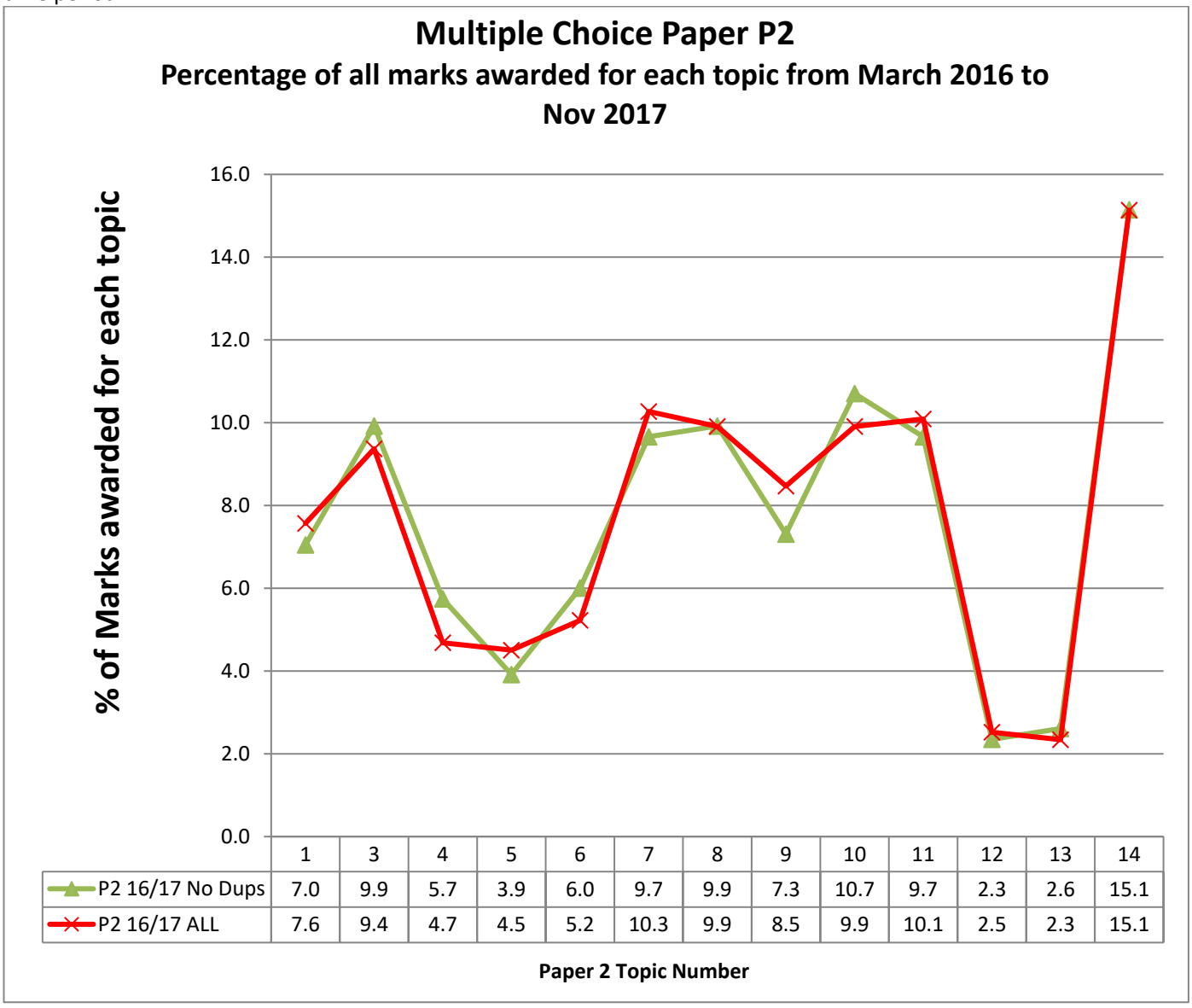
iG Extended EQ P2 EXTENDED 2016s to 2017s REVISION PACK 476marks All time zone variants

In the graph below, the red line with crosses is most representative of the ratios of marks per topic for P2 in this time period



	1	3	4	5	6	7	8	9	10	11	12	13	14
P2 16/17 No Dups	7.0	9.9	5.7	3.9	6.0	9.7	9.9	7.3	10.7	9.7	2.3	2.6	15.1
P2 16/17 ALL	7.6	9.4	4.7	4.5	5.2	10.3	9.9	8.5	9.9	10.1	2.5	2.3	15.1

Contents

Note on papers used:

There is a small proportion of questions that are duplicated across different time zones (possibly to ensure consistency when deciding UMS conversion scores for the different time zones)
Paper 21 keeps all questions, then for questions duplicated in only P22 and P23, the version from P23 is deleted. So P23 loses duplicates first and should end up the smallest, then P22.

Syllabus overview – Topic numbers used in this booklet follow the CIE syllabus

Content

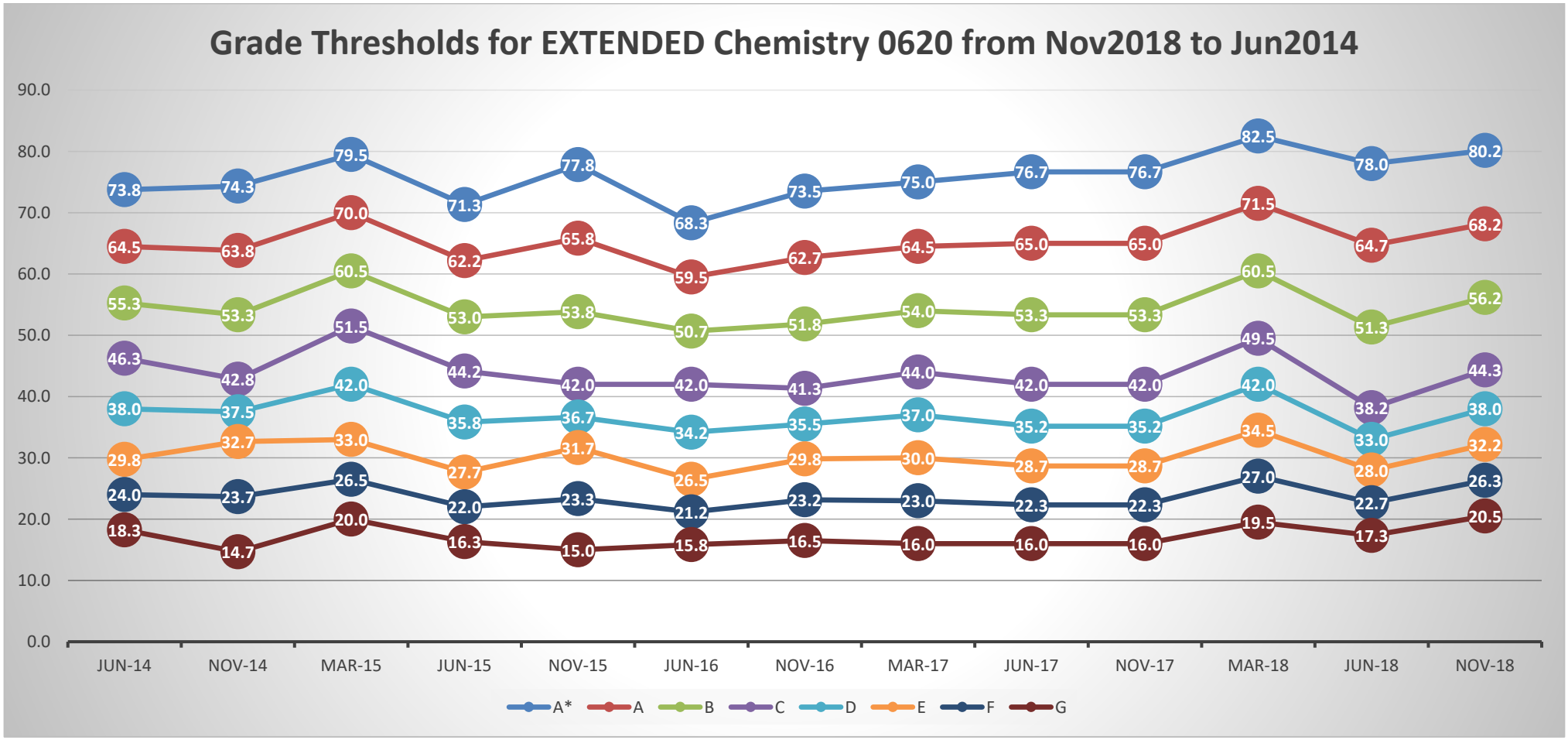
Candidates study the following topics:

1 The particulate nature of matter
2 Experimental techniques
3 Atoms, elements and compounds
4 Stoichiometry
5 Electricity and chemistry
6 Chemical energetics
7 Chemical reactions
8 Acids, bases and salts
9 The Periodic Table
10 Metals
11 Air and water
12 Sulfur
13 Carbonates
14 Organic chemistry

Mapping CIE Topic Numbers to a given textbook

CIE Topic	Topic Title	Textbook Chapters	Textbook Chapter Title
1	1 The particulate nature of matter	1	1 States of Matter.pdf
2	2 Experimental techniques (combined into topic 1 by me)	2	2 Mixtures Solutions and Solvents.pdf
3	3 Atoms, elements and compounds	3	3 Atoms and Elements.pdf
3	3 Atoms, elements and compounds	4	4 Atoms Combining.pdf
4	4 Stoichiometry	5	5 Reacting Masses and Chemical Equations.pdf
4	4 Stoichiometry	6	6 Using the Mole.pdf
7	7 Chemical reactions	7	7 Redox Reactions.pdf
5	5 Electricity and chemistry	8	8 Electricity and chemical change.pdf
6	6 Chemical energetics	9	9 Energy Changes and Reversible Reactions.pdf
7	7 Chemical reactions	10	10 The Speed of a Reaction.pdf
8	8 Acids, bases and salts	11	11 Acids Bases and Salts.pdf
9	9 The Periodic Table	12	12 The Periodic Table.pdf
10	10 Metals	13	13 the Behaviour of metals.pdf
10	10 Metals	14	14 Making use of metals.pdf
11	11 Air and water	15	15 Air and water.pdf
12	12 Sulfur	16	16 Some non metals and their compounds.pdf
13	13 Carbonates	16	16 Some non metals and their compounds.pdf
14	14 Organic chemistry	17	17 Organic Chemistry.pdf
14	14 Organic chemistry	18	18 Polymers.pdf
	Topics 2 and 8, mostly	19	19 In the Lab.pdf

Grade Thresholds for EXTENDED Chemistry 0620 from Nov2018 to Jun2014



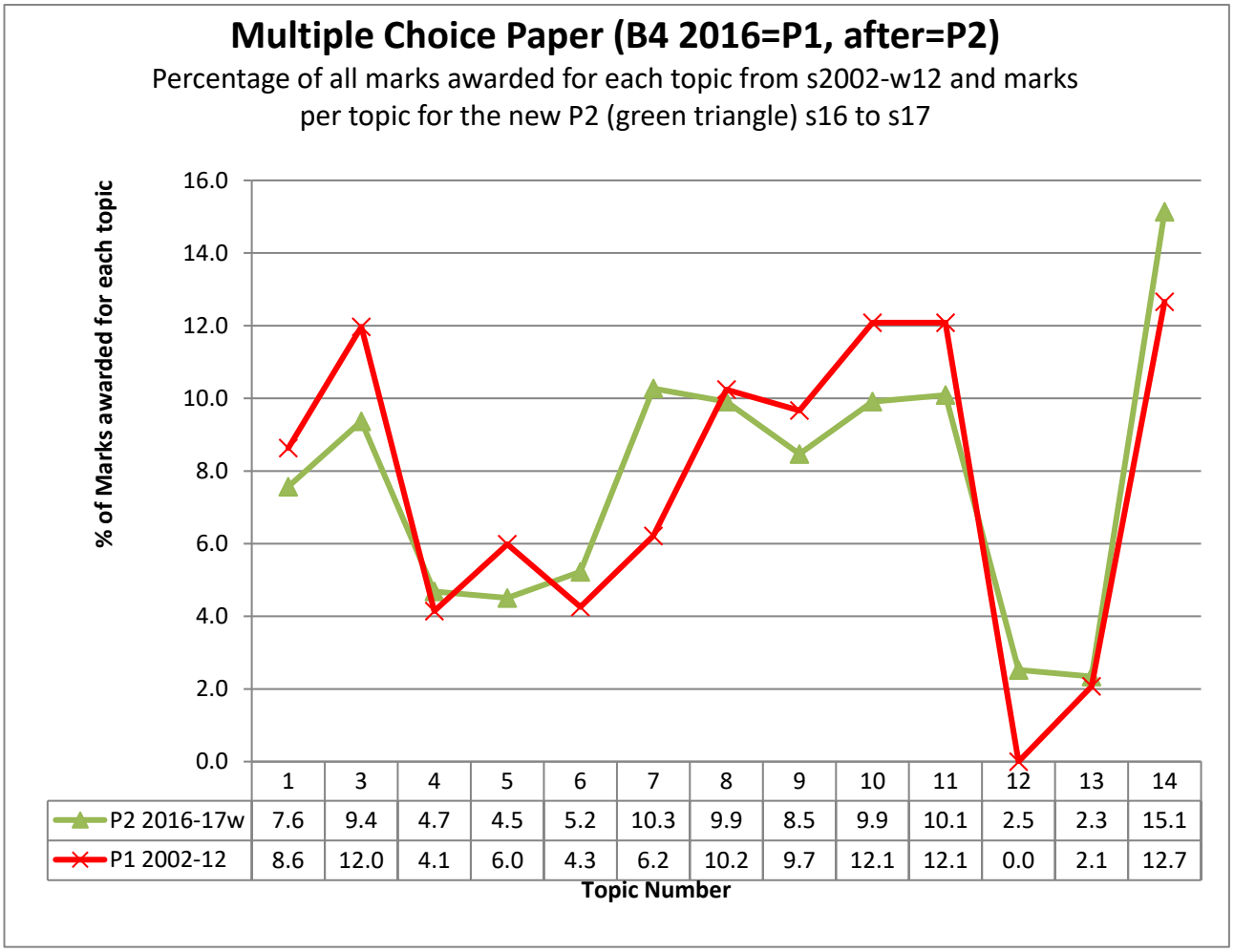
June 2016 was the first year using this new format, where P1 was replaced for the Extended candidates with Paper 2, the only substnatial change, and grade boundaries dropped by nearly 10% for the A*, emphasising how important understanding the exam techniques and patterns in Paper 2 really is!

The higher boundaries are usually for

- November students (possibly a result of more students in the Northern Hemisphere taking a resit)
- March, which is only carried out in India

Multiple Choice Paper Topic Frequency has largely remained stable from 2002 to 20017

(B4 2016=P1, after=P2)



	1	3	4	5	6	7	8	9	10	11	12	13	14
P2 2016-17w	7.6	9.4	4.7	4.5	5.2	10.3	9.9	8.5	9.9	10.1	2.5	2.3	15.1
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

The questions, however, are totally different between Core and Extended papers. Being able to do well in a Core paper (i.e. get 100%) means that you are still only working at a C grade level!!!

QUESTIONS SECTION

Topic Chem 1 **3 Q# 1/** iG Extended/2017/w/Paper 21/

1 Which process causes the greatest increase in the distance between particles?

A condensation

B freezing

C melting

D sublimation

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

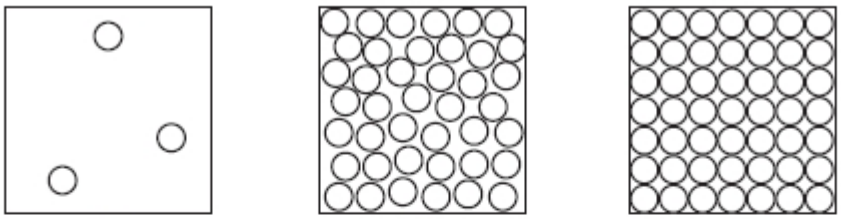
3 The results obtained from a chromatogram are shown.

	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

1 The diagram shows the arrangement of particles in the three states of matter.



Solid carbon dioxide (dry ice) sublimes to gaseous carbon dioxide.

Which row describes the initial and final states?

	initial state	final state
A	P	R
B	Q	P
C	R	P
D	R	Q

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

1 Which statement describes sublimation?

A Particles moving slowly past each other speed up and move further apart.

B Particles vibrating next to each other become mobile and move slowly past each other.

C Particles vibrating next to each other start to move rapidly and move further apart.

D Rapidly moving particles slow down and move closer together.

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

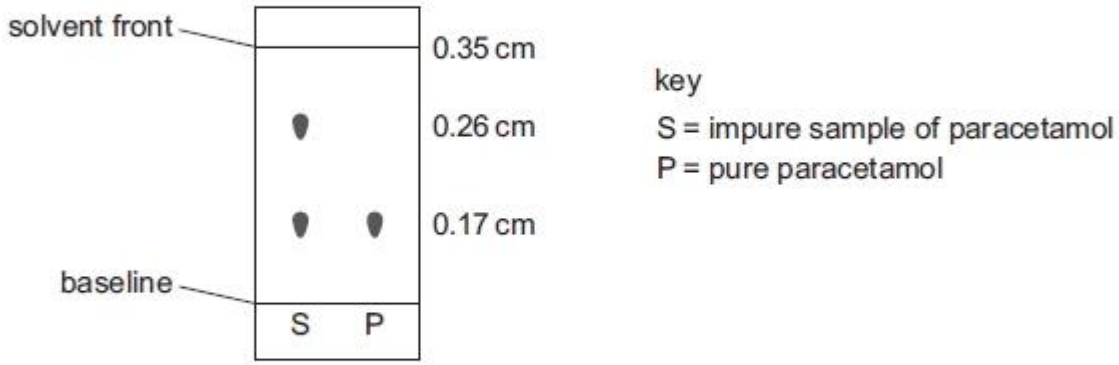
B 100 cm^3 beaker

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

Topic Chem 1 **2 Q# 4/** iG Extended/2017/s/Paper 23/

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.

