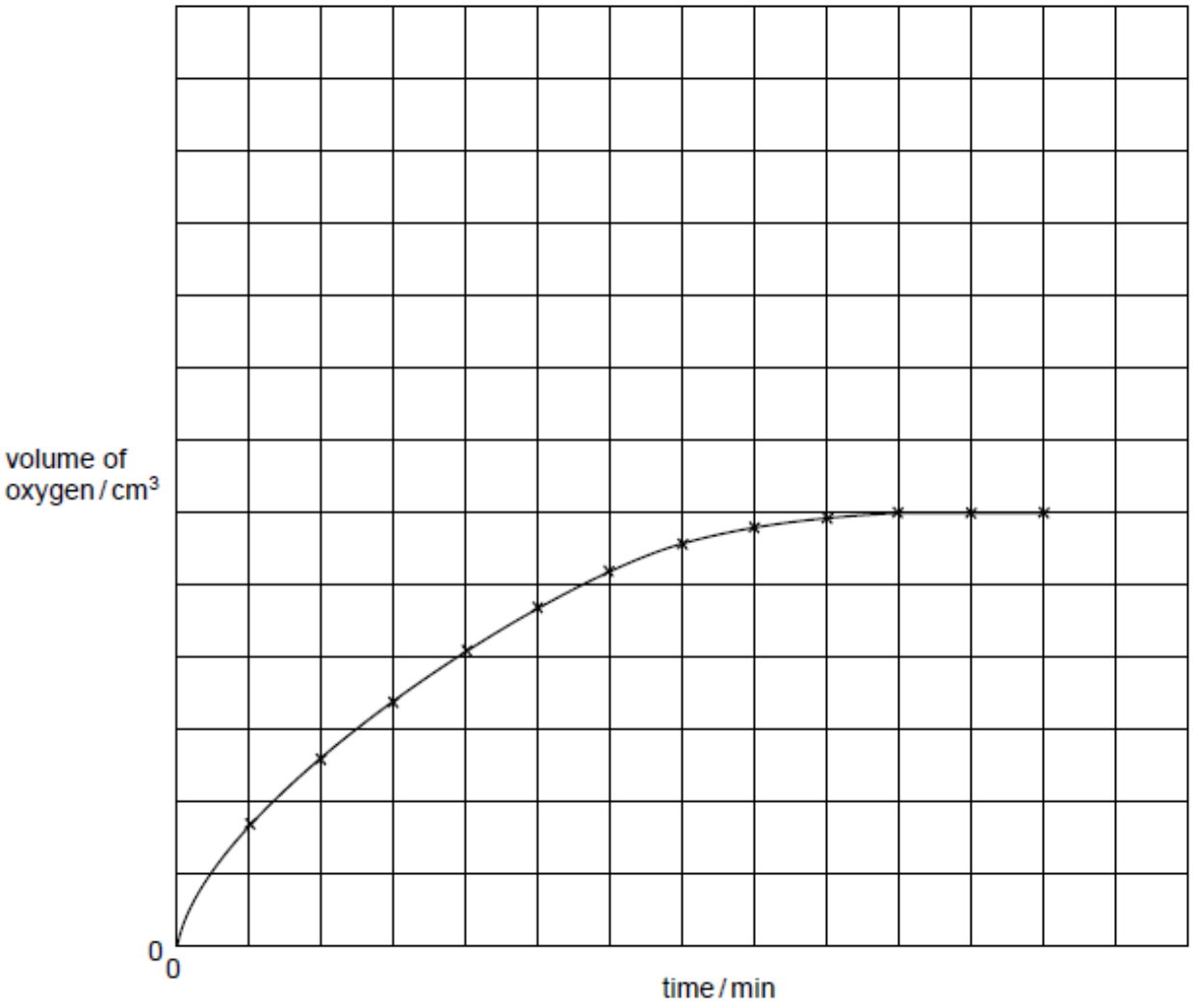
(c) Aqueous hydrogen peroxide decomposes to form water and oxygen.

$$2H_2O_2(aq) \rightarrow 2H_2O(l) + O_2(g)$$

This reaction is catalysed by manganese(IV) oxide

The following experiments were carried out to investigate the rate of this reaction.

A 0.1 g sample of manganese(IV) oxide was added to 20 cm^3 of 0.2 M hydrogen peroxide solution. The volume of oxygen produced was measured every minute. The results of this experiment are shown on the graph.



(i) How does the rate of reaction vary with time? Explain why the rate varies.

.....

.....[3]

(ii) The following experiment was carried out at the same temperature.

0.1 g of manganese(IV) oxide and 20 cm^3 of 0.4 M hydrogen peroxide

Sketch the curve for this experiment on the same grid. [2]

(iii) How would the shape of the graph differ if only half the mass of catalyst had been used in these experiments?

.....

.....

.....[2]

6 Three of the factors that can influence the rate of a chemical reaction are:

- physical state of the reactants
- light
- the presence of a catalyst

(a) The first recorded dust explosion was in a flour mill in Italy in 1785. Flour contains carbohydrates. Explosions are very fast exothermic reactions.

(i) Use the collision theory to explain why the reaction between the particles of flour and the oxygen in the air is very fast.

.....

..... [2]

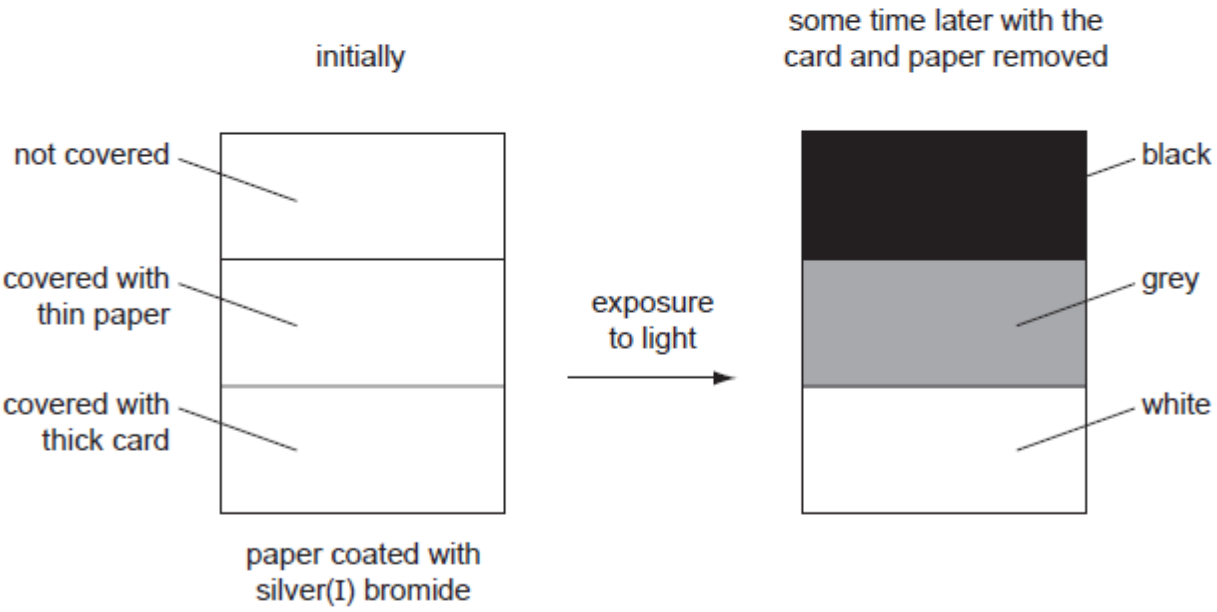
(ii) Write a word equation for this exothermic reaction.

..... [1]

The decomposition of silver(I) bromide is the basis of film photography. The equation for this decomposition is:

$$\underset{\text{white}}{2AgBr} \longrightarrow \underset{\text{black}}{2Ag} + Br_2$$

This reaction is photochemical.
A piece of white paper was coated with silver(I) bromide and the following experiment was carried out.



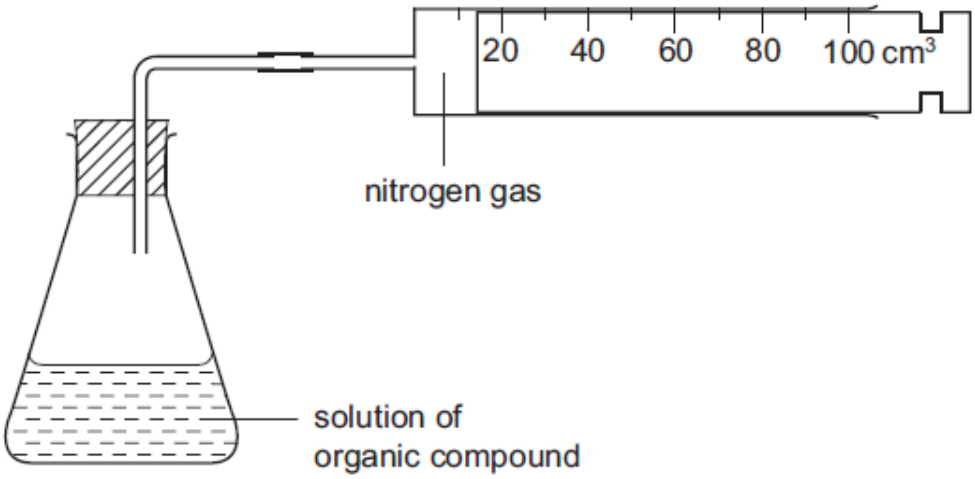
(b) Explain the results.

.....