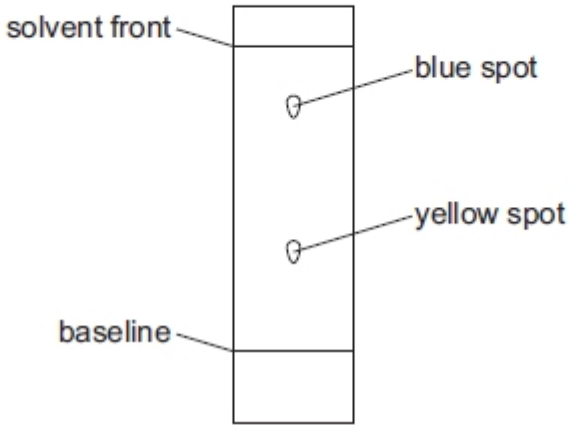
B It is a liquid at 69 °C and a gas at 380 °C.

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

Topic Chem 1 **2 Q# 5/** iG Extended/2017/s/Paper 22/

2 Impurities change the melting and boiling points of substances.

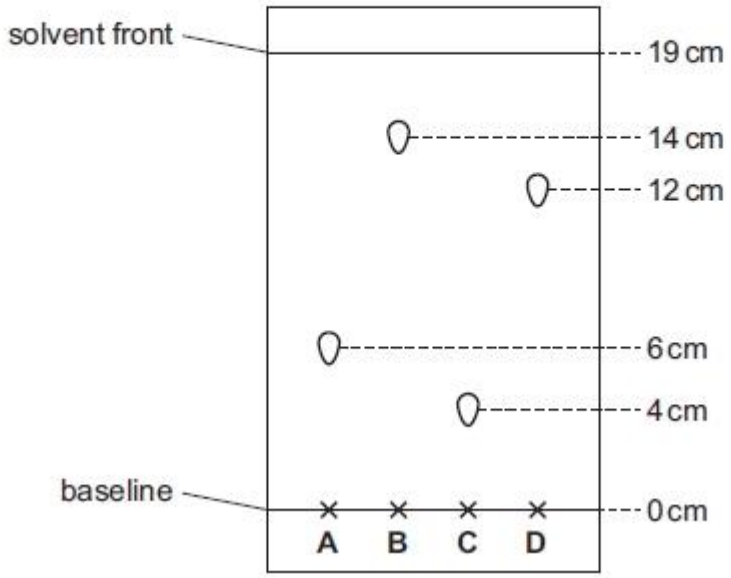
Sodium chloride is added to a sample of pure water.

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.

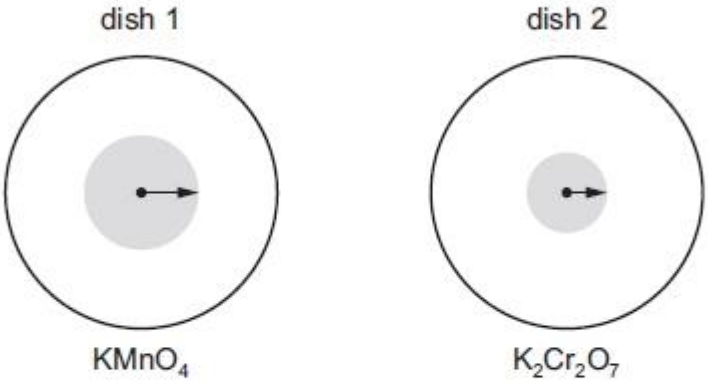
Which substance has an R_f value of approximately 0.32?



Topic Chem 1 **3 Q# 6/** iG Extended/2017/s/Paper 21/

1 Small crystals of purple $KMnO_4$ (M_r = 158) and orange $K_2Cr_2O_7$ (M_r = 294) were placed at the centres of separate petri dishes filled with agar jelly. They were left to stand under the same physical conditions.

After some time, the colour of each substance had spread out as shown.



The lengths of the arrows indicate the relative distances travelled by particles of each substance.

Which statement is correct?

A Diffusion is faster in dish 1 because the mass of the particles is greater.

B Diffusion is faster in dish 2 because the mass of the particles is greater.

C Diffusion is slower in dish 1 because the mass of the particles is smaller.

D Diffusion is slower in dish 2 because the mass of the particles is greater.

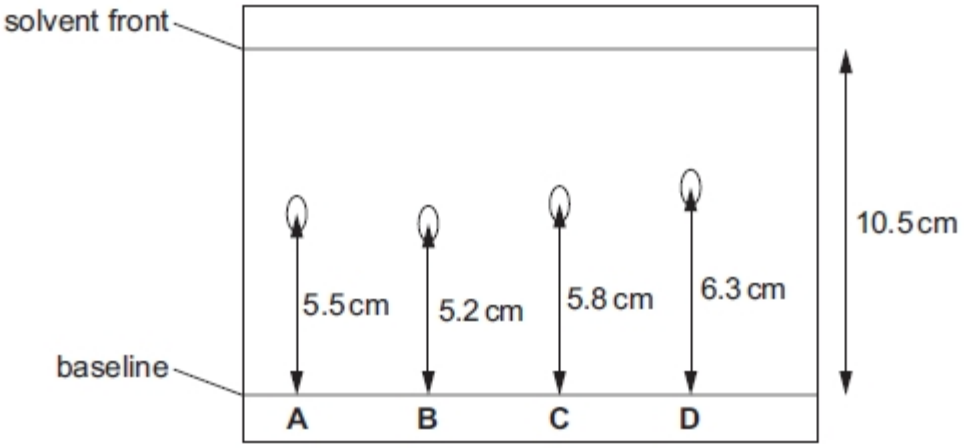
2 Pure water has a boiling point of 100 °C and a freezing point of 0 °C.

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

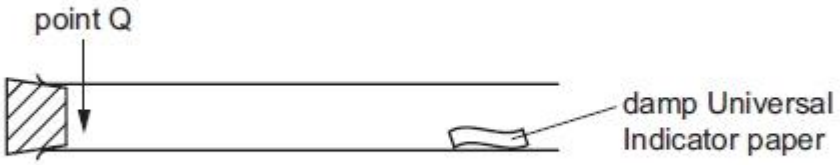
3 A chromatogram obtained from the chromatography of four substances is shown.

Which substance has an R_f value of 0.6?



Topic Chem 1 **3 Q# 7/** iG Extended/2017/m/Paper 22/

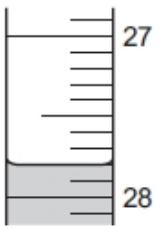
1 A gas is released at point Q in the apparatus shown.



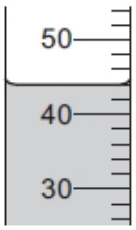
Which gas changes the colour of the damp Universal Indicator paper most quickly?

	gas	relative molecular mass
A	ammonia	17
B	carbon dioxide	44
C	chlorine	71
D	hydrogen	2

2 The diagrams show liquids in a burette and a measuring cylinder.



burette

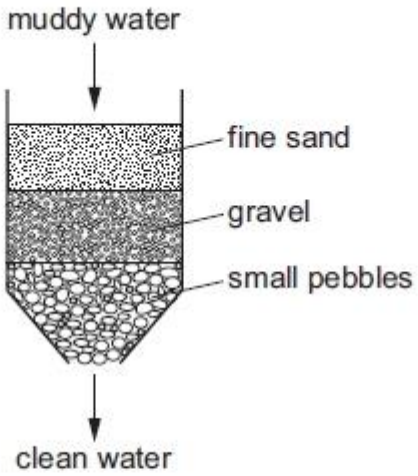


measuring cylinder

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

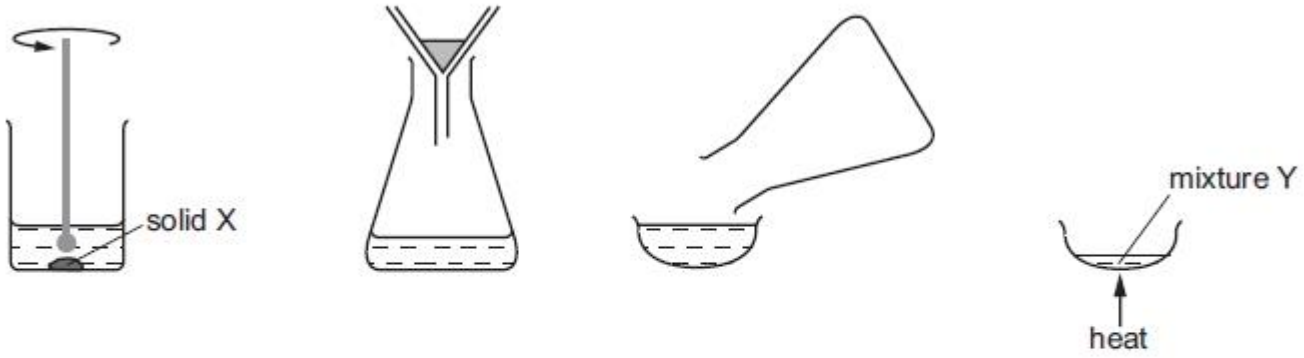
C filtration

D solvent extraction

Topic Chem 1 **1 Q# 8/** iG Extended/2016/w/Paper 23/

3 A solid X is purified in five steps.

The first four steps of the purification are shown in the diagram.



In **step 5**, how is a pure sample of solid X obtained from mixture Y?

A dissolving

B distillation

C evaporating

D filtering

Topic Chem 1 **1 Q# 9/** iG Extended/2016/w/Paper 22/

3 A sample contains a mixture of powdered limestone (calcium carbonate), sugar and wax.

What is the correct way to obtain a pure sample of sugar?

A Dissolve the mixture in dilute hydrochloric acid, filter and wash the residue.

B Dissolve the mixture in hexane, filter and evaporate the filtrate.

C Dissolve the mixture in water, filter and evaporate the filtrate.

D Dissolve the mixture in water, filter and wash the residue.

Topic Chem 1 **3 Q# 10/** iG Extended/2016/w/Paper 21/

1 'Particles moving **very slowly** from an area of higher concentration to an area of lower concentration.'

Which process is being described?

A a liquid being frozen

B a solid melting

C a substance diffusing through a liquid

D a substance diffusing through the air

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

burette

B

clock

C

pipette

D

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?

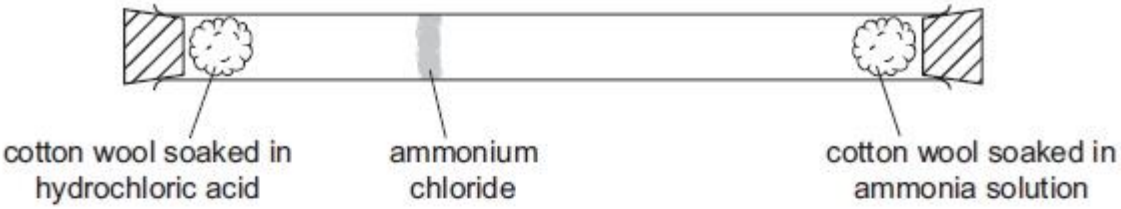
A a mixture of P and R

B a mixture of Q and P

C a mixture of Q and R

D a mixture of R and S

1 The diagram shows an experiment to demonstrate diffusion.



Which statement explains why the ring of ammonium chloride appears as shown?

A Ammonia solution only produces a gas which moves until it meets the hydrochloric acid.

B Both solutions produce a gas, but ammonia moves quicker than hydrogen chloride because it is lighter.

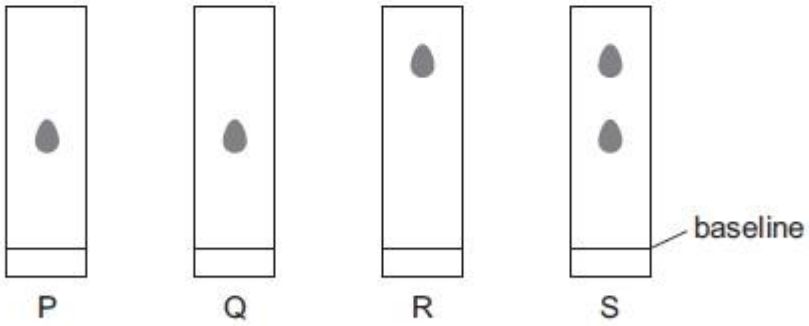
C Hydrochloric acid produces hydrogen chloride which stays at one end of the tube until the ammonia reaches it.

D The two solutions run along the tube until they meet.

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?

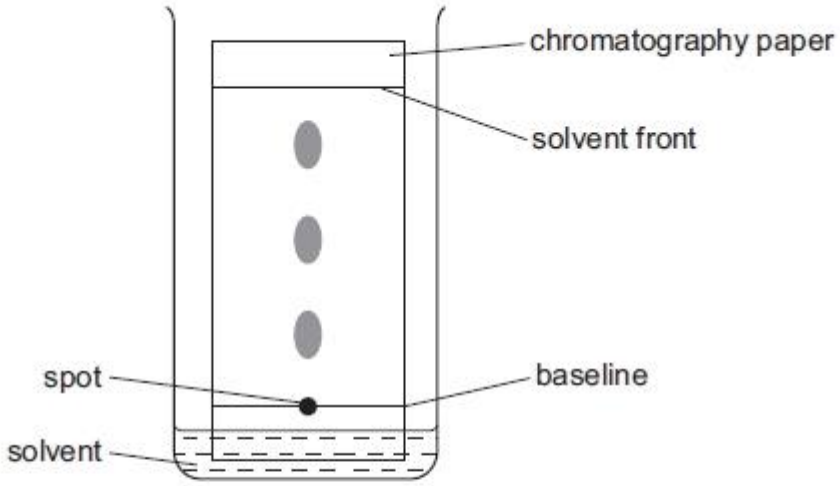
A P and Q are pure substances.

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 $\frac{\text{the distance travelled by the solvent front}}{\text{the distance travelled by the component}}$

Topic Chem 1 **3 Q# 12/** iG Extended/2016/s/Paper 22/

1 The particles of a substance gain energy and change from a regular ordered structure to a disordered structure with large distances between the particles.

Which change of state is described?

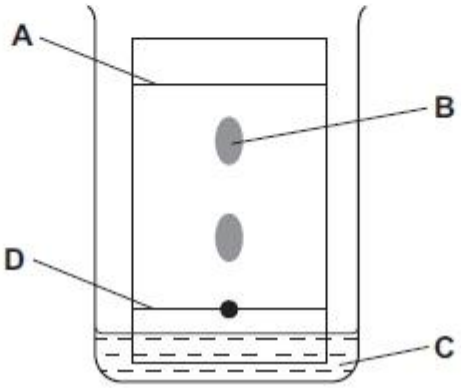
A boiling

B evaporation

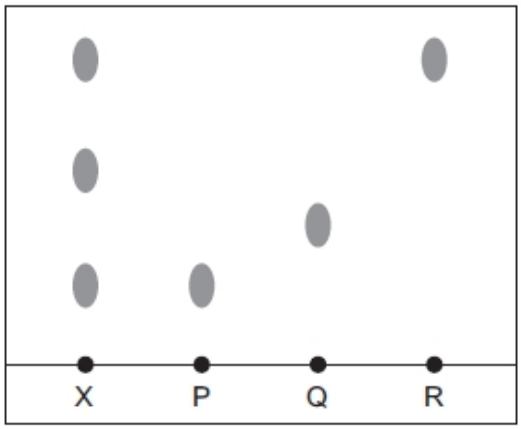
C melting

D sublimation

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.

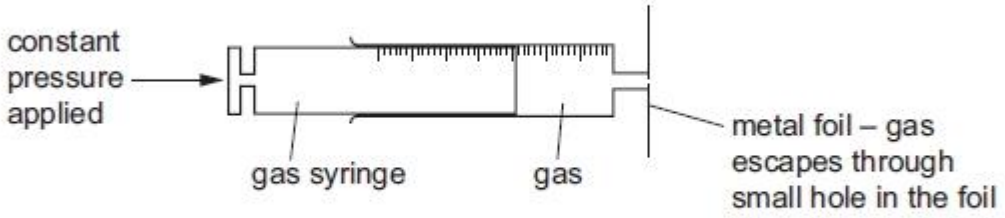
B P and R could be present in X.

C P and R have different solubilities in the solvent.

D Q has a greater R_f value than R.

Topic Chem 1 **3 Q# 13/** iG Extended/2016/s/Paper 21/

1 The rate of diffusion of two gases, methane, CH_4, and ethene, C_2H_4, is measured using the apparatus shown.



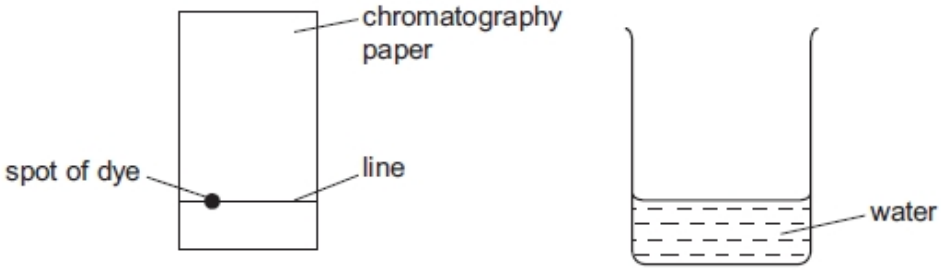
Which gas diffuses faster and why?

	gas that diffuses faster	reason
A	ethene	Ethene molecules are heavier and so move faster.
B	ethene	Ethene molecules have a double bond which makes them more reactive.
C	methane	Methane molecules are lighter and so move faster.
D	methane	Methane molecules are smaller so they can get out of the small hole more easily.

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.

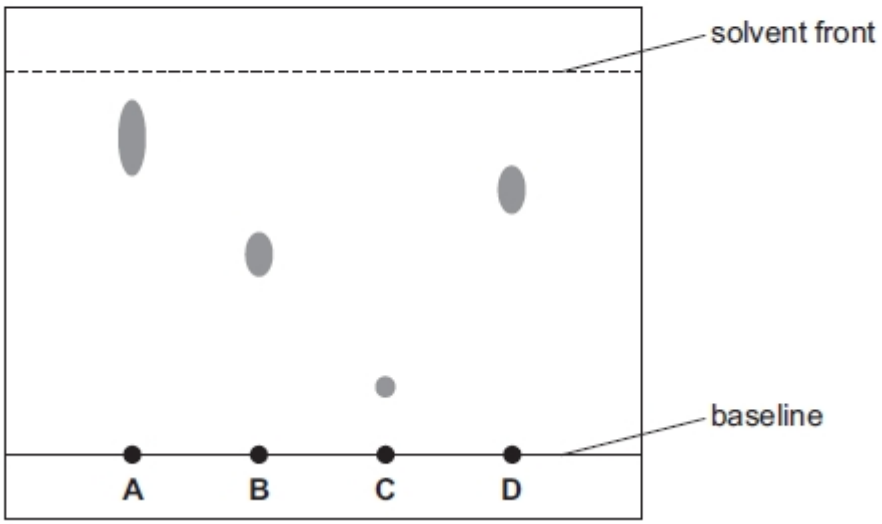


Which row is correct?

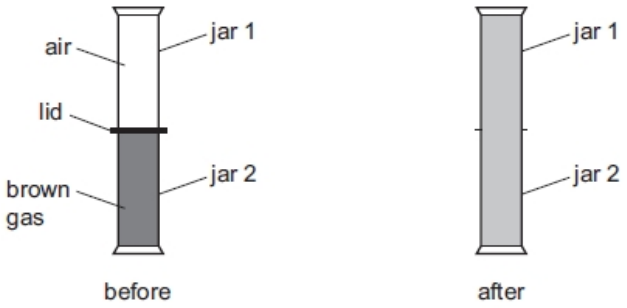
	what is used to draw the line	position of spot
A	ink	above the level of the water
B	ink	below the level of the water
C	pencil	above the level of the water
D	pencil	below the level of the water

3 The paper chromatogram below was obtained from four different dyes.

Which dye has an R_f value of 0.7?



1 Two gas jars are set up as shown.



The lid is removed and the gas jars are left to stand. After some time the contents of both gas jar are brown.

Which process causes this to happen?

A condensation

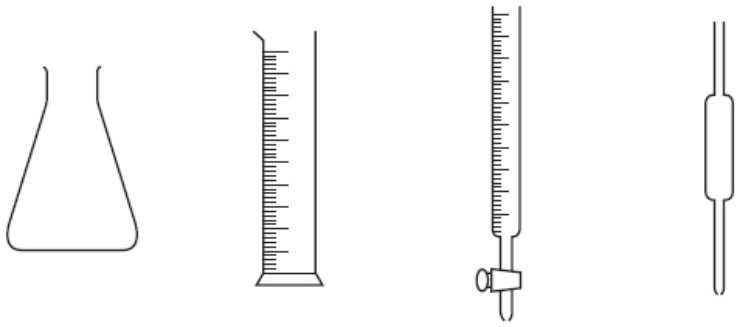
B diffusion

C evaporation

D filtration

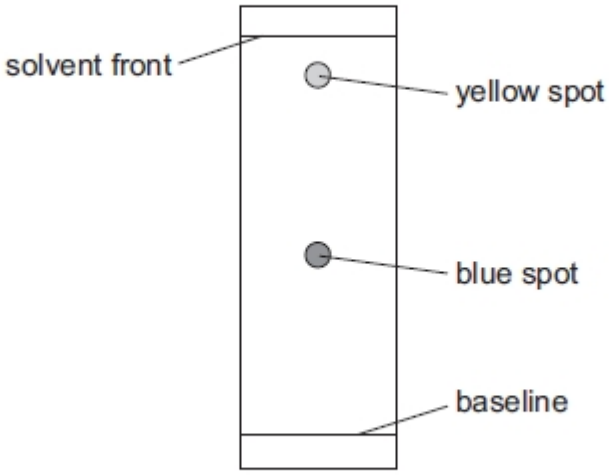
2 Which piece of apparatus is used to measure variable quantities of liquid in a titration?

A **B** **C** **D**



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

4 Two statements about silicon(IV) oxide are given.

1 It is a hard substance.

2 It has a macromolecular structure with strong covalent bonds.

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 not correct.

D Statement 2 is correct but statement 1 is not correct.

5 Which statement explains why isotopes of the same element have the same chemical properties?

A They have a different number of neutrons in the nucleus.

B They have the same number of neutrons in the nucleus.

C They have the same number of outer shell electrons.

D They have the same number of protons as neutrons.

6 Which dot-and-cross diagram shows the outer shell electron arrangement in a molecule of nitrogen?

A

B

C

D

7 The equation for the reaction between barium chloride solution and dilute sulfuric acid is shown.

$$BaCl_2 + H_2SO_4 \rightarrow BaSO_4 + 2HCl$$

Which row shows the state symbols for this equation?

	$BaCl_2$	H_2SO_4	$BaSO_4$	$2HCl$
A	(aq)	(aq)	(s)	(aq)
B	(aq)	(l)	(s)	(aq)
C	(l)	(aq)	(s)	(l)
D	(aq)	(l)	(aq)	(l)

4 Which row describes silicon(IV) oxide?

	has a giant structure	is an acidic oxide	conducts electricity
A	✓	✓	✓
B	✓	✓	✗
C	✓	✗	✗
D	✗	✓	✓

5 Why do isotopes of the same element have the same chemical properties?

A They have the same nucleon number.

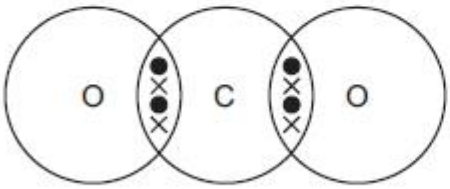
B They have the same number of electrons in the outer shell.

C They have the same number of neutrons in the nucleus.

D They have the same number of protons as neutrons.

6 Which dot-and-cross diagram shows the outer shell electron arrangement in a molecule of carbon dioxide?

A



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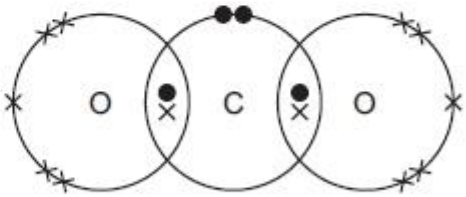

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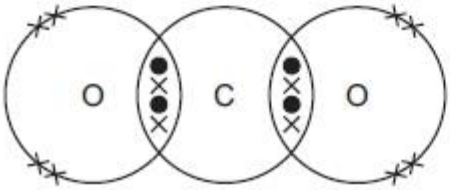

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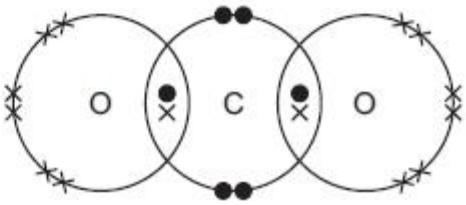


4 Which compound is silicon(IV) oxide?

	melting point /°C	good electrical conductor when solid	good electrical conductor when molten
A	–73	no	no
B	801	no	yes
C	1495	yes	yes
D	1710	no	no

5 Carbon has three naturally occurring isotopes, ^{12}C, ^{13}C and ^{14}C.

Which statement explains why the isotopes have the same chemical properties?

A They have the same number of electrons in the first shell.

B They have the same number of electrons in the outer shell.

C They have the same number of neutrons in the nucleus.

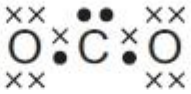
D They have the same number of protons as neutrons.

6 Which dot-and-cross diagram shows the outer shell electron arrangement in a molecule of carbon dioxide?

A

B

C



D

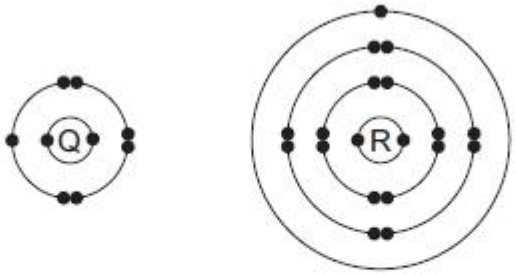
7 The equation represents the reaction between solid magnesium oxide and dilute hydrochloric acid to form magnesium chloride and water.

$$MgO + 2HCl \rightarrow MgCl_2 + H_2O$$

Which row shows the state symbols for hydrochloric acid, magnesium chloride and water?

	HCl	$MgCl_2$	H_2O
A	(aq)	(aq)	(l)
B	(aq)	(l)	(l)
C	(l)	(aq)	(aq)
D	(l)	(l)	(aq)

4 The electronic structures of atoms Q and R are shown.



Q and R form an ionic compound.

What is the formula of the compound?

A QR_7 **B** Q_2R_4 **C** QR **D** Q_7R

5 Which substance is a macromolecule?

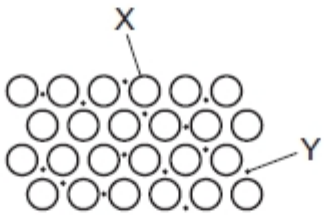
A ammonia

B carbon dioxide

C diamond

D water

6 The diagram shows metallic bonding.



Which labels are correct?

	X	Y
A	atomic nucleus	outer electron
B	metal atom	mobile electron
C	metal ion	mobile electron
D	positive ion	negative ion

Topic Chem 3 **3 Q# 19/** iG Extended/2017/s/Paper 22/

4 Which element does **not** form a stable ion with the same electronic structure as argon?

A aluminium

B chlorine

C phosphorus

D potassium

5 Graphite and diamond are both forms of the element carbon.

Which row shows the number of other carbon atoms that each carbon atom is covalently bonded to in graphite and diamond?

	graphite	diamond
A	3	3
B	3	4
C	4	3
D	4	4

6 Which statement describes metallic bonding?

A The attraction between a lattice of negative ions and delocalised protons.

B The attraction between a lattice of positive ions and delocalised electrons.

C The attraction between delocalised protons and electrons.

D The attraction between oppositely charged ions.

Topic Chem 3 **3 Q# 20/** iG Extended/2017/s/Paper 21/

4 Sodium reacts with chlorine to form sodium chloride.

Which statements describe what happens to the sodium atoms in this reaction?

1 Sodium atoms form positive ions.

2 Sodium atoms form negative ions.

3 Sodium atoms gain electrons.

4 Sodium atoms lose electrons.

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

5 Diamond is extremely hard and does not conduct electricity.

Which statement explains these properties?

A It has a lattice of positive carbon ions in a 'sea of electrons'.

B It has delocalised electrons and each carbon atom forms three covalent bonds with other carbon atoms.

C It has no delocalised electrons and each carbon atom forms four covalent bonds with other carbon atoms.

D It has strong ionic bonds between each carbon atom.

6 Which statement about metals is **not** correct?

A Metals are malleable because the metal ions can slide over one another.

B Metals conduct electricity because electrons can move through the lattice.

C Metals consist of a giant lattice of metal ions in a 'sea of electrons'.

D Metals have high melting points because of the strong attraction between the metal ions.

Topic Chem 3 **4 Q# 21/** iG Extended/2017/m/Paper 22/

4 Which statement explains why isotopes of an element have the same chemical properties?

A They have different numbers of neutrons.

B They have the same number of electrons as protons.

C They have the same number of electrons in the outer shell.

D They have the same number of protons in the nucleus.

5 The formulae of some ions are shown.

positive ions	negative ions
Al^{3+}	Br^-
Ca^{2+}	CO_3^{2-}
Cu^{2+}	NO_3^-
Fe^{3+}	S^{2-}
K^+	SO_4^{2-}

In which row is the formula **not** correct?

	compound	formula
A	aluminium sulfate	$Al_2(SO_4)_3$
B	calcium nitrate	$Ca(NO_3)_2$
C	iron(III) bromide	Fe_3Br
D	potassium sulfide	K_2S

6 Diamond and silicon(IV) oxide both have giant structures.

Which statements are correct?

1 Both substances are compounds.

2 There are strong covalent bonds in diamond.

3 Silicon(IV) oxide is bonded ionically.

4 Both substances have very high melting points.

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

7 Which statement about metals is correct?

A Layers of positive ions can slide over each other making metals malleable.

B Metallic bonding consists of a lattice of negative ions in a sea of delocalised electrons.

C Metallic bonding consists of a lattice of positive ions in a sea of delocalised negative ions.

D Metals conduct electricity because positive ions are free to move.

Topic Chem 3 **4 Q# 22/** iG Extended/2016/w/Paper 23/

4 An atom has three electron shells. There are three electrons in the outer shell.

How many protons and how many neutrons are in this atom?

	protons	neutrons
A	13	14
B	13	27
C	14	13
D	21	24

5 Ethanol is a liquid at room temperature and boils at 78 °C.

Sodium chloride is a solid at room temperature.

Which statement about the bonding in ethanol and sodium chloride is **not** correct?

A Each ethanol molecule is held together by weak covalent bonds.

B The ethanol molecules are held together by weak attractive forces.

C The sodium ions and chloride ions are held together by strong attractive forces.

D The sodium ions and chloride ions are held together in a giant lattice.

6 The molecules N_2, C_2H_4, CO_2 and CH_3OH all have covalent bonds.

These bonds consist of shared pairs of electrons.

Which row gives the total number of shared pairs of electrons in the molecules shown?

	molecule	total number of shared pairs of electrons
A	N_2	2
B	C_2H_4	6
C	CO_2	2
D	CH_3OH	4

7 Metals are malleable.

Which statement explains why metals are malleable?

A Metallic bonding is very strong.

B Metals are good conductors of electricity.

C Positive metal ions are arranged in a regular lattice structure.

D The layers of positive metal ions can slide over each other.

Topic Chem 3 **4 Q# 23/** iG Extended/2016/w/Paper 22/

4 The table shows information about four different particles.

particle	proton number	nucleon number	number of protons	number of neutrons	number of electrons
Na	11	23	11	W	11
Na^+	11	23	11	12	X
O	8	16	8	Y	8
O^{2-}	8	16	8	8	Z

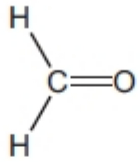
What are the values of W, X, Y and Z?

	W	X	Y	Z
A	11	10	10	8
B	11	11	8	10
C	12	10	8	10
D	12	11	10	8

5 In which ionic compound do the metal ion and the non-metal ion have the same electronic structure?

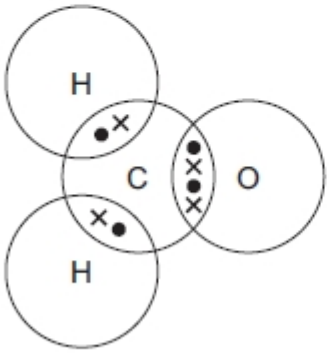
A CaO **B** KBr **C** MgO **D** NaCl

6 The structure of methanal is shown.

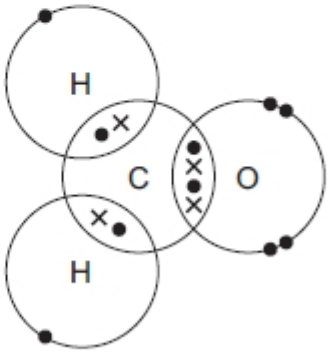


Which diagram shows the arrangement of outer shell electrons in a molecule of methanal?

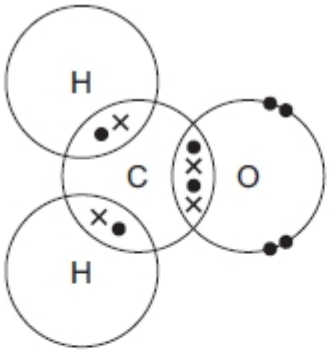
A



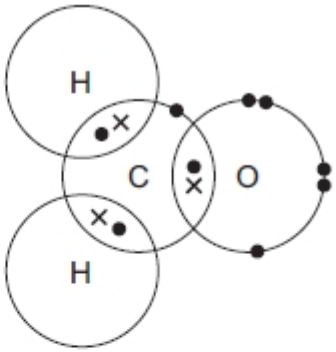
B



C



D



7 Iron is a metal. Its structure consists of a giant lattice of positive ions in a 'sea of electrons'.

Which statements about solid iron are correct?

1 Iron conducts electricity because the electrons are free to move.

2 Iron conducts heat because the positive ions are free to move.

3 Iron has a high melting point due to the strong covalent bonds.

4 Iron is malleable because the layers of ions can slide over one another.

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

4 The table shows information about atoms of three different elements.

element	proton number	nucleon number	number of protons	number of neutrons	number of electrons
chlorine	17	35	17	W	17
chlorine	17	X	17	19	17
argon	Y	40	18	22	18
potassium	19	39	19	20	Z

What are the values of W, X, Y and Z?

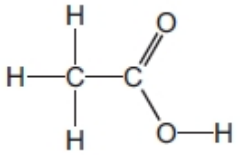
	W	X	Y	Z
A	18	35	18	19
B	18	36	18	19
C	19	35	19	18
D	19	36	19	18

5 Metal P reacts with non-metal Q to form a compound.

Which process takes place and which type of compound is formed?

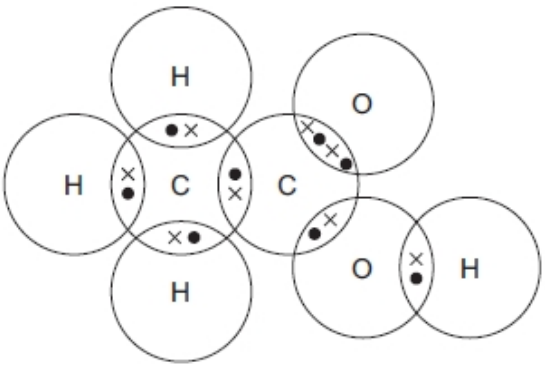
	process	type of compound
A	electrons are transferred from P to Q	covalent
B	electrons are transferred from P to Q	ionic
C	electrons are transferred from Q to P	covalent
D	electrons are transferred from Q to P	ionic

6 The structure of ethanoic acid is shown.

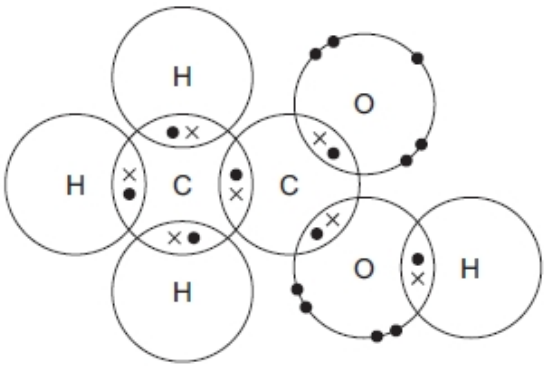


Which diagram shows the arrangement of outer shell electrons in a molecule of ethanoic acid?