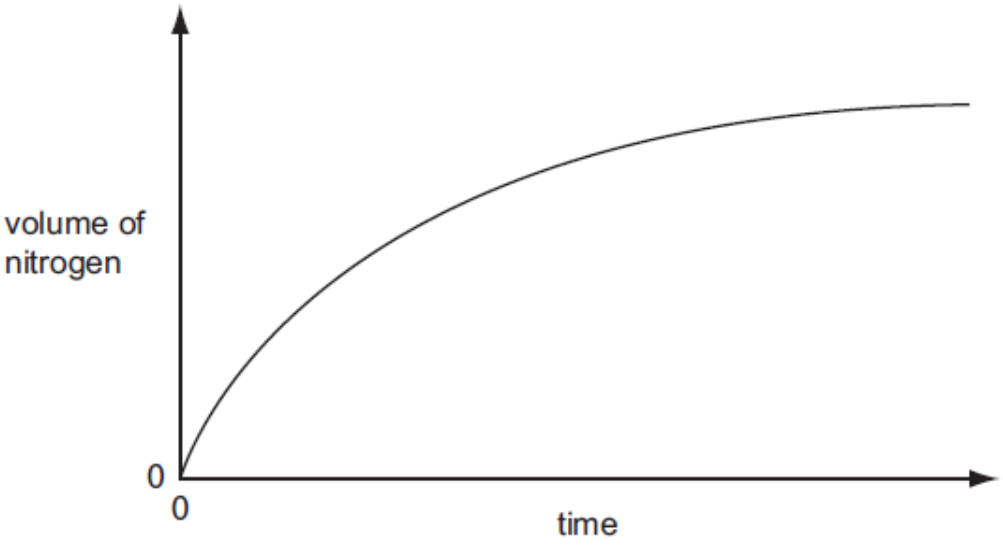
.....

..... [3]

(c) The rate of this reaction can be measured using the following apparatus.



The results of this experiment are shown on the graph below.



(i) How does the rate of this reaction vary with time?

.....

..... [1]

(ii) Why does the rate vary?

.....

..... [2]

(iii) The reaction is catalysed by copper powder. Sketch the graph for the catalysed reaction on the same grid. [2]

(iv) Why is copper powder more effective as a catalyst than a single piece of copper?

..... [1]

Q# 14/ iGCSE Chemistry/2012/w/Paper 31/

5 Carbonyl chloride, $COCl_2$, is widely used in industry to make polymers, dyes and pharmaceuticals.

(a) Carbonyl chloride was first made in 1812 by exposing a mixture of carbon monoxide and chlorine to bright sunlight. This is a photochemical reaction.

$$CO(g) + Cl_2(g) \rightarrow COCl_2(g)$$

(i) Explain the phrase *photochemical reaction*.

.....

..... [2]

(ii) Give another example of a photochemical reaction and explain why it is important either to the environment or in industry.

.....

.....

..... [3]

Q# 15/ iGCSE Chemistry/2012/w/Paper 31/

5 Carbonyl chloride, $COCl_2$, is widely used in industry to make polymers, dyes and pharmaceuticals.

(b) Carbonyl chloride is now made by the reversible reaction given below.

$$CO(g) + Cl_2(g) \rightleftharpoons COCl_2(g)$$

The forward reaction is exothermic.
The reaction is catalysed by carbon within a temperature range of 50 to 150 °C.

(i) Predict the effect on the yield of carbonyl chloride of increasing the pressure. Explain your answer.

.....

..... [2]

(ii) If the temperature is allowed to increase to above 200 °C, very little carbonyl chloride is formed. Explain why.

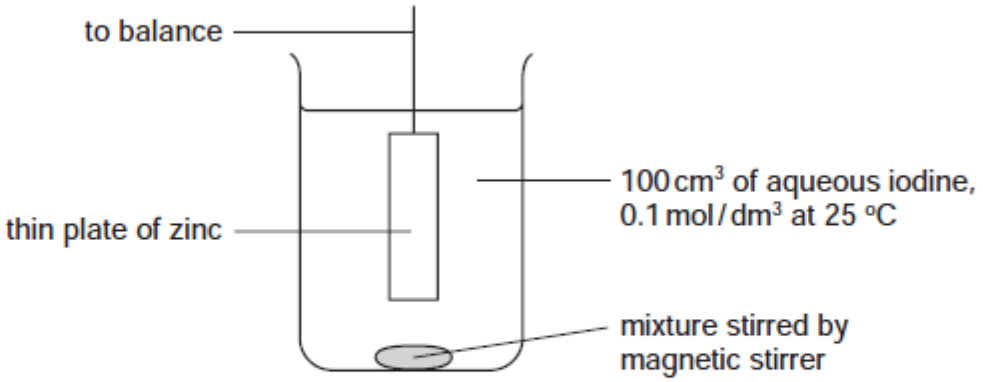
.....

..... [2]

(iii) Explain why a catalyst is used.

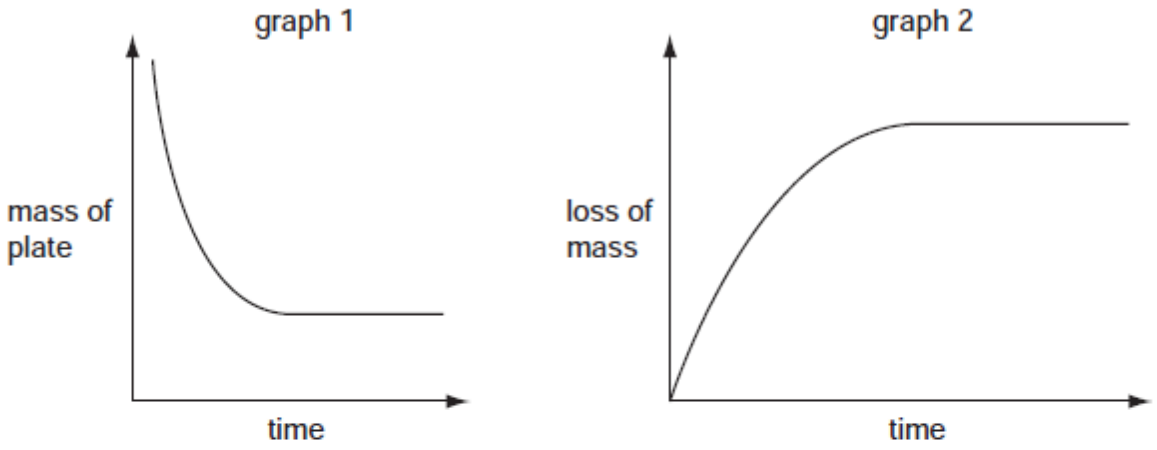
..... [1]

2 The following apparatus was used to measure the rate of the reaction between zinc and iodine.



The mass of the zinc plate was measured every minute until the reaction was complete.

(c) From the results of this experiment two graphs were plotted.



(i) Which reagent iodine or zinc was in excess? Give a reason for your choice.

.....

[1]

(ii) Describe how the shape of graph 1 would change if 100cm^3 of 0.05 mol/dm^3 iodine had been used.

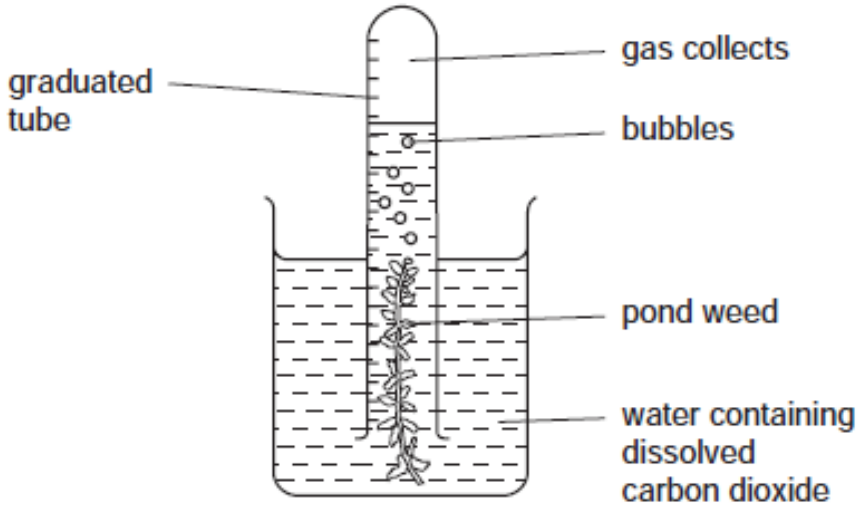
.....

.....

[2]

(iii) On graph 2, sketch the shape if the reaction had been carried out using 100 cm^3 of 0.1 mol/dm^3 iodine at 35 °C instead of at 25 °C. [2]

(d) The rate of photosynthesis of pond weed can be measured using the following experiment.



(i) Describe how you could show that the gas collected in this experiment is oxygen.

[1]

(ii) What measurements are needed to calculate the rate of this reaction?

[2]

(iii) What would be the effect, and why, of moving the apparatus further away from the light?

[2]

Q# 18/ iGCSE Chemistry/2002/s/Paper 3/ Q4

(b) Bromine is obtained from the bromide ions in sea water. Sea water is concentrated by evaporation. Chlorine gas is bubbled through the solution. Chlorine oxidises the bromide ion to bromine.

(i) Complete the following equation.

$$Cl_2 + \text{.....}Br^- \longrightarrow \text{.....} + \text{.....} \quad [2]$$

(ii) Explain using the idea of electron transfer why the bromide ion is oxidised by chlorine.

The bromide ion is oxidised because .....

.....

Chlorine is the oxidising agent because .....

.....[2]

(iii) Name a reagent that can be oxidised by bromine molecules.