A



B



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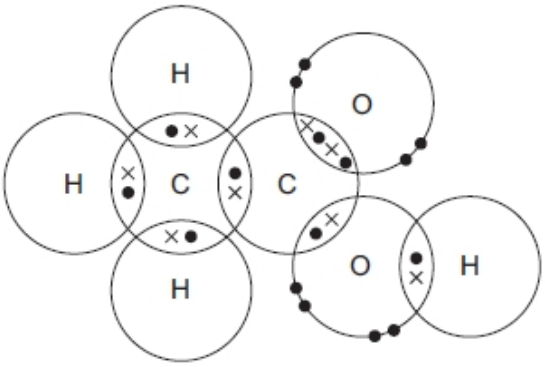
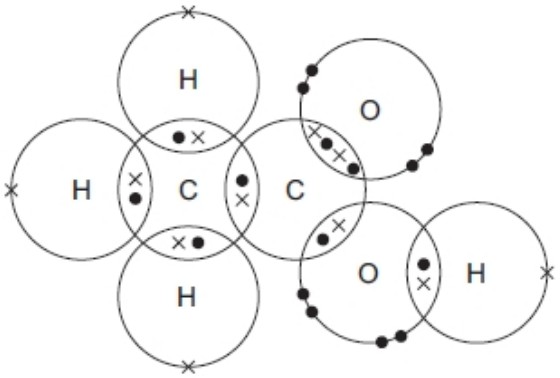


D



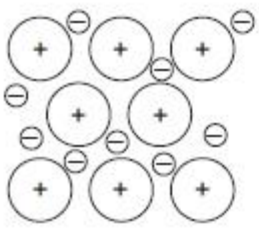
7 X is a solid at room temperature.

X has a high melting point.

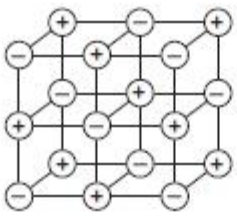
Solid X conducts electricity.

Which diagram shows how the particles are arranged in solid X?

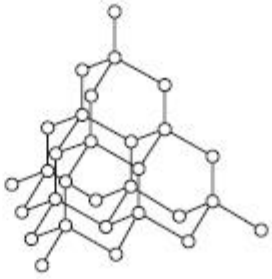
A



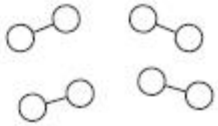
B



C



D



Topic Chem 3 **1 Q# 25/** iG Extended/2016/s/Paper 23/

7 Which substance exists as a lattice of positive ions in a 'sea of electrons'?

A liquid potassium chloride

B solid graphite

C solid magnesium

D solid silicon(IV) oxide

Topic Chem 3 **4 Q# 26/** iG Extended/2016/s/Paper 22/

7 Metals consist of a lattice of positive ions in a 'sea of electrons'.

Why is aluminium malleable?

A Its ions are attracted to the 'sea of electrons'.

B Its ions are tightly packed together.

C Its ions repel each other.

D Its layers of ions can slide over each other.

Topic Chem 3 **4 Q# 27/** iG Extended/2016/s/Paper 21/

4 Which statements about isotopes of the same element are correct?

1 They are atoms which have the same chemical properties because they have the same number of electrons in their outer shell.

2 They are atoms which have the same number of electrons and neutrons but different numbers of protons.

3 They are atoms which have the same number of electrons and protons but different numbers of neutrons.

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

5 The table shows the electronic structure of four atoms.

atom	electronic structure
W	2,8,1
X	2,8,4
Y	2,8,7
Z	2,8,8

Which two atoms combine to form a covalent compound?

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

6 Which statement describes the attractive forces between molecules (intermolecular forces)?

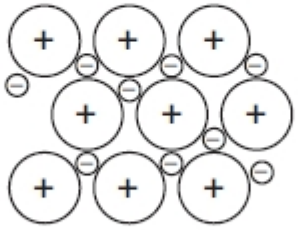
A They are strong covalent bonds which hold molecules together.

B They are strong ionic bonds which hold molecules together.

C They are weak forces formed between covalently-bonded molecules.

D They are weak forces which hold ions together in a lattice.

7 The diagram represents the general structure of a solid Z.



What is Z?

A aluminium

B iodine

C silicon dioxide

D sulfur

Topic Chem 3 **4 Q# 28/** iG Extended/2016/m/Paper 22/

4 In which row are the substances correctly classified?

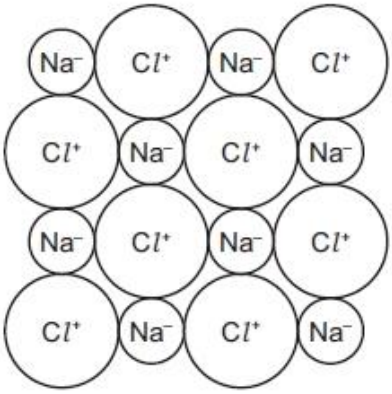
	element	compound	mixture
A	brass	sulfur	water
B	sulfur	brass	water
C	sulfur	water	brass
D	water	sulfur	brass

5 Which molecule contains only single covalent bonds?

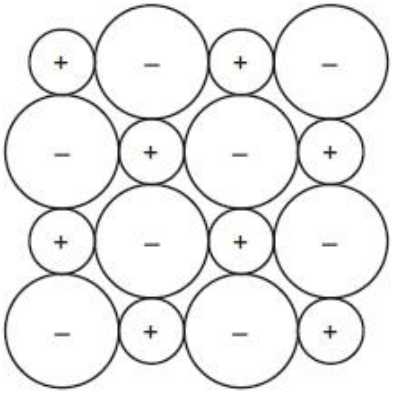
A Cl_2 **B** CO_2 **C** N_2 **D** O_2

6 Which structure represents the sodium chloride lattice?

A



B



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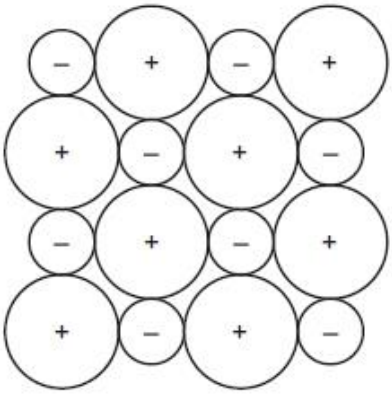
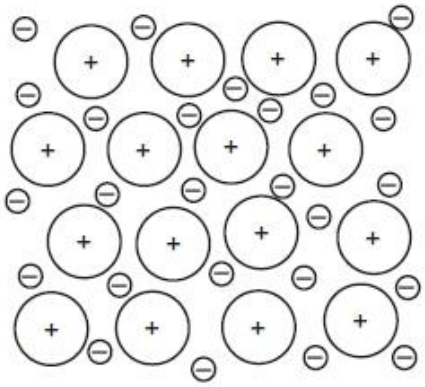


D



7 X and Y are isotopes of the same element.

Which statement is correct?

A X and Y have atoms with different numbers of electron shells.

B X and Y have atoms with the same nucleon number.

C X and Y have atoms with the same number of outer shell electrons.

D X and Y have different chemical properties.

Topic Chem 4 **1 Q# 29/** iG Extended/2017/w/Paper 21/

8 A compound is analysed and found to contain 85.7% carbon and 14.3% hydrogen.

What is its empirical formula?

A CH **B** CH_2 **C** C_2H_4 **D** C_6H

Topic Chem 4 **2 Q# 30/** iG Extended/2017/w/Paper 22/

7 The equation for the reaction between phosphorus and oxygen is shown.

$$xP_4 + yO_2 \rightarrow zP_2O_5$$

Which values of *x*, *y* and *z* balance the equation?

	x	*y*	*z*
A	1	5	2
B	1	10	2
C	2	5	2
D	2	10	1

8 The relative molecular mass of an alcohol is 88.

Its percentage composition by mass is: C, 54.5%; H, 9.1%; O, 36.4%.

Which row shows the empirical formula and molecular formula for this alcohol?

	empirical formula	molecular formula
A	C_2H_4O	C_2H_4O
B	C_2H_4O	$C_4H_8O_2$
C	$C_4H_8O_2$	$C_4H_8O_2$
D	$C_4H_8O_2$	C_2H_4O

Topic Chem 4 **1 Q# 31/** iG Extended/2017/w/Paper 23/

8 A compound contains 34.5% calcium, 24.1% silicon and 41.4% oxygen by mass.

What is its empirical formula?

A Ca_2SiO_3 **B** $CaSiO_3$ **C** $CaSi_2O_3$ **D** $CaSiO_6$

Topic Chem 4 **2 Q# 32/** iG Extended/2017/s/Paper 23/

7 Aqueous iron(III) sulfate and aqueous sodium hydroxide react to give a precipitate of iron(III) hydroxide and a solution of sodium sulfate.

What is the balanced equation for this reaction?

A $Fe_2(SO_4)_3(aq) + 2NaOH(aq) \rightarrow Fe(OH)_3(s) + Na_2SO_4(aq)$

B $Fe_2(SO_4)_3(aq) + 3NaOH(aq) \rightarrow Fe(OH)_3(s) + 3Na_2SO_4(aq)$

C $Fe_2(SO_4)_3(aq) + 6NaOH(aq) \rightarrow 2Fe(OH)_3(s) + 3Na_2SO_4(aq)$

D $2Fe_2(SO_4)_3(aq) + 6NaOH(aq) \rightarrow 4Fe(OH)_3(s) + 6Na_2SO_4(aq)$

8 The equation for the reaction between sodium carbonate and dilute hydrochloric acid is shown.

$$Na_2CO_3 + 2HCl \rightarrow 2NaCl + H_2O + CO_2$$

What is the maximum volume of carbon dioxide produced when 26.5 g of sodium carbonate react with dilute hydrochloric acid?

A $6\,dm^3$ **B** $12\,dm^3$ **C** $18\,dm^3$ **D** $24\,dm^3$

Topic Chem 4 **2 Q# 33/** iG Extended/2017/s/Paper 22/

7 Which equations are balanced?

1 $Fe_2O_3 + 3CO \rightarrow 2Fe + 3CO_2$

2 $ZnCO_3 + 2HCl \rightarrow ZnCl_2 + CO_2 + 2H_2O$

3 $Mg(NO_3)_2 + NaOH \rightarrow Mg(OH)_2 + 2NaNO_3$

4 $CaCO_3 + H_2SO_4 \rightarrow CaSO_4 + H_2O + CO_2$

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

8 Calcium carbide, CaC_2, reacts with water to form ethyne, C_2H_2, and calcium hydroxide.

The equation for the reaction is shown.

$$CaC_2(s) + 2H_2O(l) \rightarrow C_2H_2(g) + Ca(OH)_2(s)$$

Which volume of ethyne is produced when 6 g of water react completely with calcium carbide?

A $4\,dm^3$ **B** $8\,dm^3$ **C** $36\,dm^3$ **D** $72\,dm^3$

Topic Chem 4 **2 Q# 34/** iG Extended/2017/s/Paper 21/

7 Aluminium reacts with fluorine.

$$xAl(s) + yF_2(g) \rightarrow zAlF_3(s)$$

Which values of *x*, *y* and *z* balance the equation?

	x	*y*	*z*
A	1	2	1
B	2	3	2
C	3	2	3
D	4	3	4

8 Carbon monoxide burns in oxygen to produce carbon dioxide.

$$2CO(g) + O_2(g) \rightarrow 2CO_2(g)$$

Which mass of carbon dioxide is produced from 14 g of carbon monoxide?

A 22 g **B** 28 g **C** 44 g **D** 88 g

Topic Chem 4 **2 Q# 35/** iG Extended/2017/m/Paper 22/

8 The gas hydrazine has the molecular formula N_2H_4.

Hydrazine burns in air to form nitrogen gas and steam.

$$N_2H_4(g) + O_2(g) \rightarrow N_2(g) + 2H_2O(g)$$

Which statements are correct?

1 1 mole of hydrazine gives 72 dm^3 of gaseous products when it reacts with oxygen at room temperature and pressure.

2 The empirical formula of hydrazine is NH_2.

3 The total number of atoms in 1 mole of hydrazine is 6 × the Avogadro constant.

4 The volume of 1 mole of hydrazine at room temperature and pressure is 6 × 24 dm^3.

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

9 Copper(II) carbonate is broken down by heating to form copper(II) oxide and carbon dioxide gas.

The equation for the reaction is shown.

$$CuCO_3 \rightarrow CuO + CO_2$$

31.0 g of copper(II) carbonate are heated until all of the contents of the test-tube have turned from green to black.

The yield of copper(II) oxide formed is 17.5 g.

What is the percentage yield?

A 19.02% **B** 21.88% **C** 56.50% **D** 87.50%

Topic Chem 4 **2 Q# 36/** iG Extended/2016/w/Paper 23/

8 The equation shows the complete combustion of propane.

$$C_3H_8(g) + 5O_2(g) \rightarrow 3CO_2(g) + 4H_2O(l)$$

Which statement is correct?

A 10 cm^3 of propane cannot burn if less than 50 cm^3 of oxygen is present.

B 10 cm^3 of propane would produce 40 cm^3 of liquid water.

C 100 cm^3 of oxygen would be sufficient to react completely with 20 cm^3 of propane.

D This reaction would result in an increase in the volume of gas.

9 Sodium hydroxide reacts with sulfuric acid.

The equation for the reaction is shown.

$$2NaOH + H_2SO_4 \rightarrow Na_2SO_4 + 2H_2O$$

Which volume of 0.4 mol/dm^3 sodium hydroxide reacts with 50.0 cm^3 of 0.1 mol/dm^3 sulfuric acid?

A 12.5 cm^3 **B** 25.0 cm^3 **C** 50.0 cm^3 **D** 100.0 cm^3

Topic Chem 4 **2 Q# 37/** iG Extended/2016/w/Paper 22/

8 Which sample contains the greatest number of molecules?

A 4 g of hydrogen

B 18 g of water

C 24 dm^3 of oxygen

D 66 g of carbon dioxide

9 Sodium carbonate solution reacts with dilute hydrochloric acid. The equation for the reaction is shown.

$$Na_2CO_3(aq) + 2HCl(aq) \rightarrow 2NaCl(aq) + CO_2(g) + H_2O(l)$$

Excess sodium carbonate is added to 10.0 cm^3 of 0.10 mol / dm^3 hydrochloric acid.

Which volume of carbon dioxide gas is made?

A 12 cm^3 **B** 24 cm^3 **C** 12 000 cm^3 **D** 24 000 cm^3

Topic Chem 4 **2 Q# 38/** iG Extended/2016/w/Paper 21/

8 Benzene is a liquid with molecular formula C_6H_6.

Ethene is a gas with molecular formula C_2H_4.

Which statement is correct?

A 1 mole of benzene and 1 mole of ethene contain the same number of atoms.

B 1 mole of benzene and 1 mole of ethene both have a volume of 24 dm^3 at room temperature and pressure.

C Both benzene and ethene have the same empirical formula.

D The number of carbon atoms in 0.5 moles of ethene is equal to the Avogadro constant.

9 Sodium hydrogencarbonate undergoes thermal decomposition as shown.

$$2NaHCO_3 \rightarrow Na_2CO_3 + CO_2 + H_2O$$

What is the maximum mass of sodium carbonate that can be made from 0.100 moles of sodium hydrogencarbonate?

A 4.15 g **B** 5.30 g **C** 10.6 g **D** 21.2 g

Topic Chem 4 **2 Q# 39/** iG Extended/2016/s/Paper 23/

8 Analysis of a compound formed between magnesium and nitrogen showed it contained 14.4 g of magnesium and 5.6 g of nitrogen.

What is the empirical formula of the compound?

A Mg_2N_3 **B** Mg_3N_2 **C** Mg_4N_6 **D** Mg_6N_4

9 An excess of zinc is added to 100 cm^3 of 1.0 mol/dm^3 hydrochloric acid.

The equation for the reaction is:

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

What is the maximum volume of hydrogen evolved at room temperature and pressure?

A 1.2 dm^3 **B** 2.0 dm^3 **C** 2.4 dm^3 **D** 24 dm^3

Topic Chem 4 **2 Q# 40/** iG Extended/2016/s/Paper 22/

8 A sample of 16.0 g of a metal oxide, MO, is reduced to 12.8 g of the metal, M.

What is the relative atomic mass, A_r, of M?

A 32 **B** 64 **C** 80 **D** 128

9 The equation for the reaction between calcium carbonate and hydrochloric acid is shown.

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

How many moles of calcium carbonate will give 24 cm^3 of carbon dioxide when reacted with an excess of the acid?

A 1 mol **B** 0.1 mol **C** 0.01 mol **D** 0.001 mol

Topic Chem 4 **2 Q# 41/** iG Extended/2016/s/Paper 21/

8 A compound, X, contains 40.0% carbon, 6.7% hydrogen and 53.3% oxygen by mass.

The relative molecular mass, M_r, of X is 60.

What is the molecular formula of X?

A CH_2O **B** CH_4O **C** C_2H_4O **D** $C_2H_4O_2$

9 25 cm^3 of 0.1 mol/dm^3 hydrochloric acid exactly neutralise 20 cm^3 of aqueous sodium hydroxide.

The equation for this reaction is:

$$NaOH + HCl \rightarrow NaCl + H_2O$$

What is the concentration of the sodium hydroxide solution?

A 0.080 mol/dm^3

B 0.800 mol/dm^3

C 0.125 mol/dm^3

D 1.25 mol/dm^3

Topic Chem 4 **2 Q# 42/** iG Extended/2016/m/Paper 22/

8 Which quantities of chemicals will react exactly with no reactants left over?

A 12 g of carbon and 12 g of oxygen

B 12 g of carbon and 48 g of oxygen

C 12 g of magnesium and 16 g of oxygen

D 24 g of magnesium and 16 g of oxygen

9 Magnesium nitride is formed when magnesium burns in air. Magnesium nitride is an ionic compound.

What is the formula of magnesium nitride?