.....[1]

Q# 19/ iGCSE Chemistry/2015/s/Paper 31/

3 **(a)** The reactions between metals and acids are redox reactions.

$$Zn + 2H^+ \rightarrow Zn^{2+} + H_2$$

(c) If the first experiment was repeated using ethanoic acid, CH_3COOH, instead of hydrochloric acid, how and why would the graph be different from graph 1?

.....

.....

.....

..... [4]

(d) Calculate the maximum mass of zinc which will react with 50 cm^3 of hydrochloric acid, of concentration 2.0 mol/dm^3.

$$Zn + 2HCl \rightarrow ZnCl_2 + H_2$$

Show your working.

[3]

Q# 20/ iGCSE Chemistry/2008/s/Paper 31/

5 Carbonyl chloride, $COCl_2$, is a colourless gas. It is made by the following reaction.

$$CO(g) + Cl_2(g) \underset{\text{heat}}{\overset{\text{cool}}{\rightleftharpoons}} COCl_2(g)$$

(a) When the pressure on the equilibrium mixture is decreased, the position of equilibrium moves to left.

(i) How does the concentration of each of the three chemicals change?

.....

..... [2]

(ii) Explain why the position of equilibrium moves to left.

.....

..... [2]

(b) Using the information given with the equation, is the forward reaction exothermic or endothermic? Give a reason for your choice.

.....

..... [2]

Q# 21/ iGCSE Chemistry/2007/w/Paper 3/ Q2 (b)

(iii) The reaction between magnesium and bromine is redox. Complete the sentences.

Magnesium is the ..... agent because it has

..... electrons.

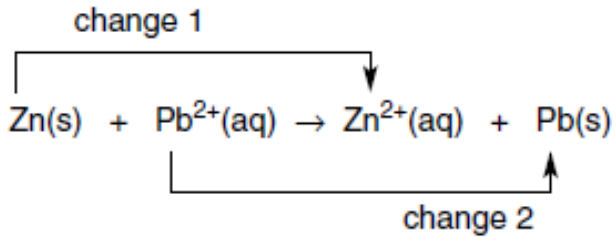
Bromine has been ..... because it has .....

electrons. [4]

Q# 22/ iGCSE Chemistry/2003/w/Paper 3/ Q2

(c) A solution of an impure zinc ore contained zinc, lead and silver(I) ions. The addition of zinc dust will displace both lead and silver.

(i) The ionic equation for the displacement of lead is as follows.



Which change is reduction? Explain your answer.

.....

.....[2]

(ii) Write an ionic equation for the reaction between zinc atoms and silver(I) ions.

.....[2]

Q# 23/ iGCSE Chemistry/2002/s/Paper 3/

2 Fermentation of sugars is one method of making ethanol. Vines produce glucose by photosynthesis. The glucose collects in the grapes which grow in clusters on the vine.

(b) Explain how the vine produces glucose by photosynthesis.

.....

.....

.....

.....[4]

Q# 24/ 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.

(d) The oxidation states of vanadium in its compounds are V(+5), V(+4), V(+3) and V(+2). The vanadium(III) ion can behave as a reductant or an oxidant.

(i) Indicate on the following equation which reactant is the oxidant.

$$2V^{3+} + Zn \rightarrow 2V^{2+} + Zn^{2+}$$

[1]

(ii) Which change in the following equation is oxidation? Explain your choice.

$$V^{3+} + Fe^{3+} \rightarrow V^{4+} + Fe^{2+}$$

.....

..... [2]

Q# 25/ iGCSE Chemistry/2011/w/Paper 31/ Q5

(b) Iron has two oxidation states +2 and +3. There are two possible equations for the redox reaction between iron and bromine.

$$Fe + Br_2 \rightarrow Fe^{2+} + 2Br^-$$

$$2Fe + 3Br_2 \rightarrow 2Fe^{3+} + 6Br^-$$

(i) Indicate, on the first equation, the change which is oxidation. Give a reason for your choice.

.....

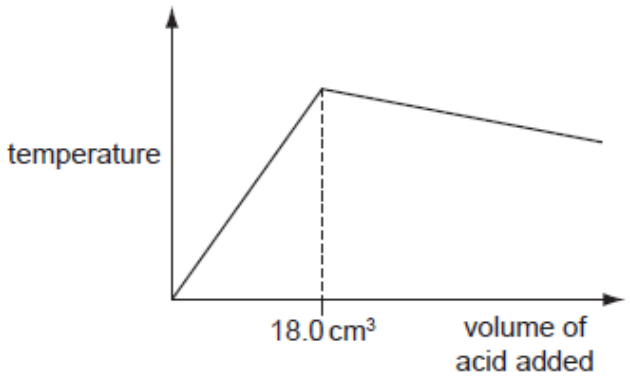
..... [2]

(ii) Which substance in the first equation is the reductant (reducing agent)?

..... [1]

Q# 26/ 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.



$$NaOH(aq) + HI(aq) \rightarrow NaI(aq) + H_2O(l)$$

(i) Explain why the temperature increases rapidly at first then stops increasing.

.....

..... [2]

(ii) Suggest why the temperature drops after the addition of 18.0 cm^3 of acid.

..... [1]

Q# 27/ iGCSE Chemistry/2010/w/Paper 31/

6 The table below shows the elements in the second period of the Periodic Table and some of their oxidation states in their most common compounds.

element	Li	Be	B	C	N	O	F	Ne
number of outer electrons	1	2	3	4	5	6	7	8
oxidation state	+1	+2	+3	+4	–3	–2	–1	0

(a) (i) What does it mean when the only oxidation state of an element is zero?

.....

..... [1]

(ii) Explain why some elements have positive oxidation states but others have negative ones.

.....

..... [2]

Q# 28/ iGCSE Chemistry/2009/w/Paper 3/ Q6

(b) Sulfuric acid was first made in the Middle East by heating the mineral, green vitriol, $FeSO_4.7H_2O$. The gases formed were cooled.

$FeSO_4.7H_2O(s) \rightarrow FeSO_4(s) + 7H_2O(g)$
green crystals yellow powder

$2FeSO_4(s) \rightarrow Fe_2O_3(s) + SO_2(g) + SO_3(g)$

On cooling

$SO_3 + H_2O \rightarrow H_2SO_4$ sulfuric acid
$SO_2 + H_2O \rightarrow H_2SO_3$ sulfurous acid

(ii) Sulfurous acid is a reductant. What would you see when acidified potassium manganate(VII) is added to a solution containing this acid?

.....

..... [2]

(iii) Suggest an explanation why sulfurous acid in contact with air changes into sulfuric acid.

..... [1]

Q# 29/ iGCSE Chemistry/2005/w/Paper 3/ Q3

(b) Both of the following reactions are reversible.

reaction 1 $N_2(g) + O_2(g) \rightleftharpoons 2NO(g)$

reaction 2 $2NO(g) + O_2(g) \rightleftharpoons 2NO_2(g)$

(i) Suggest a reason why an increase in pressure does not affect the position of equilibrium for reaction 1.

..... [1]

(ii) What effect would an increase in pressure have on the position of equilibrium for reaction 2? Give a reason for your answer.

.....

..... [2]

Q# 30/ iGCSE Chemistry/2002/w/Paper 3/

3 The elements in Period 3 and some of their common oxidation states are shown below.

Element	Na	Mg	Al	Si	P	S	Cl	Ar
Oxidation State	+1	+2	+3	+4	–3	–2	–1	0

(a) (i) Why do the oxidation states increase from sodium to silicon?

.....[1]

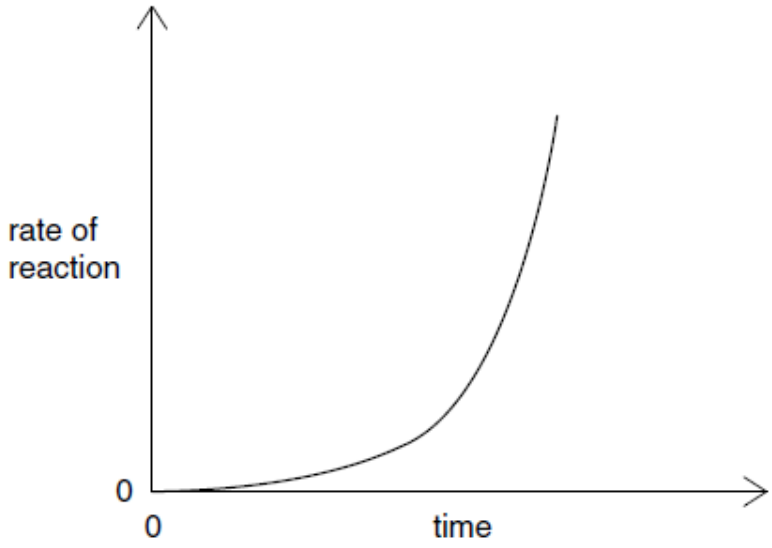
(ii) After Group(IV) the oxidation states are negative and decrease across the period. Explain why.

.....

.....[2]

Q# 31/ iGCSE Chemistry/2002/s/Paper 3/ Q2

(d) The graph shows how the rate of the exothermic reaction between aluminium and hydrochloric acid varies with time.



(i) Suggest a reason why the reaction goes slowly at first.

.....[1]

(ii) Suggest **two** reasons for the increase in rate.

.....

.....[2]

Q# 32/ iGCSE Chemistry/2001/w/Paper 3/ Q2 (b)

(v) Give another example of a reaction that is influenced by light. Describe **one** important application of this reaction.

reaction .....

application .....[3]

Q# 33/ 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.