A MgN_2 **B** Mg_2N_2 **C** Mg_2N_3 **D** Mg_3N_2

Topic Chem 5 **2 Q# 43/** iG Extended/2017/w/Paper 21/

9 Which statements about the electrolysis of concentrated copper(II) chloride are correct?

1 Electrons are transferred from the cathode to the copper(II) ions.

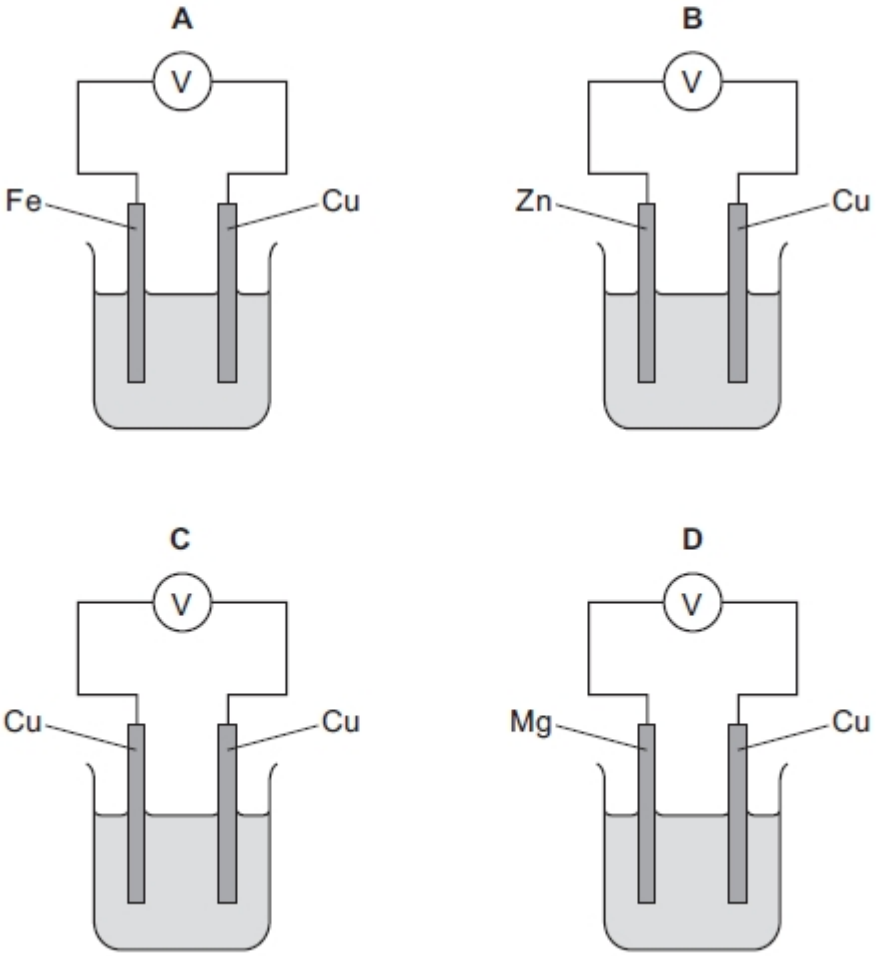
2 Electrons move round the external circuit from the cathode to the anode.

3 Chloride ions are attracted to the anode.

4 Hydroxide ions transfer electrons to the cathode.

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

10 Which metal combination produces the highest voltage reading in the cells shown?



Topic Chem 5 **1 Q# 44/** iG Extended/2017/s/Paper 22/

9 Which statement about electrolysis is correct?

A Electrons move through the electrolyte from the cathode to the anode.

B Electrons move towards the cathode in the external circuit.

C Negative ions move towards the anode in the external circuit.

D Positive ions move through the electrolyte towards the anode during electrolysis.

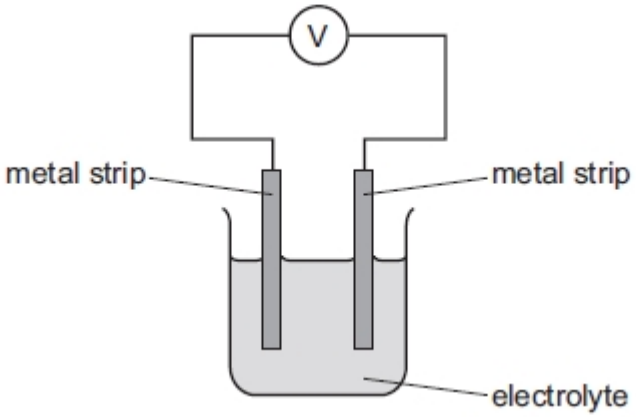
Topic Chem 5 **1 Q# 45/** iG Extended/2017/s/Paper 21/

10 The reactivity series for a number of different metals is shown.

most reactive → least reactive

magnesium	zinc	iron	copper	silver	platinum

The diagram shows different metal strips dipped into an electrolyte.



Which pair of metals produces the highest voltage?

A copper and magnesium

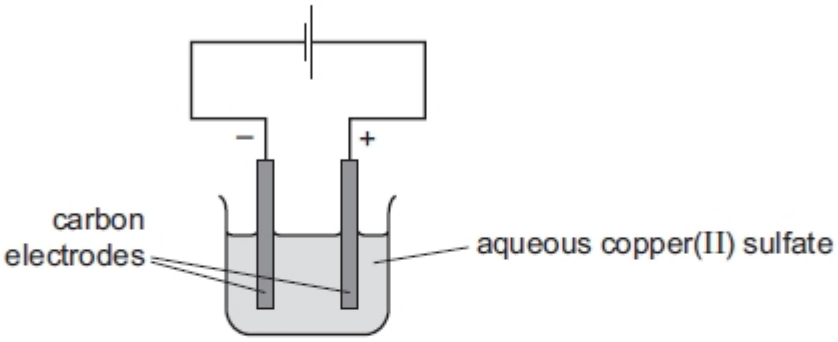
B magnesium and platinum

C magnesium and zinc

D silver and platinum

Topic Chem 5 **2 Q# 46/** iG Extended/2017/m/Paper 22/

10 The diagram shows the electrolysis of aqueous copper(II) sulfate.



Which statement is correct?

A Copper metal is deposited at the positive electrode.

B In the external circuit the electrons move from positive to negative.

C In the solution the electrons move from negative to positive.

D Oxygen gas is produced at the positive electrode.

11 Four solutions are separately electrolysed.

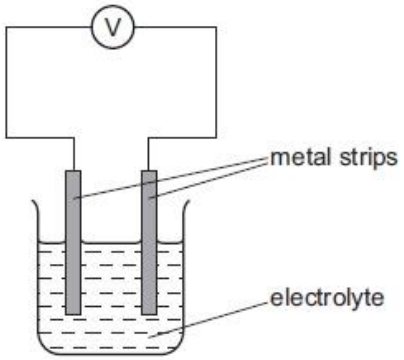
experiment	solution	electrodes
1	dilute aqueous sodium chloride	carbon
2	aqueous copper(II) sulfate	copper
3	concentrated hydrochloric acid	carbon
4	dilute sulfuric acid	carbon

In which two experiments is a colourless gas evolved at the anode?

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

Topic Chem 5 **1 Q# 47/** iG Extended/2016/w/Paper 23/

11 The diagram shows two different metal strips dipped into an electrolyte.



Which pair of metals produces the highest voltage?

A copper and iron

B copper and magnesium

C copper and zinc

D magnesium and iron

Topic Chem 5 **1 Q# 48/** iG Extended/2016/w/Paper 22/

11 A student sets up a number of simple cells by putting strips of two different metals into dilute sulfuric acid.

Which cell produces the highest voltage?

A copper and magnesium

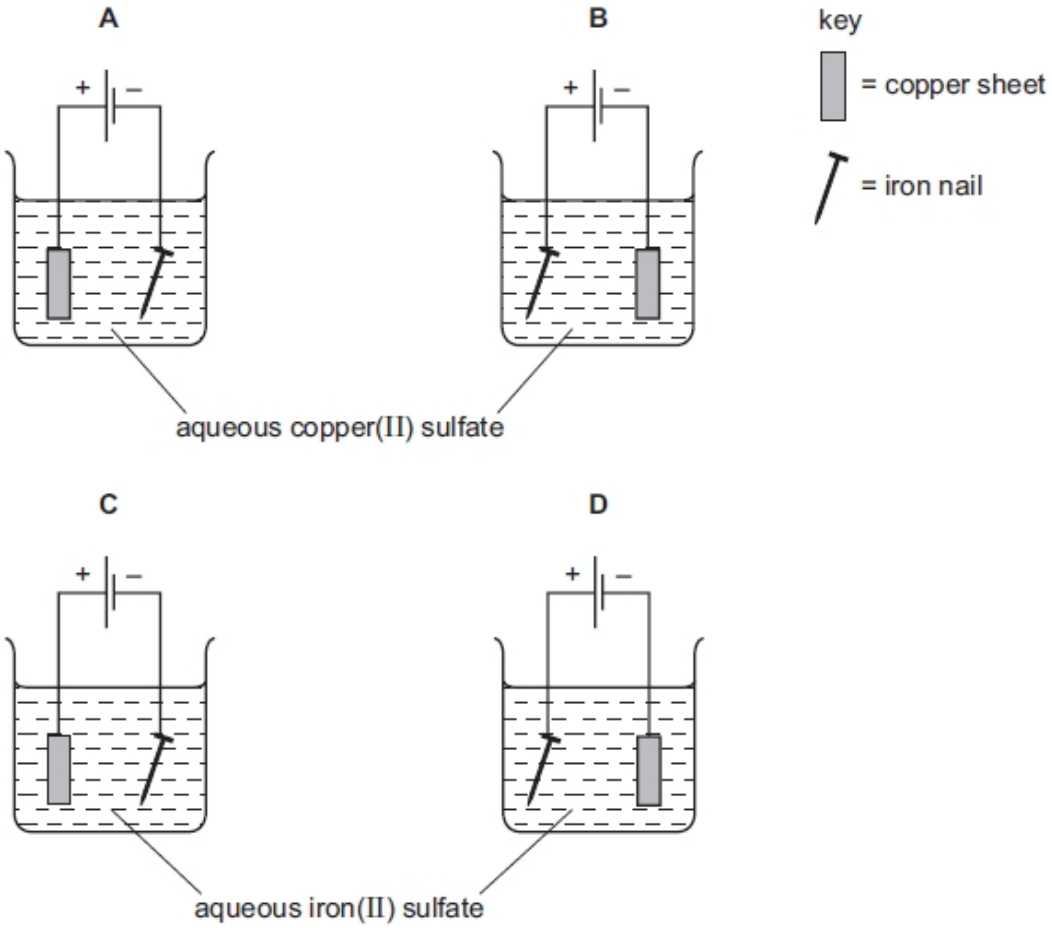
B copper and zinc

C iron and copper

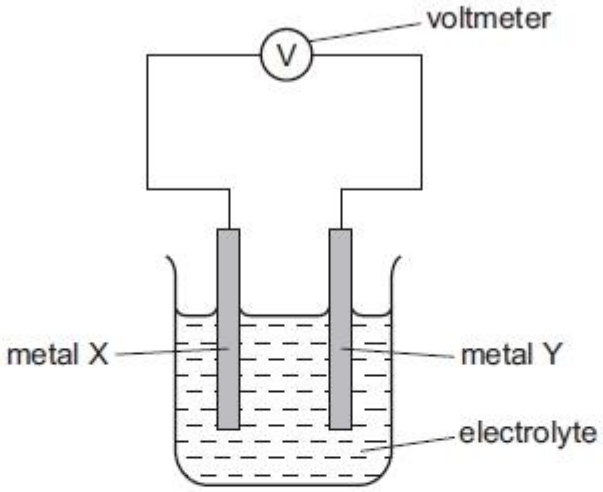
D magnesium and zinc

Topic Chem 5 **2 Q# 49/** iG Extended/2016/w/Paper 21/

10 Which apparatus could be used to electroplate an iron nail with copper?



11 The diagram shows a simple cell.

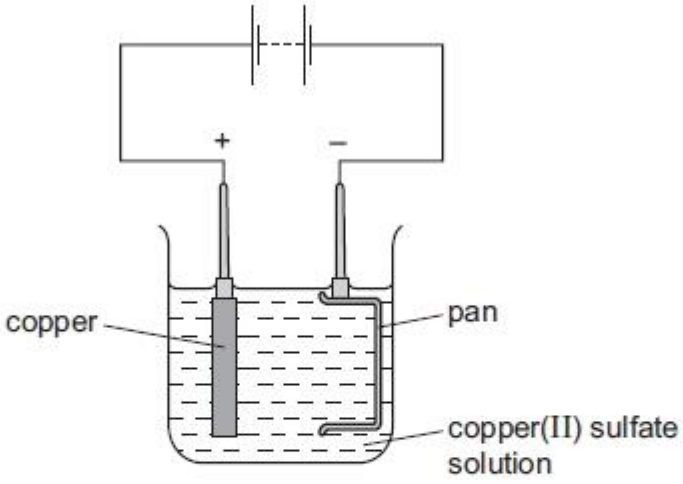


Which two metals produce the highest reading on the voltmeter?

	X	Y
A	magnesium	copper
B	magnesium	iron
C	zinc	copper
D	zinc	iron

Topic Chem 5 **2 Q# 50/** iG Extended/2016/s/Paper 23/

10 The diagram shows a method used to copper-plate a pan



Which equation represents the reaction at the cathode?

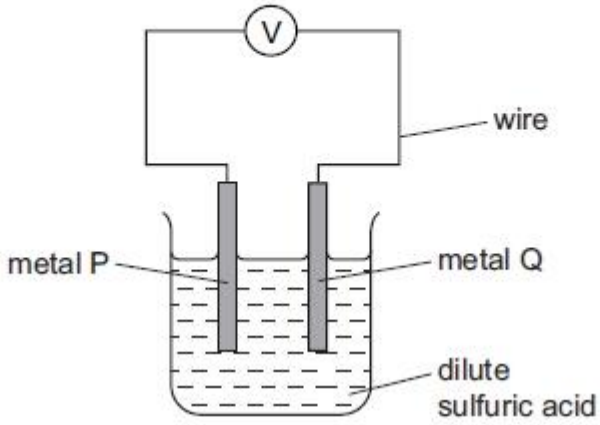
A $Cu^{2+} + 2e^- \rightarrow Cu$

B $2H^+ + 2e^- \rightarrow H_2$

C $4OH^- \rightarrow O_2 + 2H_2O + 4e^-$

D $2O^{2-} \rightarrow O_2 + 4e^-$

12 The diagram shows a simple cell.

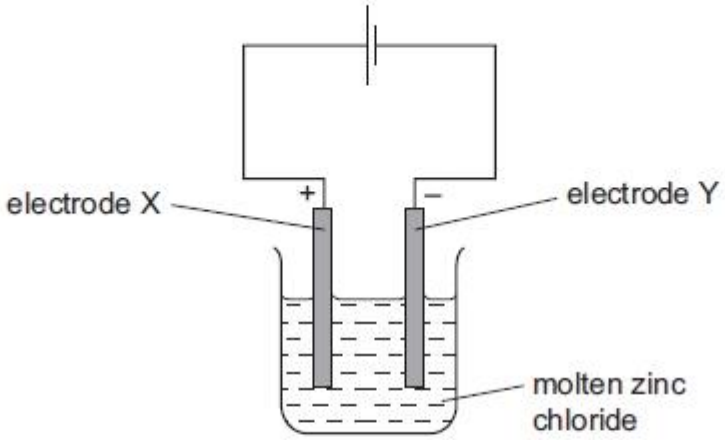


Which pair of metals produces the largest voltage?

	metal P	metal Q
A	iron	copper
B	magnesium	copper
C	magnesium	zinc
D	zinc	copper

Topic Chem 5 **2 Q# 51/** iG Extended/2016/s/Paper 22/

10 The diagram shows the electrolysis of molten zinc chloride, $ZnCl_2$.



Which statement is correct?

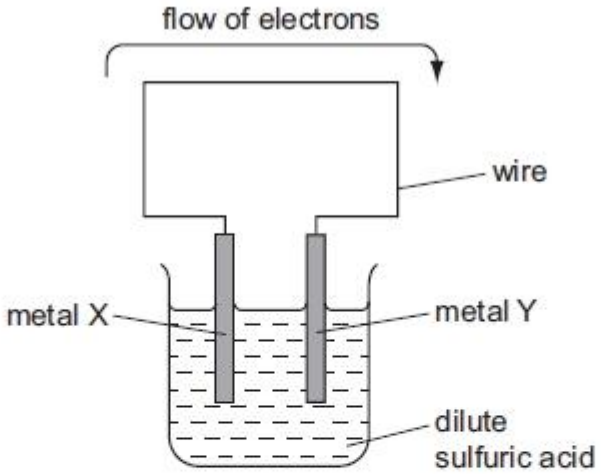
A Oxidation occurs at electrode X and the equation is: $2Cl^- \rightarrow Cl_2 + 2e^-$.

B Oxidation occurs at electrode Y and the equation is: $Zn^{2+} + 2e^- \rightarrow Zn$.

C Reduction occurs at electrode X and the equation is: $Zn^{2+} + 2e^- \rightarrow Zn$.

D Reduction occurs at electrode Y and the equation is: $2Cl^- \rightarrow Cl_2 + 2e^-$.

12 The diagram shows a simple cell.



For which pair of metals would electrons flow from metal X to metal Y?

	X	Y
A	copper	iron
B	copper	zinc
C	iron	zinc
D	zinc	iron

Topic Chem 5 **2 Q# 52/** iG Extended/2016/s/Paper 21/

10 Which reactions could take place at the anode during electrolysis?

1 $4OH^-(aq) \rightarrow 2H_2O(l) + O_2(g) + 4e^-$

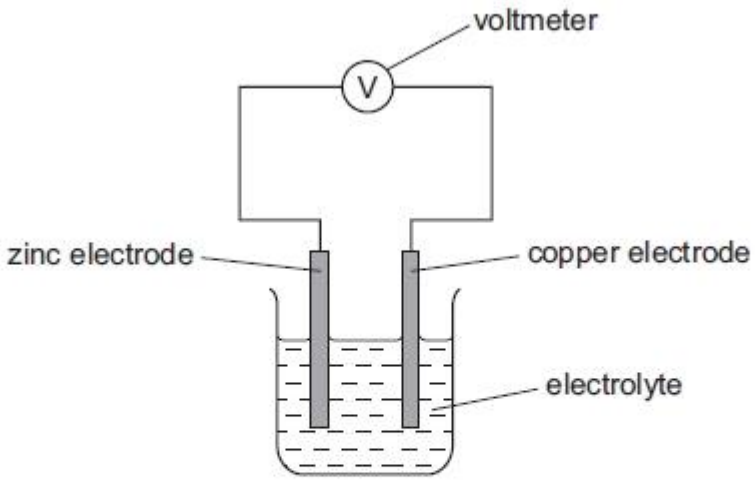
2 $2Cl^-(aq) \rightarrow Cl_2(g) + 2e^-$

3 $Cu^{2+}(aq) + 2e^- \rightarrow Cu(s)$

4 $2H^+(aq) + 2e^- \rightarrow H_2(g)$

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

12 The diagram shows a simple cell.



Which statement about the process occurring when the cell is in operation is correct?