(c) Vanadium(V) oxide is used to catalyse the exothermic reaction between sulfur dioxide and oxygen in the Contact Process.

$$2SO_2 + O_2 \rightleftharpoons 2SO_3$$

The rate of this reaction can be increased either by using a catalyst or by increasing the temperature. Explain why a catalyst is used and not a higher temperature.

.....

.....

..... [2]

Q# 34/ iGCSE Chemistry/2009/w/Paper 3/ Q6

(b) Sulfuric acid was first made in the Middle East by heating the mineral, green vitriol, $FeSO_4.7H_2O$. The gases formed were cooled.

$FeSO_4.7H_2O(s) \rightarrow FeSO_4(s) + 7H_2O(g)$
green crystals yellow powder

$2FeSO_4(s) \rightarrow Fe_2O_3(s) + SO_2(g) + SO_3(g)$

On cooling

$SO_3 + H_2O \rightarrow H_2SO_4$ sulfuric acid
$SO_2 + H_2O \rightarrow H_2SO_3$ sulfurous acid

(i) How could you show that the first reaction is reversible?

.....

..... [2]

Q# 35/ iGCSE Chemistry/2007/w/Paper 3/ Q6

(c) Methanol is made from carbon monoxide.

$CO(g) + 2H_2(g) \rightleftharpoons CH_3OH(g)$ the forward reaction is exothermic

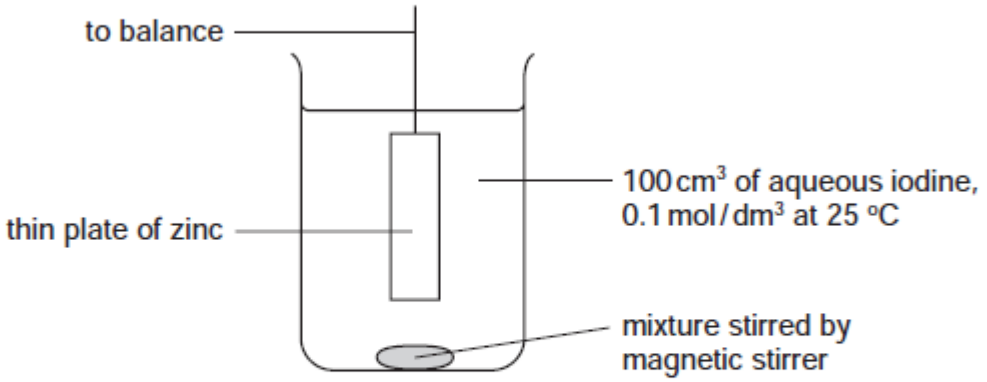
(iii) Which condition, high or low pressure, would give the maximum yield of methanol? Give a reason for your choice.

pressure .....

reason ..... [2]

Q# 36/ iGCSE Chemistry/2005/s/Paper 3/ Q2

2 The following apparatus was used to measure the rate of the reaction between zinc and iodine.



The mass of the zinc plate was measured every minute until the reaction was complete.

(a) Write an ionic equation for the redox reaction that occurred between zinc atoms and iodine molecules.

..... [2]

Q# 37/ iGCSE Chemistry/2004/s/Paper 31/

(c) Silicon is made by the carbon reduction of the macromolecular compound, silicon(IV) oxide.

(i) Balance the equation for the reduction of silicon(IV) oxide.

SiO_2 + ... C → Si + ... CO [1]

(ii) Explain why the silicon(IV) oxide is said to be reduced.

..... [1]

Q# 38/ iGCSE Chemistry/2003/w/Paper 3/ Q5

(c) Sulphur dioxide is easily oxidised in the presence of water.

$$SO_2 + 2H_2O - 2e^- \rightarrow SO_4^{2-} + 4H^+$$

(i) What colour change would be observed when an excess of aqueous sulphur dioxide is added to an acidic solution of potassium manganate(VII)?

.....[2]

Q# 39/ iGCSE Chemistry/2001/w/Paper 3/ QiGCSE Chemistry/201 (a)

(iii) The following reaction is used to detect carbon monoxide.

$$CO + \underset{\text{orange}}{Pd^{2+}} + H_2O \rightarrow CO_2 + \underset{\text{black}}{Pd} + 2H^+$$

What type of chemical reaction is the change Pd^{2+} to Pd? Give a reason for your answer.

.....[2]

Q# 40/ iGCSE Chemistry/2001/w/Paper 3/ QiGCSE Chemistry/201

(b) Carbon monoxide is used to purify nickel. Nickel reacts with carbon monoxide to form a gaseous compound.

$$Ni(s) + 4CO(g) \rightleftharpoons Ni(CO)_4(g) \qquad \text{forward reaction is exothermic}$$

(i) What reaction condition will favour the back reaction and reform nickel metal? Explain your choice.

.....

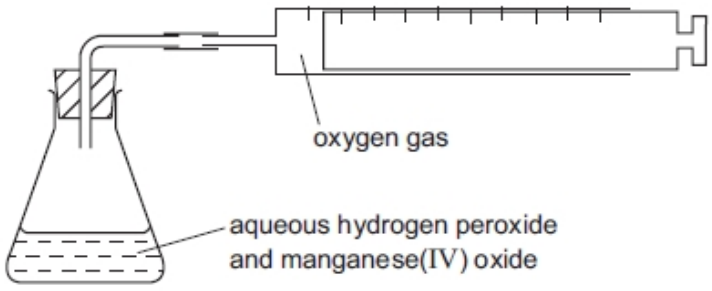
.....[2]

Q# 41/ iGCSE Chemistry/2014/s/Paper 31/

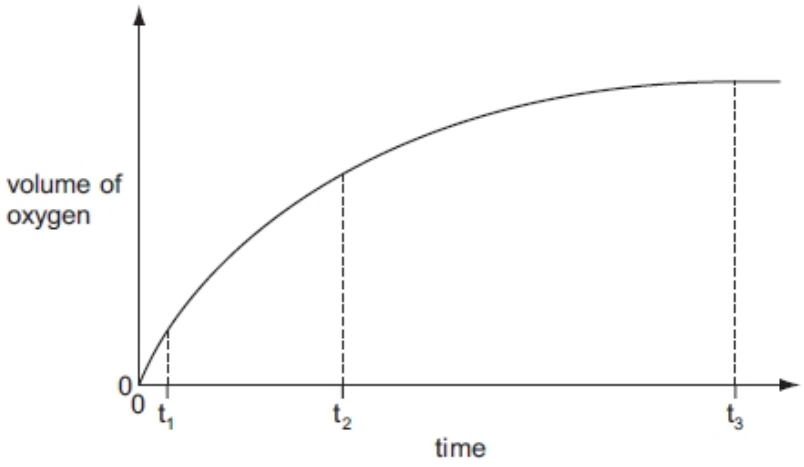
6 Hydrogen peroxide decomposes to form water and oxygen. This reaction is catalysed by manganese(IV) oxide.

$$2H_2O_2(aq) \rightarrow 2H_2O(l) + O_2(g)$$

The rate of this reaction can be investigated using the following apparatus.



40 cm³ of aqueous hydrogen peroxide was put in the flask and 0.1 g of small lumps of manganese(IV) oxide was added. The volume of oxygen collected was measured every 30 seconds. The results were plotted to give the graph shown below.



(a) (i) How do the rates at times t_1, t_2 and t_3 differ?

.....

..... [2]

(ii) Explain the trend in reaction rate that you described in **(a)(i)**.

.....

.....

..... [2]

(b) The experiment was repeated using 0.1 g of finely powdered manganese(IV) oxide. All the other variables were kept the same.

(i) On the axes opposite, sketch the graph that would be expected. [2]

(ii) Explain the shape of this graph. .....

.....

.....

..... [2]

(c) Describe how you could show that the catalyst, manganese(IV) oxide, was not used up in the reaction. Manganese(IV) oxide is insoluble in water.

.....

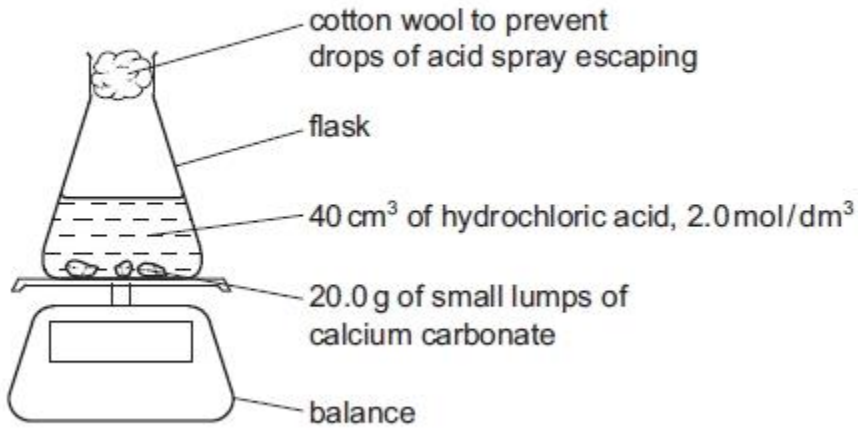
.....

.....

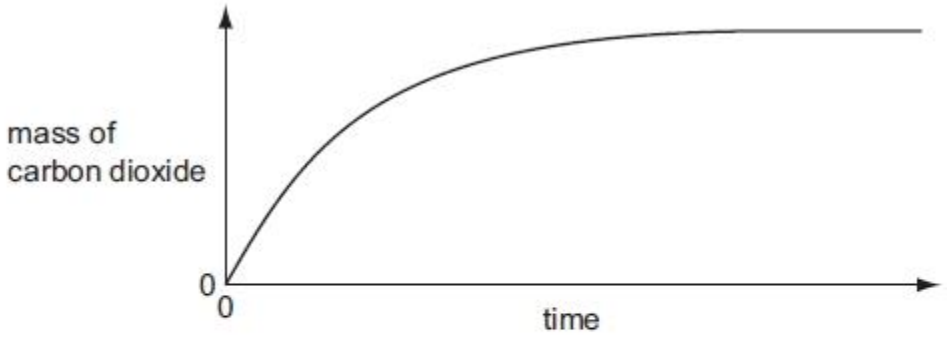
.....