A Cu^{2+} ions are formed in solution.

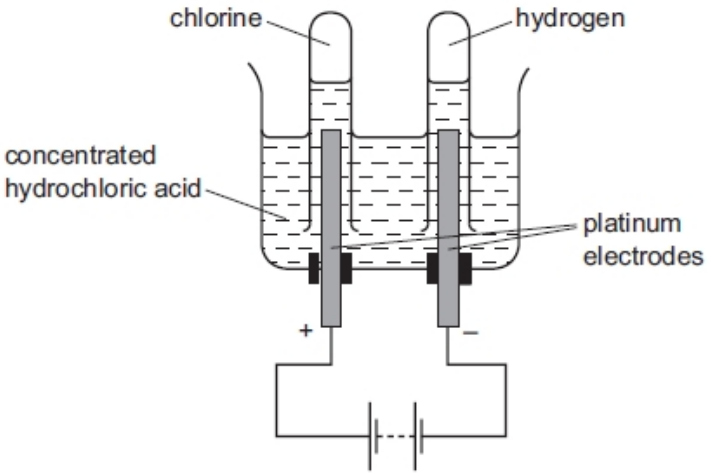
B Electrons travel through the solution.

C The reaction $Zn \rightarrow Zn^{2+} + 2e^-$ occurs.

D The zinc electrode increases in mass.

Topic Chem 5 **1 Q# 53/** iG Extended/2016/m/Paper 22/

10 The electrolysis of concentrated hydrochloric acid is shown.



Which statement describes what happens to the electrons during the electrolysis?

A They are added to chloride ions.

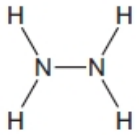
B They are added to hydrogen ions.

C They move through the circuit from positive to negative.

D They move through the solution from negative to positive.

Topic Chem 6 **2 Q# 54/** iG Extended/2017/w/Paper 21/

11 The compound hydrazine is used as a rocket fuel. It has the structural formula shown.



One of the reactions of hydrazine is shown. This reaction is exothermic.

$$N_2H_4 \rightarrow N_2 + 2H_2$$

The bond energies are shown in the table.

	bond energy in kJ/mol
H–H	+436
N–H	+390
N–N	+160
N≡N	+945

What is the energy change for this reaction?

A –339 kJ/mol **B** –97 kJ/mol **C** +97 kJ/mol **D** +339 kJ/mol

12 Which statement describes an exothermic reaction?

A The energy absorbed for bond breaking is greater than the energy released by bond formation.

B The energy absorbed for bond breaking is less than the energy released by bond formation.

C The energy released by bond breaking is greater than the energy absorbed for bond formation.

D The energy released by bond breaking is less than the energy absorbed for bond formation.

Topic Chem 6 **1 Q# 55/** iG Extended/2017/w/Paper 22/

11 The equation for the combustion of methane is shown.

$$CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$$

The energy change for the combustion of methane is –890 kJ/mol.

The bond energies are shown in the table.

bond	bond energy in kJ/mol
C–H	+410
O=O	+496
H–O	+460

What is the bond energy of the C=O bond?

A +49 kJ/mol **B** +841 kJ/mol **C** +1301 kJ/mol **D** +1335 kJ/mol

Topic Chem 6 **1 Q# 56/** iG Extended/2017/w/Paper 23/

11 Some bond energies are shown in the table.

bond	bond energy in kJ / mol
H–H	+436
O=O	+496
H–O	+460

Hydrogen reacts with oxygen. The reaction is exothermic.

$$2H_2(g) + O_2(g) \rightarrow 2H_2O(g)$$

What is the energy change for the reaction?

A –3208 kJ / mol

B –908 kJ / mol

C –472 kJ / mol

D –448 kJ / mol

Topic Chem 6 **3 Q# 57/** iG Extended/2017/s/Paper 23/

11 Heat energy is produced when hydrocarbons burn in air.

Which equations represent this statement?

1 $C_2H_5OH + 3O_2 \rightarrow 2CO_2 + 3H_2O$

2 $C_2H_4 + 3O_2 \rightarrow 2CO_2 + 2H_2O$

3 $CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$

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

13 Hydrogen and chlorine react to form hydrogen chloride.

The reaction is exothermic.

$$H_2(g) + Cl_2(g) \rightarrow 2HCl(g)$$

The overall energy change for this reaction is –184 kJ / mol.

The table gives some of the bond energies involved.

bond	bond energy in kJ / mol
H–Cl	+430
H–H	+436

What is the energy of the Cl–Cl bond?

A –240 kJ / mol

B –190 kJ / mol

C +190 kJ / mol

D +240 kJ / mol

Topic Chem 6 **3 Q# 58/** iG Extended/2017/s/Paper 22/

11 Which statement about fuels is correct?

A Heat energy can only be produced by burning fuels.

B Hydrogen is used as a fuel although it is difficult to store.

C Methane is a good fuel because it produces only water when burned.

D Uranium is burned in air to produce energy.

13 The equation for the reaction between hydrogen and chlorine is shown.

$$H_2(g) + Cl_2(g) \rightarrow 2HCl(g)$$

The reaction is exothermic.

The bond energies are shown in the table.

bond	bond energy in kJ / mol
Cl–Cl	+240
H–Cl	+430
H–H	+436

What is the energy change for the reaction?

A –1536 kJ / mol

B –184 kJ / mol

C +184 kJ / mol

D +246 kJ / mol

Topic Chem 6 **3 Q# 59/** iG Extended/2017/s/Paper 21/

11 Some properties of four fuels are shown in the table.

Which fuel is a gas at room temperature and makes two products when it burns in a plentiful supply of air?

	fuel	formula	melting point / °C	boiling point / °C
A	hydrogen	H_2	–259	–253
B	methane	CH_4	–182	–164
C	octane	C_8H_{18}	–57	126
D	wax	$C_{31}H_{64}$	60	400

12 Which statements about exothermic and endothermic reactions are correct?

1 During an exothermic reaction, heat is given out.

2 The temperature of an endothermic reaction goes up because heat is taken in.

3 Burning methane in the air is an exothermic reaction.

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

13 Chlorine reacts with ethane to produce chloroethane and hydrogen chloride.

The reaction is exothermic.

The bond energies are shown in the table.

bond	bond energy in kJ/mol
C–C*l*	+340
C–C	+350
C–H	+410
C*l*–C*l*	+240
H–C*l*	+430

What is the energy change for the reaction?

A –1420 kJ/mol

B –120 kJ/mol

C +120 kJ/mol

D +1420 kJ/mol

12 Ammonia is made by reacting nitrogen with hydrogen in the presence of an iron catalyst.

The reaction is exothermic.

The equation for the reaction is shown.

$$N_2 + 3H_2 \rightarrow 2NH_3$$

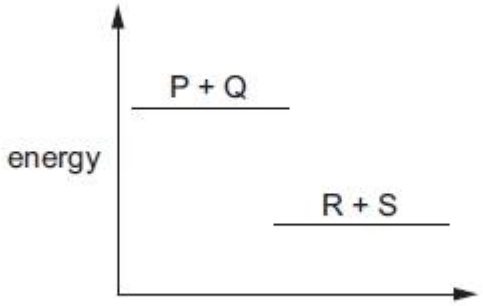
The bond energies are shown in the table.

bond	bond energy in kJ/mol
H–H	436
N–H	390
N≡N	945

What is the energy given out during this reaction?

A –4593 kJ/mol **B** –1083 kJ/mol **C** –959 kJ/mol **D** –87 kJ/mol

13 The energy level diagram for the reaction between P and Q to form R and S is shown.



Which row describes the energy changes involved and the type of reaction?

	energy changes involved	type of reaction
A	more energy is given out when the bonds in the products are formed than is needed to break the bonds in the reactants	endothermic
B	more energy is given out when the bonds in the products are formed than is needed to break the bonds in the reactants	exothermic
C	more energy is needed to break the bonds in the reactants than is given out when the bonds in the products are formed	endothermic
D	more energy is needed to break the bonds in the reactants than is given out when the bonds in the products are formed	exothermic

Topic Chem 6 **2 Q# 61/** iG Extended/2016/w/Paper 23/

12 10g of ammonium nitrate are added to water at 25°C and the mixture stirred. The ammonium nitrate dissolves and, after one minute, the temperature of the solution is 10°C.

Which word describes this change?

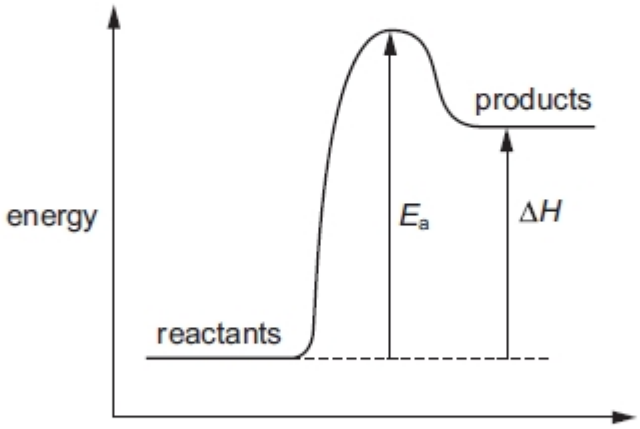
A endothermic

B exothermic

C neutralisation

D reduction

13 The energy level diagram for a reaction is shown.



Which row is correct?

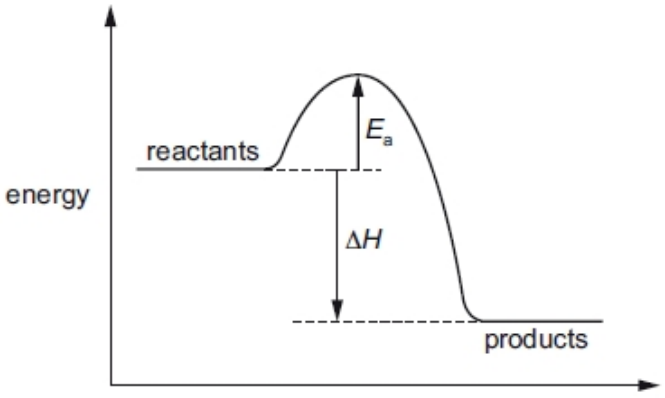
	sign of ΔH	overall energy change	sign of E_a
A	–	exothermic	–
B	+	endothermic	+
C	+	endothermic	–
D	+	exothermic	+

Topic Chem 6 **2 Q# 62/** iG Extended/2016/w/Paper 22/

12 Which experiment is the most exothermic?

	initial temperature / °C	final temperature / °C
A	20	5
B	20	32
C	25	12
D	25	34

13 The energy level diagram for a reaction is shown.

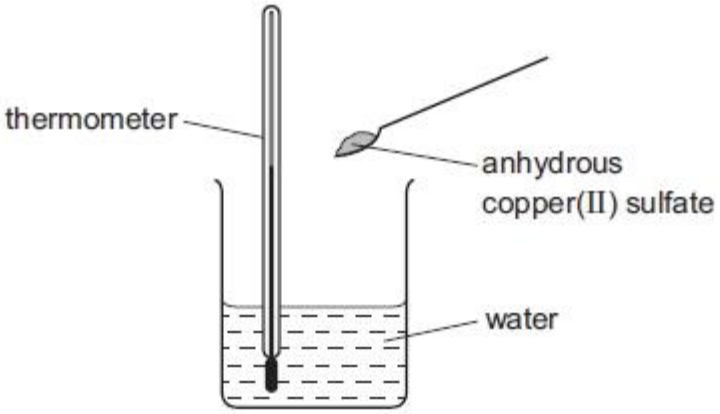


Which row is correct?

	sign of ΔH	overall energy change	sign of E_a
A	–	exothermic	–
B	+	endothermic	+
C	+	endothermic	–
D	–	exothermic	+

Topic Chem 6 **1 Q# 63/** iG Extended/2016/w/Paper 21/

12 When anhydrous copper(II) sulfate is added to water a solution is formed and heat is given out.

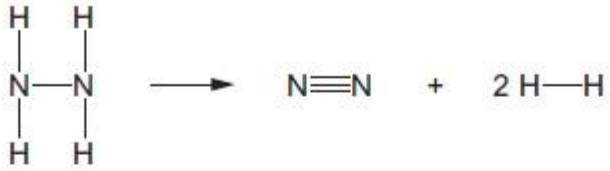


Which row shows the temperature change and the type of reaction taking place?

	temperature change	type of reaction
A	decrease	endothermic
B	decrease	exothermic
C	increase	endothermic
D	increase	exothermic

Topic Chem 6 **1 Q# 65/** iG Extended/2016/s/Paper 23/

13 Hydrazine, N_2H_4, decomposes as shown.



The energy change for this reaction is –95 kJ/mol.

The table shows some bond energies involved.

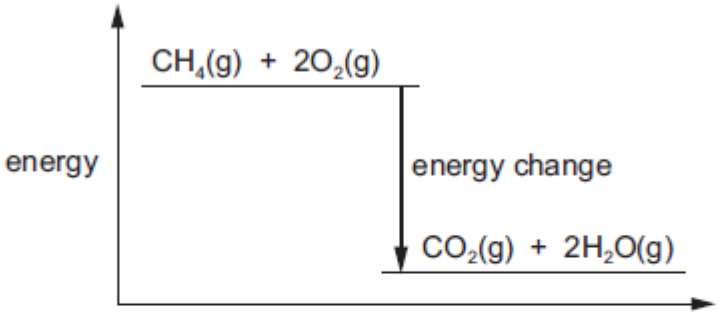
bond	bond energy in kJ/mol
N≡N	945
N–H	391
H–H	436

What is the bond energy of the N–N bond?

A 158 kJ/mol **B** 315 kJ/mol **C** 348 kJ/mol **D** 895 kJ/mol

Topic Chem 6 **1 Q# 66/** iG Extended/2016/s/Paper 22/

13 The energy level diagram for the combustion of methane is shown.



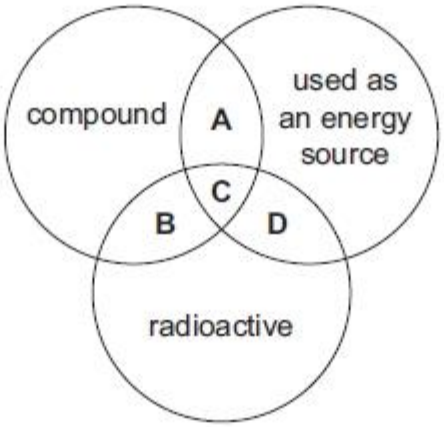
Which row gives the equation and energy change for this reaction?

	equation	energy change in kJ/mol
A	$CH_4(g) + 2O_2(g) \rightarrow CO_2(g) + 2H_2O(g)$	+891
B	$CH_4(g) + 2O_2(g) \rightarrow CO_2(g) + 2H_2O(g)$	–891
C	$CH_4(g) + 2O_2(g) \rightarrow CO_2(g) + 2H_2O(l)$	+891
D	$CH_4(g) + 2O_2(g) \rightarrow CO_2(g) + 2H_2O(l)$	–891

Topic Chem 6 **2 Q# 67/** iG Extended/2016/s/Paper 21/

11 The diagram shows some properties that substances may have.

To which labelled part of the diagram does ^{235}U belong?



13 Hydrogen burns exothermically in oxygen.

The equation for the reaction is:

$$2H_2 + O_2 \rightarrow 2H_2O$$

The table shows the bond energies involved.

bond	bond energy in kJ/mol
H–H	436
O=O	498
O–H	464

What is the energy given out during the reaction?

A –3226 kJ/mol

B –884 kJ/mol

C –486 kJ/mol

D –442 kJ/mol

Topic Chem 6 **2 Q# 68/** iG Extended/2016/m/Paper 22/

12 Which substance could **not** be used as a fuel to heat water in a boiler?

A ethanol

B hydrogen

C methane

D oxygen

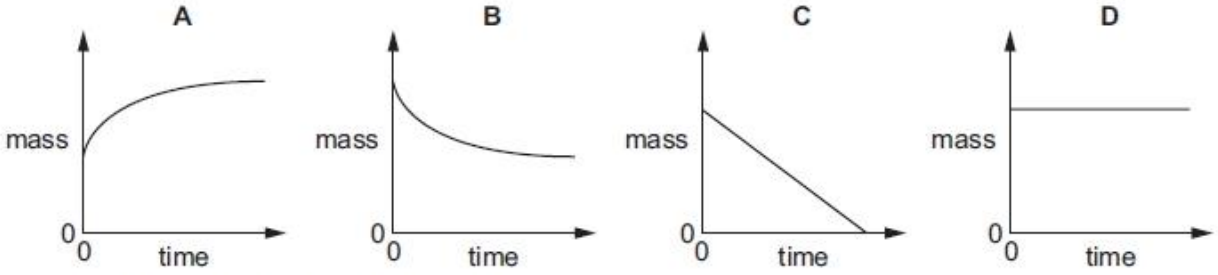
13 Which row describes an endothermic reaction?

	energy needed to break bonds / kJ	energy released by forming bonds / kJ	temperature
A	400	200	decreases
B	400	800	decreases
C	600	200	increases
D	600	800	increases

Topic Chem 7 **4 Q# 69/** iG Extended/2017/w/Paper 21/

13 The mass of a beaker and its contents is plotted against time.

Which graph represents what happens when sodium carbonate reacts with an excess of dilute hydrochloric acid in an open beaker?



14 Copper(II) oxide reacts with hydrogen.

$$CuO + H_2 \rightarrow Cu + H_2O$$

Which row is correct?

	oxidising agent	reducing agent
A	H_2	CuO
B	CuO	H_2
C	H_2O	Cu
D	Cu	H_2O

15 Ethanoic acid reacts slowly with calcium carbonate.

Which statements explain why an increase in temperature increases the rate of the reaction?

1 The activation energy of the reaction is decreased.

2 There is an increase in collision rate.

3 The particles have more energy.

4 There will be fewer successful collisions.

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

16 Methane reacts with steam to produce hydrogen and carbon monoxide.

The equation for the reaction is shown.

$$CH_4(g) + H_2O(g) \rightleftharpoons 3H_2(g) + CO(g)$$

The reaction is reversible. The forward reaction is endothermic.

Which changes in temperature and pressure increase the equilibrium yield of carbon monoxide?

	temperature	pressure
A	decrease	decrease
B	decrease	increase
C	increase	decrease
D	increase	increase

Topic Chem 7 **3 Q# 70/** iG Extended/2017/w/Paper 22/

14 Copper metal donates electrons to silver ions.

Zinc metal donates electrons to copper ions.