..... [4]

4 20.0 g of small lumps of calcium carbonate and 40 cm^3 of hydrochloric acid, concentration 2.0 mol/dm^3, were placed in a flask on a top pan balance. The mass of the flask and contents was recorded every minute.



The mass of carbon dioxide given off was plotted against time.



$$CaCO_3(s) + 2HCl(aq) \rightarrow CaCl_2(aq) + H_2O(l) + CO_2(g)$$

In all the experiments mentioned in this question, the calcium carbonate was in excess.

(a) (i) Explain how you could determine the mass of carbon dioxide given off in the first five minutes.

.....[1]

(ii) Label the graph **F** where the reaction rate is the fastest, **S** where it is slowing down and **0** where the rate is zero. [2]

(iii) Explain how the shape of the graph shows where the rate is fastest, where it is slowing down and where the rate is zero.

.....

.....

.....[2]

(b) Sketch on the same graph, the line which would have been obtained if 20.0 g of small lumps of calcium carbonate and 80 cm^3 of hydrochloric acid, concentration 1.0 mol/dm^3, had been used. [2]

(c) Explain in terms of collisions between reacting particles each of the following.

(i) The reaction rate would be slower if 20.0 g of larger lumps of calcium carbonate and 40 cm^3 of hydrochloric acid, concentration 2.0 mol/dm^3, were used.

.....

.....

..... [2]

(ii) The reaction rate would be faster if the experiment was carried out at a higher temperature.

.....

.....

..... [2]

Q# 43/ iGCSE Chemistry/2011/w/Paper 31/

4 Reversible reactions can come to equilibrium. The following are three examples of types of gaseous equilibria.

$A_2(g) + B_2(g) \rightleftharpoons 2AB(g)$ **reaction 1**

$A_2(g) + 3B_2(g) \rightleftharpoons 2AB_3(g)$ **reaction 2**

$2AB_2(g) \rightleftharpoons 2AB(g) + B_2(g)$ **reaction 3**

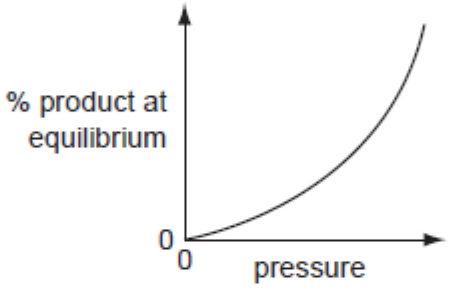
(a) Explain the term *equilibrium*.

.....

..... [2]

(b) The following graphs show how the percentage of products of a reversible reaction at equilibrium could vary with pressure.
For each graph, decide whether the percentage of products decreases, increases or stays the same when the pressure is **increased**, then match each graph to one of the above reactions and give a reason for your choice.

(i)



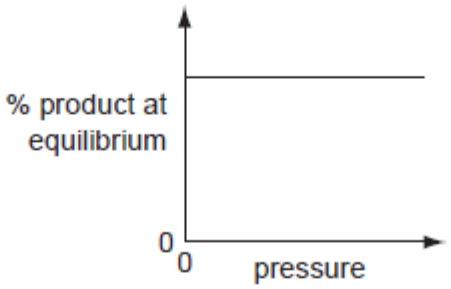
effect on percentage of products .....

reaction .....

reason .....

..... [3]

(ii)



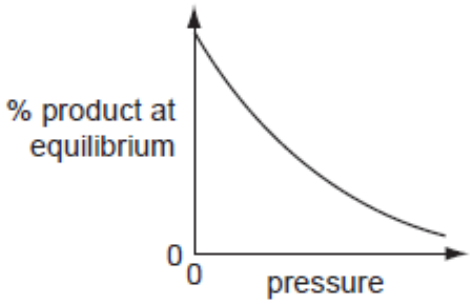
effect on percentage of products .....

reaction .....

reason .....

..... [3]

(iii)



effect on percentage of products .....

reaction .....

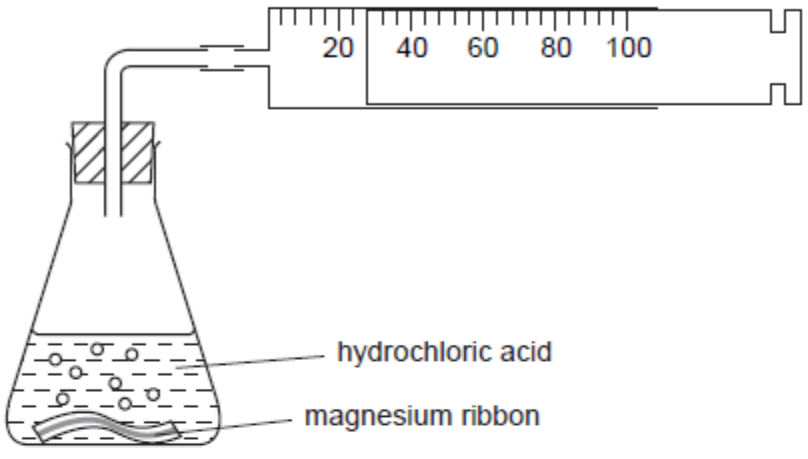
reason .....

..... [3]

Q# 44/ iGCSE Chemistry/2006/w/Paper 3

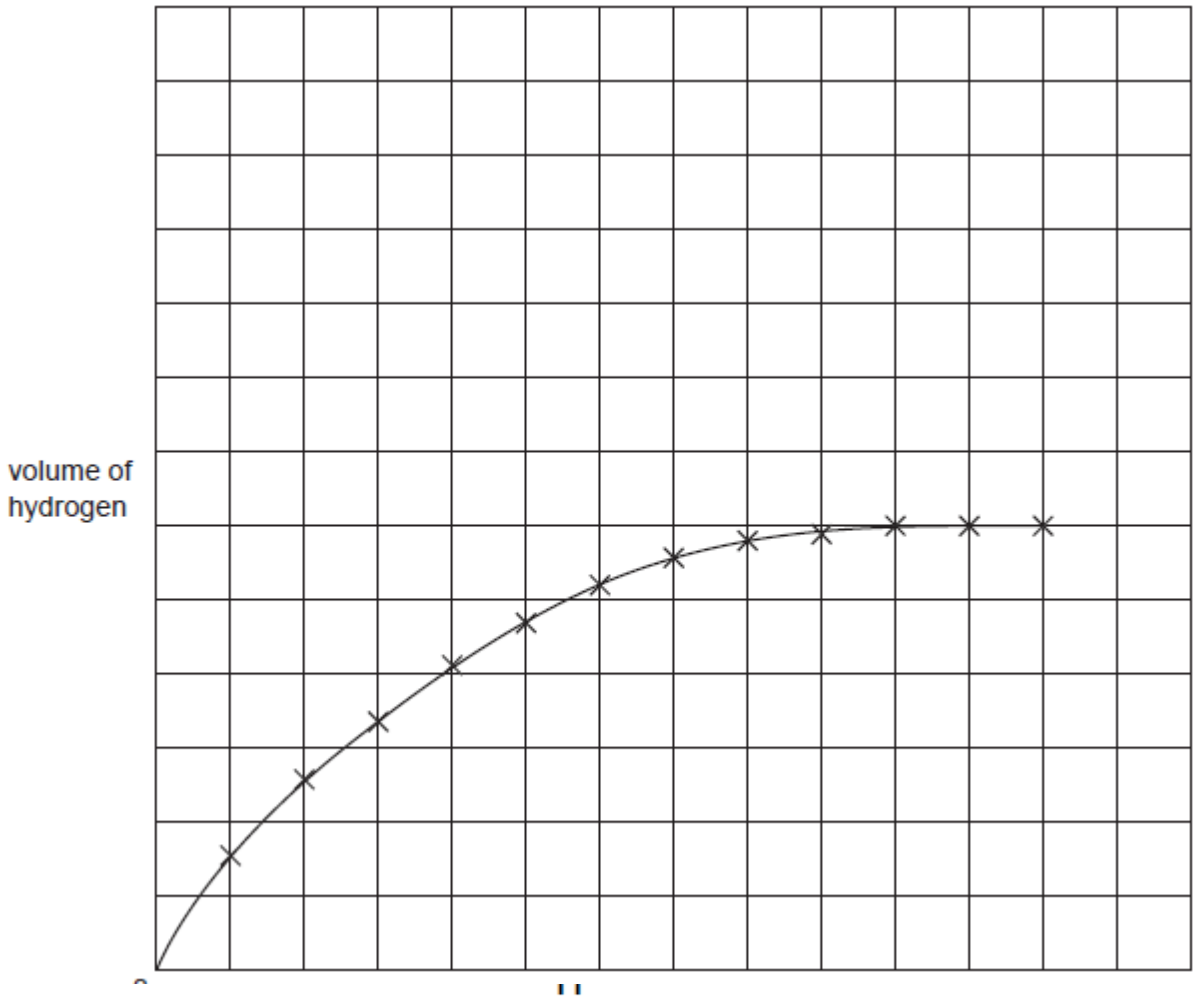
7 The rate of a reaction depends on concentration of reactants, temperature and possibly a catalyst or light.