What is the strongest reducing agent?

A copper ions

B copper metal

C silver ions

D zinc metal

15 Four statements about the effect of increasing temperature on a reaction are shown.

1 The activation energy becomes lower.

2 The particles move faster.

3 There are more collisions between reacting particles.

4 There are more collisions which have energy greater than the activation energy.

Which statements are correct?

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

16 The formation of sulfur trioxide from sulfur dioxide is a reversible reaction.

$$2SO_2(g) + O_2(g) \rightleftharpoons 2SO_3(g)$$

The forward reaction is exothermic.

Which changes would increase the equilibrium yield of SO_3?

1 increasing the pressure

2 lowering the temperature

3 decreasing the concentration of oxygen

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

Topic Chem 7 **3 Q# 71/** iG Extended/2017/w/Paper 23/

14 Silver chloride reacts when it is exposed to light.

Which row shows what happens to the silver in this process?

	half-equation	type of reaction
A	$Ag \rightarrow Ag^+ + e^-$	oxidation
B	$Ag \rightarrow Ag^+ + e^-$	reduction
C	$Ag^+ + e^- \rightarrow Ag$	oxidation
D	$Ag^+ + e^- \rightarrow Ag$	reduction

15 Which statement about the effect of concentration and temperature on the rate of a reaction is **not** correct?

A If the concentration of a reactant is increased, the rate of reaction increases because more particles have sufficient energy to react.

B If the concentration of a reactant is increased, the rate of reaction increases because there are more collisions between particles per second.

C If the temperature is increased, the rate of reaction increases because there are more collisions between particles per second.

D If the temperature is increased, the rate of reaction increases because more particles have sufficient energy to react.

16 The following reaction has reached equilibrium in a closed system.

$$2SO_2(g) + O_2(g) \rightleftharpoons 2SO_3(g)$$

The forward reaction is exothermic.

Which row shows the effect of increasing the pressure on the equilibrium mixture?

	reaction rate	amount of SO_2	amount of SO_3
A	increases	decreases	increases
B	increases	increases	decreases
C	unchanged	decreases	increases
D	unchanged	increases	decreases

Topic Chem 7 **2 Q# 72/** iG Extended/2017/s/Paper 23/

14 Which changes are physical changes?

1 melting ice to form water

2 burning hydrogen to form water

3 adding sodium to water

4 boiling water to form steam

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

16 Hydrogen is produced when methane reacts with steam.

The equation for the reaction is shown.

$$CH_4(g) + H_2O(g) \rightleftharpoons CO(g) + 3H_2(g)$$

The forward reaction is endothermic.

Which conditions produce the highest yield of hydrogen?

	pressure	temperature
A	high	high
B	high	low
C	low	high
D	low	low

Topic Chem 7 **2 Q# 73/** iG Extended/2017/s/Paper 22/

14 A gas is produced when calcium carbonate is heated.

Which type of change is this?

A chemical

B exothermic

C physical

D separation

16 The reaction used to manufacture ammonia from nitrogen and hydrogen is reversible.

An equilibrium can be established between ammonia, nitrogen and hydrogen.

Which statement describes the equilibrium?

A Both the forward reaction and the backward reaction have the same rate.

B The rate of the backward reaction is greater than the rate of the forward reaction.

C The rate of the forward reaction is greater than the rate of the backward reaction.

D The forward and backward reactions have both stopped.

Topic Chem 7 **4 Q# 74/** iG Extended/2017/s/Paper 21/

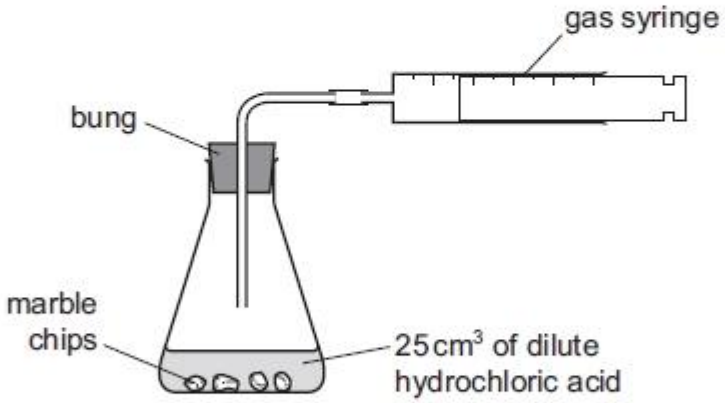
14 When sulfur is heated it undergoes a .....1..... change as it melts.

Further heating causes the sulfur to undergo a .....2..... change and form sulfur dioxide.

Which words complete gaps 1 and 2?

	1	2
A	chemical	chemical
B	chemical	physical
C	physical	chemical
D	physical	physical

15 A student was investigating the reaction between marble chips and dilute hydrochloric acid.



Which changes slow down the rate of reaction?

	temperature of acid	concentration of acid	surface area of marble chips
A	decrease	decrease	decrease
B	decrease	decrease	increase
C	increase	decrease	decrease
D	increase	increase	increase

16 Nitrogen, hydrogen and ammonia gases are placed inside a container. The container is then sealed. After some time, an equilibrium forms.

$$N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$$

Which statement describes the equilibrium in this container?

A The amount of ammonia remains constant from the moment the container is sealed.

B The amounts of ammonia, nitrogen and hydrogen in the container are always equal.

C The rate of formation of ammonia is equal to the rate of decomposition of ammonia.

D The rate of formation of ammonia is faster than the rate of decomposition of ammonia.

17 An example of a redox reaction is shown.

$$Zn + Cu^{2+} \rightarrow Zn^{2+} + Cu$$

Which statement about the reaction is correct?

A Zn is the oxidising agent and it oxidises Cu^{2+}.

B Zn is the oxidising agent and it reduces Cu^{2+}.

C Zn is the reducing agent and it oxidises Cu^{2+}.

D Zn is the reducing agent and it reduces Cu^{2+}.

Topic Chem 7 **4 Q# 75/** iG Extended/2017/m/Paper 22/

14 Copper(II) carbonate reacts with dilute sulfuric acid.

$$CuCO_3(s) + H_2SO_4(aq) \rightarrow CuSO_4(aq) + CO_2(g) + H_2O(l)$$

The rate of the reaction can be changed by varying the conditions.

Which changes always increase the rate of this chemical reaction?

1 increasing the concentration of sulfuric acid

2 increasing the size of the pieces of copper(II) carbonate

3 increasing the temperature

4 increasing the volume of sulfuric acid

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

15 Which reaction is **not** affected by the presence of light?

A a candle burning

B methane reacting with chlorine

C photosynthesis

D silver bromide decomposing to form silver

16 The equation for the reversible reaction between hydrogen and iodine to form hydrogen iodide is shown.

The colours of the reactants and products are shown.

$$H_2(g) + I_2(g) \rightleftharpoons 2HI(g)$$

colourless purple colourless

The forward reaction is exothermic.

Which statement is correct?

A An increase in pressure has no effect on the equilibrium position.

B The purple colour fades when the reaction mixture is heated.

C When equilibrium is reached, both forward and reverse reactions stop.

D When more hydrogen gas is added, the purple colour increases.

17 Chlorine displaces bromine from a solution of potassium bromide.

$$Cl_2 + 2KBr \rightarrow 2KCl + Br_2$$

What is the oxidising agent in this reaction?

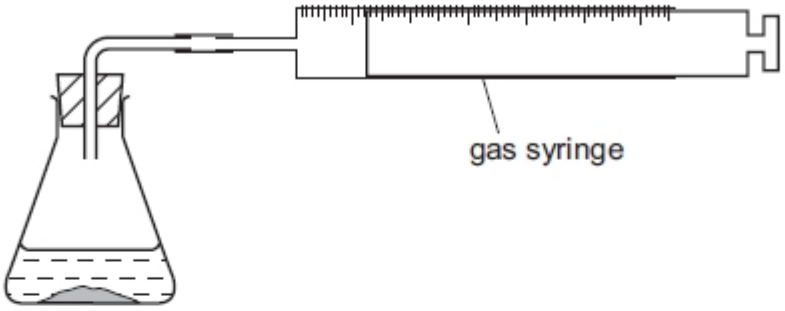
A bromide ions

B bromine

C chloride ions

D chlorine

14 An experiment X is carried out between a solid and a solution using the apparatus shown.

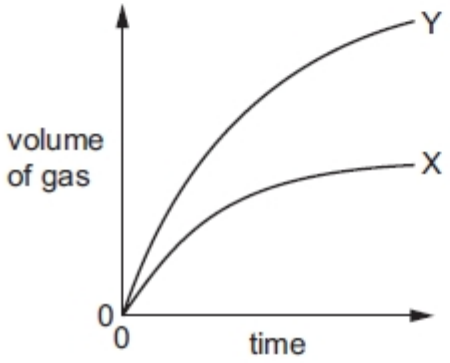


The volume of gas given off is measured at different times and the results plotted on a graph.

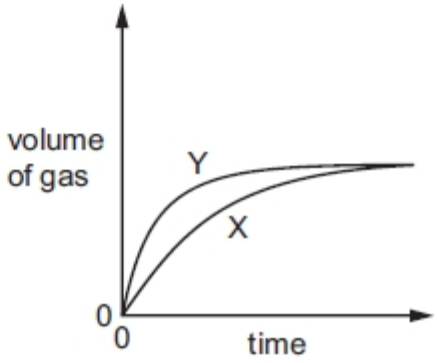
In a second experiment Y, the surface area of the solid is increased but all other factors remain the same.

Which graph shows the results of experiments X and Y?

A



B



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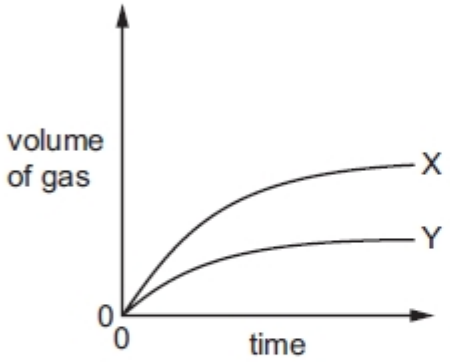
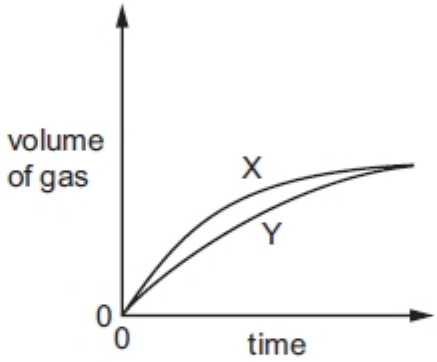


D



15 Which change in conditions increases the energy of the particles in a reaction?

A addition of a catalyst

B increase in concentration

C increase in surface area

D increase in temperature

16 Chlorine can be manufactured by the following reaction. The reaction is exothermic.

$$4HCl(g) + O_2(g) \rightleftharpoons 2H_2O(g) + 2Cl_2(g)$$

Which change increases the yield of chlorine at equilibrium?

A adding more $HCl(g)$

B adding more $H_2O(g)$

C decreasing the pressure

D increasing the temperature

17 Which change represents an oxidation reaction?

A chlorine changes to chlorate(I) ions

B chlorine changes to chloride ions

C copper(II) ions change to copper

D potassium manganate(VII) ions change to potassium manganate(VI) ions

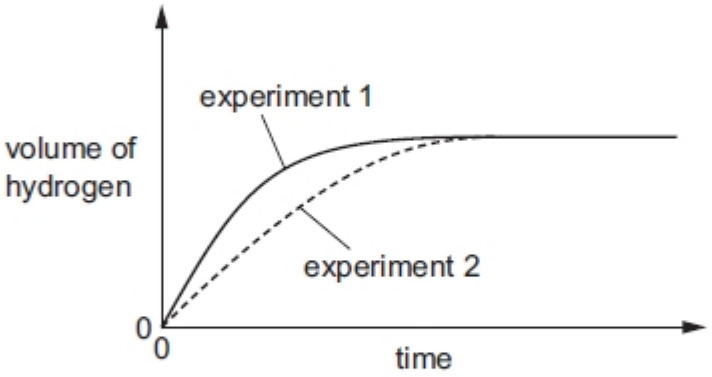
Topic Chem 7 **4 Q# 77/** iG Extended/2016/w/Paper 22/

14 Zinc granules are reacted with excess dilute hydrochloric acid.

The volume of hydrogen given off is measured at different times.

The results are shown on the graph, labelled experiment 1.

The results for a second experiment are also shown on the graph, labelled experiment 2.



Which change to the conditions was made in experiment 2?

A The concentration of the hydrochloric acid was decreased.

B The size of the zinc granules was decreased.

C The surface area of the zinc granules was increased.

D The temperature was increased.

15 In an experiment nitric acid is added to excess marble chips and the volume of carbon dioxide formed is measured.

The experiment is repeated using smaller marble chips. All other conditions remain the same.

Which statement about the second experiment is correct?

A The collisions are more frequent and higher energy.

B The collisions are more frequent and the same energy.

C The collisions are the same frequency and the same energy.

D The collisions are the same frequency and higher energy.

16 At 400 °C the reaction between hydrogen and iodine reaches an equilibrium. The reaction is exothermic.

$$H_2(g) + I_2(g) \rightleftharpoons 2HI(g) \qquad \Delta H = -13\,kJ/mol$$

Which change in conditions would increase the percentage of hydrogen iodide in the equilibrium mixture?

A a decrease in pressure

B a decrease in temperature

C an increase in pressure

D an increase in temperature

17 Chromium forms the compound chromium(III) sulfate.

What does the (III) represent?

A the charge on a sulfate ion

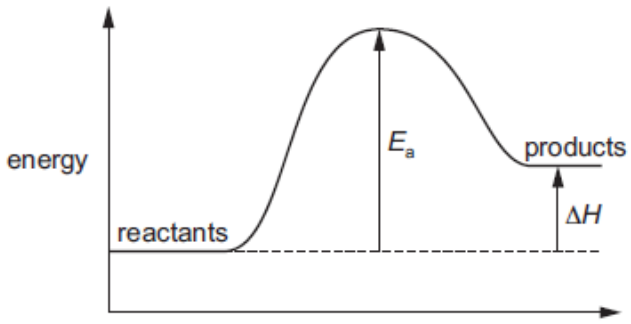
B the number of chromium ions combined with one sulfate ion

C the number of sulfate ions combined with one chromium ion

D the oxidation state of chromium

Topic Chem 7 **5 Q# 78/** iG Extended/2016/w/Paper 21/

13 The energy level diagram for a reaction is shown.



Which statement is **not** correct for this energy level diagram?

A It could be the energy level diagram for the reaction when petrol is burnt.

B Less energy is released in bond forming than is needed for bond breaking.

C The activation energy, E_a, has a positive value.

D The energy change, ΔH, for the reaction is positive.

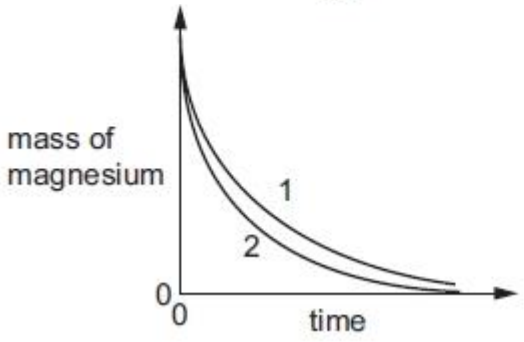
14 The rate of reaction between magnesium and excess dilute hydrochloric acid was followed by measuring the mass of magnesium present at regular time intervals.

Two experiments were performed.

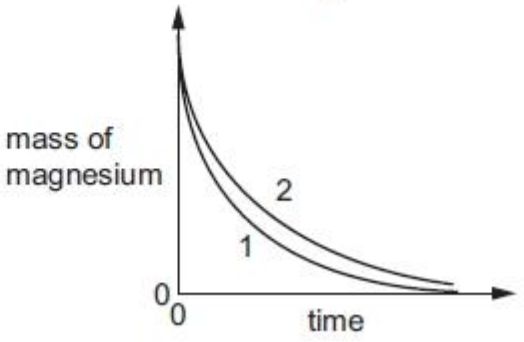
Both experiments used 0.1 g of magnesium ribbon. The acid in experiment 1 was less concentrated than in experiment 2.

Which graph shows the results of the experiments?

A



B



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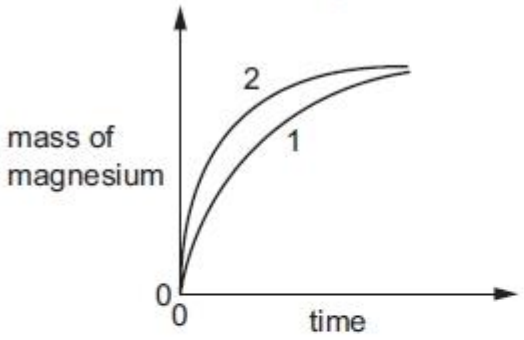

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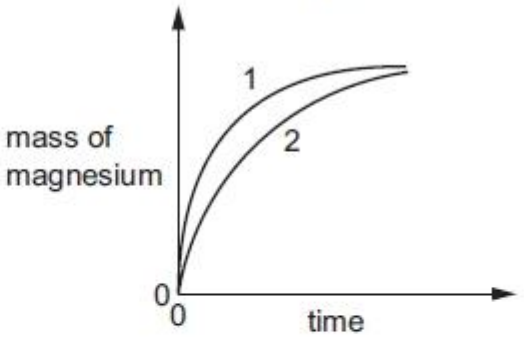


15 Which statement explains why coal dust forms an explosive mixture with air?

A Coal dust catalyses the explosion.

B Coal dust has a large surface area.

C Crushing coal increases the concentration of the coal.

D Crushing coal increases the temperature of the coal.

16 The following reversible reaction takes place in a closed vessel at constant temperature.

$$P(g) + Q(g) + R(g) \rightleftharpoons S(g) + T(g)$$

When the system has reached equilibrium, more T is added.

After the addition of T, which substances increase in concentration?

A P, Q, R and S

B P and Q only

C P, Q and R only

D S only

17 Four ionic half-equations are shown.

1 $Cu^{2+}(aq) + 2e^- \rightarrow Cu(s)$

2 $2I^-(aq) \rightarrow I_2(aq) + 2e^-$

3 $Fe^{2+}(aq) \rightarrow Fe^{3+}(aq) + e^-$

4 $Cl_2(g) + 2e^- \rightarrow 2Cl^-(aq)$

Which statement is correct?