(a) A piece of magnesium ribbon was added to 100 cm^3 of 1.0 mol/dm^3 hydrochloric acid. The hydrogen evolved was collected in a gas syringe and its volume measured every 30 seconds.



/

In all the experiments mentioned in this question, the acid was in excess.
The results were plotted to give a graph.



(i) The experiment was repeated. Two pieces of magnesium ribbon were added to 100 cm^3 of 1.0 mol/dm^3 hydrochloric acid. Sketch this graph on the same grid and label it X.

[2]

(ii) The experiment was repeated using one piece of magnesium ribbon and 100 cm^3 of 1.0 mol/dm^3 ethanoic acid. Describe how the **shape** of this graph would differ from the one given on the grid.

.....

..... [2]

(b) Reaction rate increases when concentration or temperature is increased.
Using the idea of reacting particles, explain why;

increasing concentration increases reaction rate,

.....

..... [2]

increasing temperature increases reaction rate.

.....

..... [2]

(c) The rate of a photochemical reaction is affected by light. A reaction, in plants, between carbon dioxide and water is photochemical.

(i) Name the **two** products of this reaction.

.....

..... [2]

(ii) This reaction will only occur in the presence of light and another chemical. Name this chemical.

..... [1]

Q# 45/ iGCSE Chemistry/2012/w/Paper 31/

3 The speed (rate) of a chemical reaction depends on a number of factors which include temperature and the presence of a catalyst.

(a) Reaction speed increases as the temperature increases.

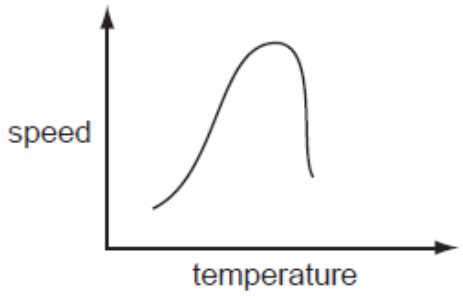
(i) Explain why reaction speed increases with temperature.

.....

.....

..... [3]

(ii) Reactions involving enzymes do not follow the above pattern.
The following graph shows how the speed of such a reaction varies with temperature.



Suggest an explanation why initially the reaction speed increases then above a certain temperature the speed decreases.

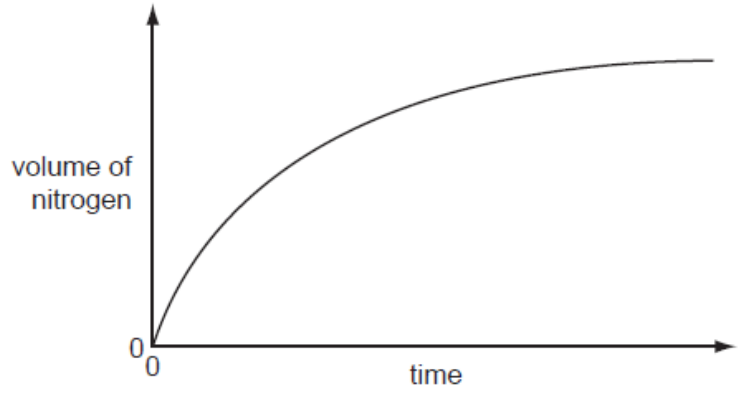
.....

..... [2]

(b) An organic compound decomposes to give off nitrogen.

$$C_6H_5N_2Cl(aq) \rightarrow C_6H_5Cl(l) + N_2(g)$$

The speed of this reaction can be determined by measuring the volume of nitrogen formed at regular intervals. Typical results are shown in the graph below.



(i) The reaction is catalysed by copper.
Sketch the graph for the catalysed reaction on the diagram above. [2]

(ii) How does the speed of this reaction vary with time?

..... [1]

(iii) Why does the speed of reaction vary with time?

.....

..... [2]

Q# 46/ iGCSE Chemistry/2003/w/Paper 3/

2 Some of the factors that can determine the rate of a reaction are concentration, temperature and light intensity.

(a) A small piece of calcium carbonate was added to an excess of hydrochloric acid. The time taken for the carbonate to react completely was measured.

$$CaCO_3(s) + 2HCl(aq) \longrightarrow CaCl_2(aq) + CO_2(g) + H_2O(l)$$

The experiment was repeated at the same temperature, using pieces of calcium carbonate of the same size but with acid of a different concentration. In all the experiments an excess of acid was used.

concentration of acid / mol dm^{-3}	4	2	2	.....
number of pieces of carbonate	1	1	2	1
time / s	.....	80	.....	160

(i) Complete the table (assume the rate is proportional to both the acid concentration and the number of pieces of calcium carbonate). [3]

(ii) Explain why the reaction rate would increase if the temperature was increased.

.....

.....[2]

(iii) Explain why the rate of this reaction increases if the piece of carbonate is crushed to a powder.

.....[1]

(iv) Fine powders mixed with air can explode violently. Name an industrial process where there is a risk of this type of explosion.

.....

.....[1]

(b) Sodium chlorate(I) decomposes to form oxygen and sodium chloride. This is an example of a photochemical reaction. The rate of reaction depends on the intensity of the light.

$$2NaClO(aq) \longrightarrow 2NaCl(aq) + O_2(g)$$

(i) Describe how the rate of this reaction could be measured.

.....

.....[2]

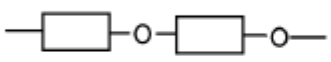
(ii) How could you show that this reaction is photochemical?

.....

.....[1]

Mark Scheme

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

Question	Answer	Marks
7(a)(i)	**step 2 and** it is electron gain / oxidation state decreases;	1
7(a)(ii)	silver (ion) **and** it accepts electrons / gets reduced / oxidation state decreases;	1
7(b)	*prediction:* the '*not covered*' section will be black; the '*covered in thick card*' section will be white/ cream; the '*covered in thin card*' section will be grey; *explanation:* the more light, the more silver ions are reduced;	 1 1 1 1
7(c)(i)	carbon dioxide + water → glucose + oxygen reactants correct; products correct;	 1 1
7(c)(ii)	chlorophyll;	1
7(c)(iii)	 one correct –O– link between rectangles; two correct glucose units with continuation bonds;	 1 1
7(c)(iv)	the reaction of glucose with oxygen to release (carbon dioxide and water and) energy; **or** the reaction of glucose in a biological system to release energy;	1

Q# 2/ iGCSE Chemistry/2015/s/Paper 31/

Question	Answer	Marks	Guidance
2(b)(i)	*Any **one** from:* (making) car (bodies); machinery; chains; pylons; white goods; nails; screws; as a building material; sheds / roofs; reinforcing concrete;	1	**A** bridges **A** tools **I** cutlery
2(b)(ii)	*Any **one** from:* knives; drills; railway tracks; machine/ cutting tools / hammers; razor blades; chisels;	1	**I** cutlery items **I** bridges
2(b)(iii)	M1 atoms or cations or (positive) ions or metal ions; M2 arranged in a lattice or in layers or in rows or in a regular structure; M3 rows or layers slide over one another;	3	**I** (sea of) electrons **R** protons or nuclei for M1 **A** M2 non-directional forces **A** ECF on particle named in M1 for M3 **I** 'atoms' slide over one another
2(b)(iv)	M1 carbon **atoms** or **particles** in structure different size (to cations); M2 so reduce moving or interrupt movement;	2	**R** ions and molecules for M1 **A** M2 for prevents sliding **A** M2 for 'stops' sliding
3(a)(i)	Zn to Zn^{2+} ; because electron loss;	2	**A** because oxidation number has increased for M2

Question	Answer	Marks	Guidance
3(a)(ii)	(2)H^+ or 'hydrogen ion(s)'; it accepts electrons or takes electrons (from zinc atoms);	2	**R** H_2 or 'hydrogen' **A** because it is reduced or because it decreases in oxidation number **A** it causes zinc to lose electrons
3(b)(i)	zinc displaces copper or zinc more reactive than copper; $Zn + CuCl_2 \rightarrow ZnCl_2 + Cu$ **OR** $Zn + Cu^{2+} \rightarrow Cu + Zn^{2+}$;	2	**A** copper less reactive than zinc **I** zinc reacts with copper ions or with Cu^{2+} or with copper chloride **I** zinc reacts with copper **I** Cu^{2+} ions are reduced **A** multiples **I** state symbols
3(b)(ii)	steeper (line) or higher gradient; (means an) increased rate; but the same (final) volume;	3	**A** less time to complete the reaction / same amount of gas in less time / faster reaction / more gas in the same time period **A** same volume of hydrogen produced **A** 'amount' for volume **A** no extra gas is made

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

3 (a) (i) pieces have (same) surface area [1]
same amount / mass / quantity / volume / number of moles of carbonate [1]

(ii) no more bubbles / carbon dioxide **or** piece disappears / dissolves [1]

(b) experiment 1 $Ca^{2+} + CO_2 + H_2O$ [1]

(c) (i) more concentrated **or** higher concentration (of acid) (in experiment 1) [1]
accept: arguments based on collision theory

(ii) ethanoic acid is a weak acid **or** hydrochloric acid is a strong acid [1]
accept: stronger or weaker

ethanoic acid less ionised / dissociated / lower / smaller concentration of hydrogen ions [1]
accept: less hydrogen ions and vice versa argument but not dissociation of ions

(iii) lower temperature (particles) have less energy [1]
moving more slowly [1]
fewer collisions / lower collision rate [1]
or
lower temperature (particles) have less energy [1]
fewer particles collide [1]
with the necessary energy to react [1]
note: less energy fewer successful collisions gains all 3 marks

Q# 4/ iGCSE Chemistry/2015/s/Paper 31/

Question	Answer	Marks	Guidance
5(c)(i)	example of a reversible reaction including attempts at removing/adding waters of crystallisation **OR** example of a reaction which under closed conditions would be reversible;	1	**A** written description of the reaction e.g. 'Haber process' unless equation is attempted in which case ignore written description **A** word equations/unbalanced equations **A** equations without equilibrium arrows **I** descriptions of physical changes
5(c)(ii)	*Any **two** from:* (a reaction) M1 which can take place in both directions **OR** which can be approached from both directions; M2 in which concentrations/macroscopic properties do not change (with time); M3 the two reaction rates are equal;	2	**I** reference to 'closed system' **A** 'a reaction which can go forwards and backwards' for M1 **I** 'a reaction with an equilibrium arrow' or with '⇌' for M1 **R** concentrations (of reactants and products) are the same
5(d)	M1 equilibrium goes to LHS **OR** equilibrium goes to reactants side; M2 because the concentration of chlorine decreases;	2	**A** reaction goes to LHS but **R** 'equilibrium goes to LHS and to products side' **A** backward reaction is favoured **I** less yield or less products **A** 'reactant' for 'chlorine' but not reactants **A** to replace missing chlorine

Question	Answer	Marks	Guidance
5(e)	M1 equilibrium goes to RHS **OR** equilibrium goes to products side; M2 exothermic reactions are favoured by low temperatures; M3 the forward reaction is exothermic;	3	**A** reaction goes to RHS but **R** 'equilibrium goes to RHS and to reactants side' **A** forward reaction is favoured **I** more yield or more products **A** for M1 and M2 'decreasing temperature makes the equilibrium go to RHS' **A** backward reaction is endothermic

Q# 5/ iGCSE Chemistry/2010/s/Paper 31/ Q4

(b) **(i)** with copper / first experiment [1]

(ii) copper acts as a catalyst [1]

(c) **(i)** smaller gradient [1]
not rate is slower

(ii) same final volume of hydrogen / same level (on graph) [1]

(d) temperature / heat [1]
increase temperature – reaction faster particles have more energy / particles move faster / particles collide more frequently / more particles have enough energy to react
not more excited
accept arguments for a decrease in temperature [1]

powdered
greater surface area
greater collision rate / more particles exposed (to acid)
any **two** [2]
not concentration / light / catalyst / pressure

Q# 6/ iGCSE Chemistry/2007/w/Paper 3/

7 **(a)** **(i)** lower concentration [1]
ACCEPT without reference to experiment 2
but higher concentration must be referred to expt 1
COND fewer collisions **or** lower rate of collision [1]

(ii) powdered so larger surface area [1]
COND so more collisions **or** higher rate of collisions [1]

(iii) higher temperature particles move faster
or more particles have enough energy to react **or** have more energy
or more particles have Ea [1]
COND collide more frequently
or more particles have energy to react
or more collisions result in a reaction [1]
NOTE for conformity faster collisions = rate of collisions

(b) **(i)** from origin [1]
gradient decreases until = 0 [1]
therefore has to be a curve

Q# 7/ iGCSE Chemistry/2004/w/Paper 3/

3 **(a)** **(i)** no change in concentration of reagents **or** rates equal **[1]**
Accept no change in amounts or it is as if the reaction has Stopped

(ii) back reaction is endothermic **or** the forward reaction is exothermic **[1]**
Increase in temperature favours the endothermic reaction which is the back reaction or vice versa. **[1]**
NB look for correct conclusion re thermicity and comment re position of equilibrium.

(iii) increased rate [1]
because molecules collide more frequently **or** concentration of molecules is increased **or** molecules are closer [1]
NOT they have more KE
increased yield [1]
high pressure favours side with few molecules **or** smaller volume **or** moves to reduce the pressure [1]
this is product side this can be implied [1]

Q# 8/ iGCSE Chemistry/2011/w/Paper 31/

5 (a) (i) rate of reaction decreases / gradient decreases [1]
because concentration of bromine decreases [1]
reaction stops because all bromine is used up [1]

(ii) initial rate greater / gradient greater [1]
because bigger surface area / more particles of iron exposed [1]
or:
final mass the same [1]
because mass of bromine is the same so the same mass of iron is used [1]

(iii) increase / decrease / change rate of stirring / not stirred [1]
measure new rate / compare results [1]

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

6 (a) rates equal [1]
concentrations do not change / macroscopic properties remain constant [1]
accept amounts do not change

(b) endothermic [1]
cond favoured by high temperatures [1]

(c) (i) move to left [1]
cond bigger volume / more moles etc [1]
do not insist on "gas"

(ii) less yellow solid / more brown liquid [1]
accept yellow to brown / less solid more liquid / goes brown

Q# 10/ iGCSE Chemistry/2005/w/Paper 3/

Question 3

(a)(i) because concentration of $BiCl_3$ decreases **[2]**
bismuth chloride used up **ONLY [1]**

(ii) products are being formed **or** concentration of products increases. Concentration mark given either **(i) or (ii)** **[1]**

(iii) reaction has come to equilibrium **[1]**
rates equal **or** no change in concentration **[1]**

(iv) equilibrium to left **or** favours backward reaction **or**
equilibrium moves to use up hydrochloric acid **[1]**
BiOCl used up **or** $BiCl_3$ formed **[1]**

Q# 11/ iGCSE Chemistry/2002/w/Paper 3/ Q2

(c) (i) rate decreases **or** becomes zero [1]
do **NOT** accept rate increases then decreases
COND concentration decreases [2]
hydrogen peroxide used up **ONLY** [1]

(ii) steeper initial gradient [1]
double final volume [1]

(iii) initial gradient less [1]
final volume the same [1]
must relate to shape of graph

Q# 12/ iGCSE Chemistry/2008/s/Paper 31/

6 (a) (i) (fine powder) large surface area [1]
high/faster/collision rate/more collisions/fast collisions
(between solid and oxygen in air) [1]

(ii) carbohydrate + oxygen → carbon dioxide + water [1]
ACCEPT flour

(b) rate depends on light
more light more silver **or** blacker
thicker card less light [3]

Q# 13/ iGCSE Chemistry/2004/s/Paper 3/ Q3

(c) (i) decreases **or** reaction stops **or** rate becomes zero [1]

(ii) concentration **or** number of effective collisions [1]
decreases [1]
used up **or** less chemical **or** less collisions etc **[1]** only

(iii) greater initial slope [1]
same final point [1]
as long as new curve touches the original curve near the top allocate the mark

(iv) greater surface area [1]

Q# 14/ iGCSE Chemistry/2012/w/Paper 31/

5 (a) (i) rate of reaction; [1]
influenced by light / only happens in light; [1]
or:
turns light into chemical energy = [2]
accept: light is catalyst = [1]

(ii) reduction of silver halides; [1]
they are reduced to silver / $2AgCl \rightarrow 2Ag + Cl_2$; [1]
appropriate importance given; [1]
or:
photosynthesis;
correct comment about chemistry carbon dioxide to carbohydrates / carbon dioxide to oxygen;
anything sensible e.g. its role in the food chain or decrease greenhouse effect or oxygen for respiration;
or:
chlorination;
making chloroalkanes;
appropriate importance given;

Q# 15/ iGCSE Chemistry/2012/w/Paper 31/ Q5

(b) (i) pressure would move position of equilibrium to right / increase yield of $COCl_2$; [1]
increase pressure favours side with less (gas) molecules / smaller volume; [1]

(ii) increase temperature favours endothermic reaction; [1]
so less products / reduce yield; [1]

(iii) keeps rate high / increase rate at lower temperatures; [1]

Q# 16/ iGCSE Chemistry/2005/s/Paper 3/ Q2

(c) (i) zinc and a reason **[1]**
Do not mark conseq to iodine in excess

(ii) final mass of zinc bigger **or** the level section higher **or** less zinc used up **[1]**
gradient less steep **or** longer time **or** falls more slowly **[1]**

(iii) steeper gradient **[1]**
same loss of mass of zinc **[1]**

Q# 17/ 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.

(ii) measure volume **or** count bubbles **[1]**
time **[1]**
NOT units

(iii) rate slows down **[1]**
Because the reaction is photochemical **or** rate depends on intensity of light **or** light less bright or less light falling on plant **or** light provides energy for photosynthesis etc. **[1]**

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

4 (a) (i) **fluorine** **[1]**

(ii) **iodine and astatine** **[1]**

(b) (i) $Cl_2 + 2Br^- \Longrightarrow 2Cl^- + Br_2$ **[2]**
not balanced ONLY [1]

(ii) because it has lost electron(s)(Must be electron transfer) [1]

Not conseq because it took electrons from the bromide [1]
or chlorine gained electrons
or because chlorine was reduced

(iii) Iodide **or** metals **or** iron(II) etc [1]
not iodine **accept** iodine ions **or** alkene

Q# 19/ iGCSE Chemistry/2015/s/Paper 31/ Q3

3(c)	M1 less steep (line) or lower gradient;		**A** alternative phrases e.g. 'shallower'
	M2 (because of) decreased rate;		**A** more time to complete the reaction **A** same amount of gas in more time **A** slower rate or slower reaction
	M3 ethanoic is a weak(er) acid;		ORA
	M4 only partially ionised or dissociated **OR** lower concentration of hydrogen ions;	4	**A** not fully dissociated or ionised **A** ionises less (than HCl) **I** less hydrogen ions

Q# 20/ iGCSE Chemistry/2008/s/Paper 31/

5 (a) (i) (concentration) of reactants/CO and Cl_2 increases [1]
(concentration) of product decreases/$COCl_2$) [1]

(ii) (decrease in pressure favours side)
with more molecules **or** moles **or** side with bigger volume (of gas) [2]
NB [2] or [0]

(b) forward reaction is exothermic [1]
COND because it is favoured by low temperatures **or** cool [1]
ACCEPT argument re back reaction

Q# 21/ iGCSE Chemistry/2007/w/Paper 3/ Q3 (b)

(iii) reducing **or** reduction **or** reductant [1]
lost electrons **or** given **or** donated electrons **or** transferred (to bromine) [1]
reduced [1]
gained **or** accepted electrons [1]

Q# 22/ iGCSE Chemistry/2003/w/Paper 3/ Q3

(c) (i) one involving lead – change 2 [1]
cond because electrons are gained [1]
or oxidation number less

(ii) correct equation [2]
$Zn + 2Ag^+ = 2Ag + Zn^{2+}$
not balanced **ONLY** [1]

Q# 23/ iGCSE Chemistry/2002/s/Paper 3/ Q2

(b) **light**
chlorophyll
water and carbon dioxide
react to form (glucose) and oxygen [4]
or equation [2]

Q# 24/ iGCSE Chemistry/2012/s/Paper 31/4

(d) (i) V^{3+} is oxidant; [1]

(ii) V^{3+} to V^{4+}; [1]
increase in oxidation number / electron loss; [1]

Q# 25/ iGCSE Chemistry/2011/w/Paper 31/ Q5

(b) (i) Fe to Fe^{2+} [1]
because oxidation is electron loss / increase in oxidation number [1]

(ii) Fe [1]

Q# 26/ iGCSE Chemistry/2011/s/Paper 31/ Q5

(d) (i) the reaction is exothermic / reaction produces heat/energy [1]
all the sodium hydroxide used up/neutralised / reaction has stopped [1]

(ii) adding colder acid / no more heat produced [1]
if not given in **(d)(i)** any comments such as "reaction has stopped" can gain mark

Q# 27/ iGCSE Chemistry/2010/w/Paper 31/

6 (a) (i) does not form compounds / does not accept and does not lose electrons / has full outer shell/has 8e in outer shell / it is a Noble Gas / it is in Group 0/8 [1]

(ii) small number of outer electrons / lose electrons then positive [1]
large number of outer electrons / gain electrons then negative [1]

Q# 28/ iGCSE Chemistry/2009/w/Paper 3/ Q6

(b) (i) add water to yellow powder **or** to anhydrous salt [1]
it would go green [1]

(ii) change from purple **or** pink [1]
to colourless **NOT** clear [1]

(iii) reacts with <u>oxygen</u> in air [1]

Q# 29/ iGCSE Chemistry/2005/w/Paper 3/ Q3

(b)(i) No change in volume **or** same number of moles on both sides **[1]**

(ii) move to right **[1]**
Increase in pressure favour side with smaller volume **or** smaller number of moles (of gas) **or** moves to side that tends to reduce pressure **[1]**

Q# 30/ iGCSE Chemistry/2002/w/Paper 3/

3 (a) (i) number of outer electrons increases [1]
or number of electrons more than complete energy level
or number of electrons to be lost
or accept clear examples
NOT just different groups or valencies

(ii) gain electrons [1]
number of electrons to be gained is less across period [1]

or number of outer electrons increases

Q# 31/ iGCSE Chemistry/2002/s/Paper 3/ Q2

(d) (i) protected by oxide layer or temperature/energy
heat low [1]

(ii) removal of oxide layer [1]
temperature/energy/heat increases [1]
NB comments must relate to this reaction

Q# 32/ iGCSE Chemistry/2001/w/Paper 3/ Q2 (b)

(v) silver salt or Ag^+ [1]
reduction or decomposition or silver, Ag, forms [1]
any reference to photography [1]

OR plastics
biodegradable
prevent littler or more easily disposed
OR chlorine or bromine
alkane
to make chloroalkanes or bromoalkanes
OR solar panels to make electricity ONLY [2]

Q# 33/ iGCSE Chemistry/2012/s/Paper 31/
4

(c) catalyst would not affect yield / change position of equilibrium / affects both sides equally; [1]
(higher) temperature would reduce yield / increase in temperature would favour back reaction; [1]

Q# 34/ iGCSE Chemistry/2009/w/Paper 3/ Q6

(b) (i) add water to yellow powder **or** to anhydrous salt [1]
it would go green [1]

Q# 35/ iGCSE Chemistry/2007/w/Paper 3/ 6 (c)

(iii) high pressure [1]
COND forward reaction volume decrease
or volume of reactants greater than that of products
or fewer moles of gas on the right
or fewer gas molecules on right [1]
NOTE accept correct arguments about either reactants **or** products

Q# 36/ iGCSE Chemistry/2005/s/Paper 3/

2 **(a)** $Zn + I_2 = Zn^{2+} + 2I^-$ **[2]**
For having either reactants **or** products correct ONLY [1]

Q# 37/ iGCSE Chemistry/2004/s/Paper 3/
iGCSE Chemistry/201

(c) **(i)** correctly balanced **[1]**

(ii) lost oxygen **[1]**
or decrease in oxidation number
NOT accepts electrons unless valid explanation

Q# 38/ iGCSE Chemistry/2003/w/Paper 3/ Q5

(c) (i) pink **or** purple [1]
colourless **NOT** clear [1]

Q# 39/ iGCSE Chemistry/2001/w/Paper 3/ QiGCSE Chemistry/201 (a)

(iii) reduction [1]
COND electron gain **or** decrease in oxidation number [1]

Q# 40/ iGCSE Chemistry/2001/w/Paper 3/ QiGCSE Chemistry/201

(b) (i) high temperature or heat [1]
back reaction endothermic or moves to left [1]

OR low pressure
left side has higher volume of gases or more moles of gas

OR remove carbon monoxide
reaction try to replace it

OR energy needed
bonds breaking or to decompose $Ni(CO)_4$

Q# 41/ iGCSE Chemistry/2014/s/Paper 31/

6 (a) (i) rate at t_2 less than at t_1 **or** the rate decreases (1)

rate at t_3 zero / reaction stopped (1) [2]

(ii) rate at t_2 less than at t_1 because **concentration** of hydrogen peroxide is less at t_2 **or concentration** of hydrogen peroxide is decreasing. (1)

(rate at t_3 zero / reaction stopped because) hydrogen peroxide is used up (1) [2]

(b) (i) steeper and must come from the origin (1)
final volumes the same (1) [2]

(ii) Any **two** from: [2]
steeper curve because of a faster rate
faster rate because of increased surface area
same amount / volume / mass / no of mol of hydrogen peroxide
ecf for M1 for a shallower curve because of slower rate.

(c) filter (and rinse / wash) (1)

dry manganese (IV) oxide (1)

weigh / measure mass manganese(IV) oxide after reaction (1)

the mass should be 0.1 g **or** unchanged. (1) [4]

Q# 42/ iGCSE Chemistry/2013/w/Paper 31/

4 (a) (i) (mass at t =0) – (mass at t = 5) [1]
NOTE: must have mass at t = 5 not final mass

(ii) fastest at origin
slowing down between origin and flat section gradient = 0
where gradrient = 0
three of above in approximately the correct positions [2]

(iii) 3 correct comments about gradient = [2]
2 correct comments about gradient = [1]
1 correct comment about gradient = [0] [2]

(b) start at origin and smaller gradient [1]
same final mass just approximate rather than exact [1]

(c) (i) smaller surface area [1]
lower collision rate [1]

(ii) molecules have more energy [1]
collide more frequently / more molecules have enough energy to react [1]

Q# 43/ iGCSE Chemistry/2011/w/Paper 31/

4 (a) rate of forward reaction equals rate of back reaction [1]
concentrations do not change / macroscopic properties remain constant (with time) [1]
accept: amounts

(b) (i) increase [1]
reaction 2 [1]
Vr > Vp [1]

(ii) same [1]
reaction 1 [1]
Vr = Vp [1]

(iii) decrease [1]
reaction 3 [1]
Vp > Vr [1]
accept: moles of gas / molecules of gas as an alternative to volume

Q# 44/ iGCSE Chemistry/2006/w/Paper 3/

7 (a) (i) greater initial slope or levels off later [1]
Twice final volume [1]

(ii) smaller slope [1]
same final volume [1]

(b) more particles in same volume/particles closer together [1]
greater collision rate [1]

molecules move faster [1]
greater collision rate [1]

OR molecules have more energy [1]
so more will have sufficient energy to react [1]

(c) (i) glucose [1]
oxygen [1]

(ii) chlorophyll [1]

Q# 45/ iGCSE Chemistry/2012/w/Paper 31/

3 **(a) (i)** any three from:
particles have more energy;
move faster;
collide more frequently;
more successful collisions; [3]
accept: atoms or molecules for particles
not: electrons
not: vibrate more

(ii) reaction faster with temperature increase; [1]
enzymes denatured / destroyed;
not: killed [1]

(b) (i) bigger initial gradient; [1]
same final volume of nitrogen; [1]

(ii) decrease / slows down; [1]

(iii) <u>concentration</u> of organic compound decreases; [2]
compound used up = [1]
or: fewer particles;
collision rate decreases;

Q# 46/ iGCSE Chemistry/2003/w/Paper 3/

2 (a) (i) 40 [1]
80 **or** 40 [1]
1 [1]
(ii) particles have more energy **or** moving faster [1]
collide more frequently
or collide with more energy [1]
(iii) greater surface area [1]
(iv) flour mills **or** coal mines **or** metal powders [1]
or fireworks **or** gunpowder

(b) (i) collect and measure <u>volume</u> of oxygen [1]
or mass **or** count bubbles
time [1]
(ii) measure rate in different light levels and comment [1]
accept if dark no reaction