A In equation 1, copper(II) ions are oxidised to copper.

B In equation 2, iodide ions are reduced to iodine.

C In equation 3, iron(II) ions are oxidised to iron(III) ions.

D In equation 4, chlorine is oxidised to chloride ions.

Topic Chem 7 **2 Q# 79/** iG Extended/2016/s/Paper 23/

15 Which row explains why increasing temperature increases the rate of reaction?

	particles collide more often	particles collide with more energy
A	✓	✓
B	✓	✗
C	✗	✓
D	✗	✗

16 Methanol is manufactured by reacting carbon monoxide and hydrogen together in the presence of an aluminium oxide catalyst.

The equation for the reaction is shown.

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

The reaction is a reversible reaction.

The forward reaction is exothermic.

Which change in conditions increases the yield of methanol?

A decreasing the concentration of the carbon monoxide

B increasing the pressure

C increasing the rate of the reaction

D increasing the temperature

Topic Chem 7 **2 Q# 80/** iG Extended/2016/s/Paper 22/

15 Which row describes how the energy of collision between particles changes when concentration and temperature are increased?

	concentration	temperature
A	increases	increases
B	increases	no change
C	no change	increases
D	no change	no change

16 Methanol is made by reacting carbon monoxide with hydrogen.

The reaction is exothermic and is a chemical equilibrium.

The equation for the reaction is shown.

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

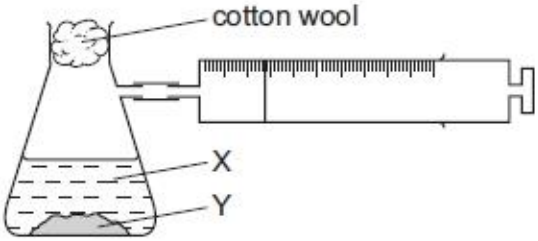
Which changes in temperature and pressure increase the yield of methanol?

	temperature	pressure
A	decrease	decrease
B	decrease	increase
C	increase	decrease
D	increase	increase

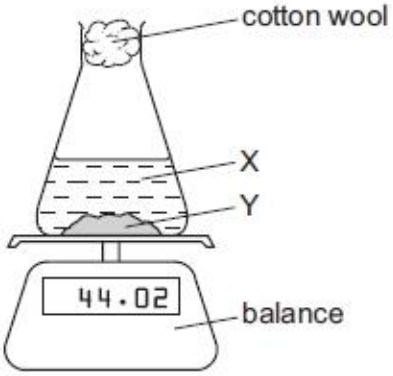
14 A liquid X reacts with solid Y to form a gas.

Which two diagrams show suitable methods for investigating the rate (speed) of the reaction?

1



2



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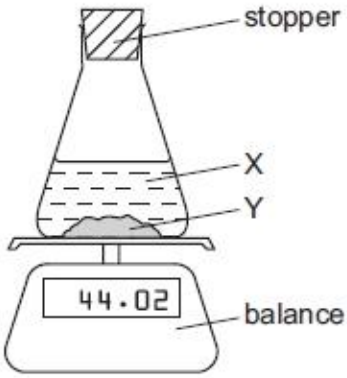

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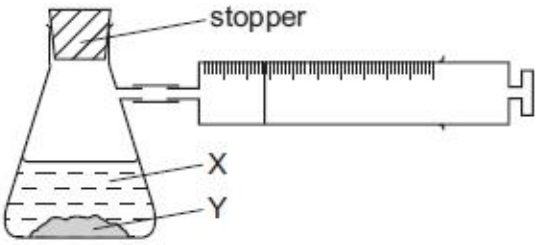


A 1 and 3 **B** 1 and 4 **C** 2 and 3 **D** 2 and 4

15 Which statements explain why increasing temperature increases the rate of a chemical reaction?

1 Heat makes the molecules move faster and collide more often.

2 Heat makes the molecules collide with more energy so they are more likely to react.

3 Increasing temperature lowers the activation energy for the reaction.

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

16 Steam reacts with carbon in an endothermic reaction.

$$C(s) + H_2O(g) \rightleftharpoons CO(g) + H_2(g)$$

Which conditions of temperature and pressure would give the largest yield of hydrogen?

	temperature	pressure
A	high	high
B	high	low
C	low	high
D	low	low

17 Which equation represents a reduction reaction?

A $Fe^{2+} + e^- \rightarrow Fe^{3+}$

B $Fe^{2+} \rightarrow Fe^{3+} + e^-$

C $Fe^{3+} + e^- \rightarrow Fe^{2+}$

D $Fe^{3+} \rightarrow Fe^{2+} + e^-$

Topic Chem 7 **4 Q# 82/** iG Extended/2016/m/Paper 22/

14 A reversible reaction is shown.

$$2NO_2(g) \rightleftharpoons N_2O_4(g) \qquad \Delta H = -58\,kJ/mol$$

Which statement about an equilibrium mixture of NO_2 and N_2O_4 is correct?

A If the pressure is decreased the amount of N_2O_4 increases.

B If the temperature is increased the amount of N_2O_4 increases.

C The rates of formation and decomposition of N_2O_4 are not the same.

D The decomposition of N_2O_4 is an endothermic reaction.

15 Which statement about catalysts in chemical reactions is **not** correct?

A Catalysts are not used up in the reaction.

B Catalysts increase the energy of the reacting particles.

C Catalysts increase the rate of the reaction.

D Catalysts lower the activation energy.

16 Zinc is extracted from zinc blende by roasting it in air to form zinc oxide.

The zinc oxide is then heated with carbon to form zinc.

The equations for the reactions are shown.

1 $2ZnS + 3O_2 \rightarrow 2ZnO + 2SO_2$

2 $ZnO + C \rightarrow Zn + CO$

Which statement about reactions 1 and 2 is **not** correct?

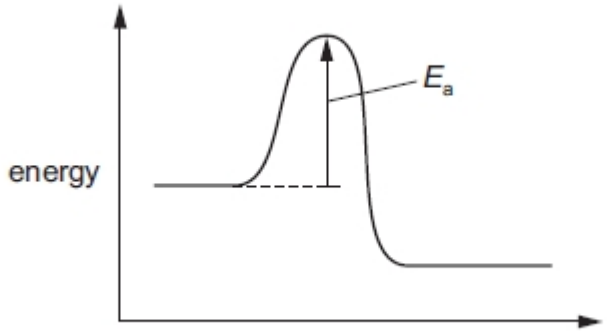
A In reaction 1 the oxidation state of sulfur increases and it is oxidised.

B In reaction 1 the oxidation state of zinc increases and it is oxidised.

C In reaction 2 the carbon acts as a reducing agent and it is oxidised.

D In reaction 2 the oxidation state of zinc decreases and it is reduced.

17 The diagram shows an energy level diagram for a reaction.



The diagram shows that the reaction is .....1..... .

Increasing the temperature increases the rate of reaction. A reason for this is that the .....2..... .

Which words correctly complete gaps 1 and 2?

	1	2
A	endothermic	activation energy decreases
B	endothermic	collision rate increases
C	exothermic	activation energy decreases
D	exothermic	collision rate increases

Topic Chem 8 **4 Q# 83/** iG Extended/2017/w/Paper 21/

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

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

Topic Chem 8 **2 Q# 84/** iG Extended/2017/w/Paper 22/

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

Topic Chem 8 **2 Q# 85/** iG Extended/2017/w/Paper 23/

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+}

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

Topic Chem 8 **4 Q# 89/** iG Extended/2017/m/Paper 22/

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

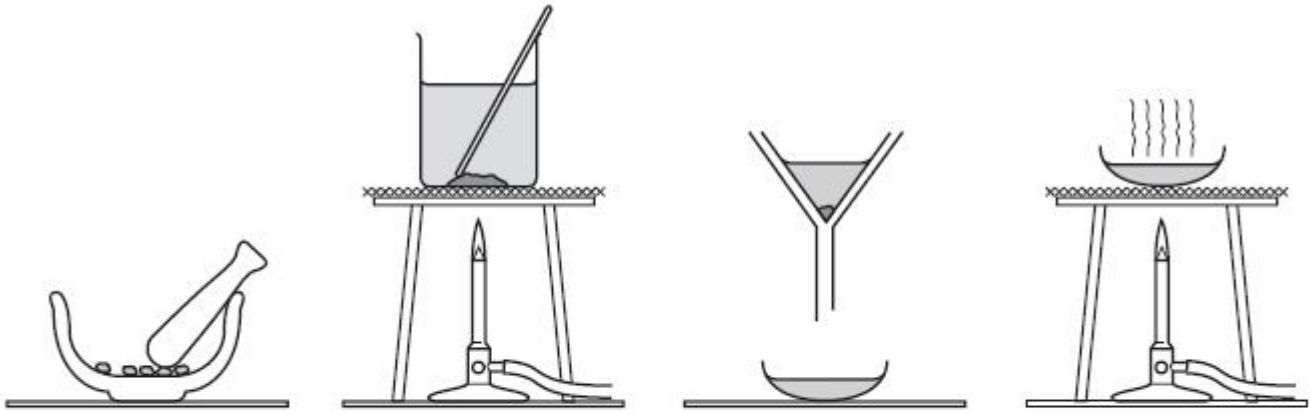
2 adding aqueous sodium hydroxide

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

Topic Chem 8 **1 Q# 90/** iG Extended/2016/w/Paper 23/

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

Topic Chem 8 **5 Q# 91/** iG Extended/2016/w/Paper 22/

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)

Topic Chem 8 **4 Q# 92/** iG Extended/2016/w/Paper 21/

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?

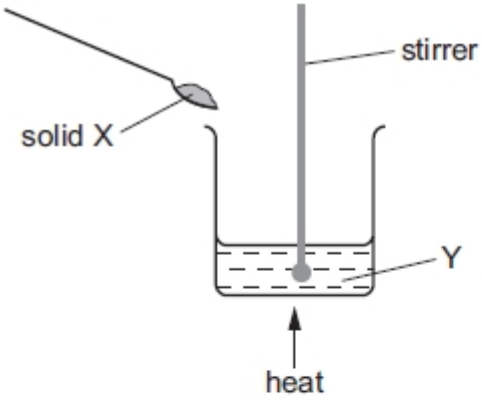
A The chloride ion is formed by accepting an electron from the water.

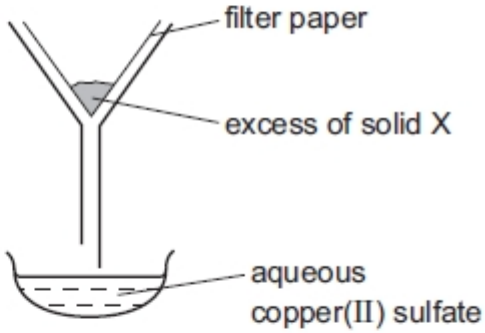
B The hydrogen chloride loses an electron to form the chloride ion.

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 $2Ag(s) + 2HCl(aq) \rightarrow 2AgCl(s) + H_2(g)$

Topic Chem 8 **1 Q# 93/** iG Extended/2016/w/Paper 21/

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

Topic Chem 8 **3 Q# 94/** iG Extended/2016/s/Paper 23/

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

Topic Chem 8 **1 Q# 95/** iG Extended/2016/s/Paper 22/

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

Topic Chem 8 **3 Q# 96/** iG Extended/2016/s/Paper 21/

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

Topic Chem 8 **4 Q# 97/** iG Extended/2016/m/Paper 22/

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

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.

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

Topic Chem 9 **3 Q# 100/** iG Extended/2017/w/Paper 23/

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

Topic Chem 9 **1 Q# 101/** iG Extended/2017/s/Paper 23/

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

Topic Chem 9 **1 Q# 102/** iG Extended/2017/s/Paper 22/

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.

Topic Chem 9 **3 Q# 103/** iG Extended/2017/s/Paper 21/

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.

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.

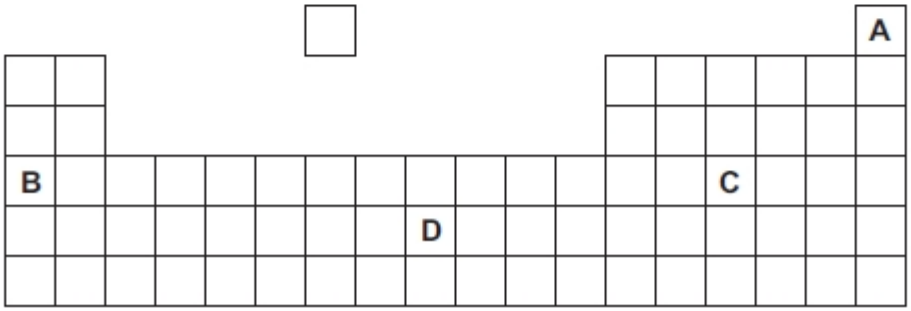
B They all have full outer shells.

C They are all gases.

D They are all monoatomic.

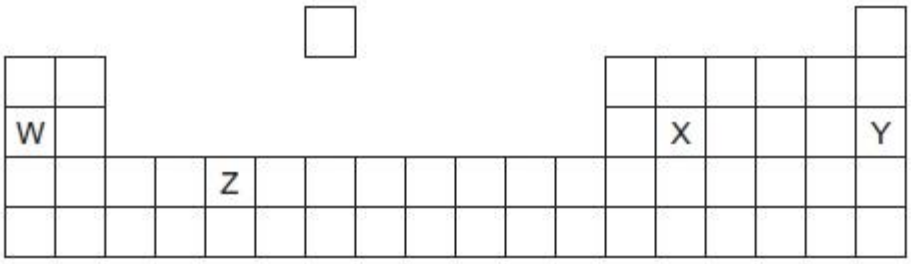
25 Part of the Periodic Table is shown.

Which element is used as a catalyst?



Topic Chem 9 **1 Q# 105/** iG Extended/2016/w/Paper 23/

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

Topic Chem 9 **2 Q# 106/** iG Extended/2016/w/Paper 22/

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

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

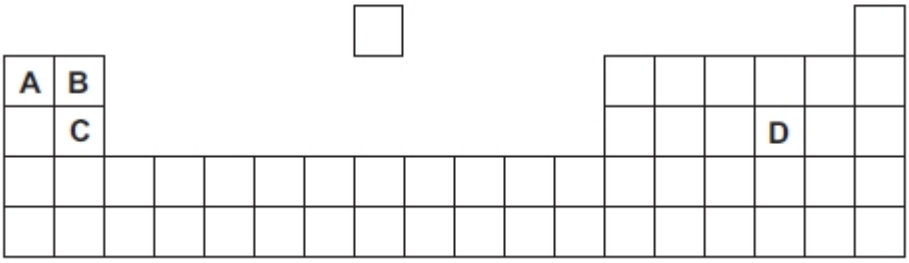
B They react when exposed to oxygen in the air.

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?



Topic Chem 9 **2 Q# 107/** iG Extended/2016/w/Paper 21/

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.

Topic Chem 9 **4 Q# 108/** iG Extended/2016/s/Paper 23/

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

Topic Chem 9 **3 Q# 109/** iG Extended/2016/s/Paper 22/

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.

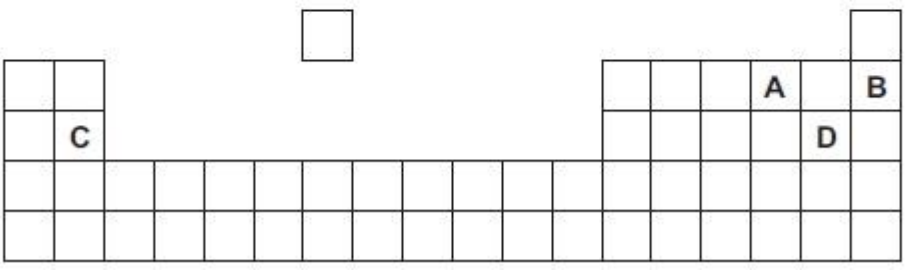
	melting point in °C	electrical conductivity of element when solid	density in g/cm^3	colour of iodide of element
P	98	good	0.97	white
Q	–39	good	13.53	red
R	1410	poor	2.33	colourless
S	1535	good	7.87	green

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.

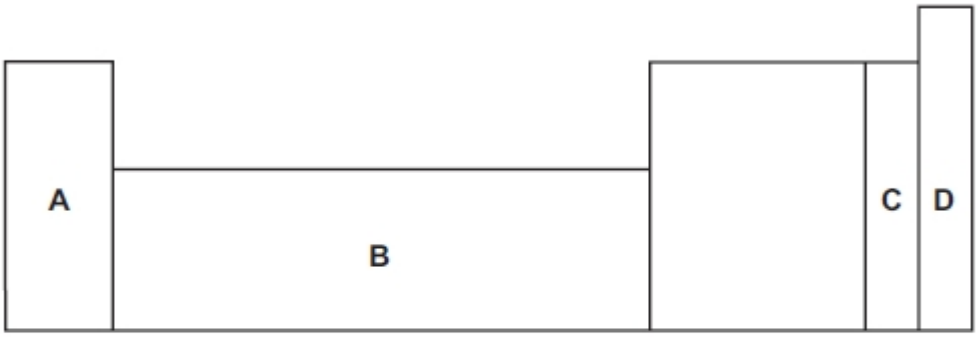
C Statement 1 is correct but statement 2 is incorrect.

D Statement 2 is correct but statement 1 is incorrect.

Topic Chem 9 **3 Q# 111/** iG Extended/2016/m/Paper 22/

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

25 What is a property of **all** metals?

A conduct electricity

B hard

C low melting points

D react with water

26 Aluminium is extracted by the electrolysis of aluminium oxide.

Which statement is **not** correct?

A Aluminium ions are oxidised at the cathode.

B Carbon dioxide is made at the anode.

C Cryolite is added to lower the melting point of the aluminium oxide.

D The electrodes are made from graphite.

27 Which row describes how the metals are used?

	mixed with zinc to form brass	used to galvanise iron
A	aluminium	tin
B	aluminium	zinc
C	copper	tin
D	copper	zinc

28 Information about the nitrates and carbonates of two metals, Q and R, is shown.

	appearance	solubility in water	effect of heat
nitrate of Q	white solid	soluble	colourless gas evolved which relights a glowing splint
carbonate of Q	white solid	soluble	no reaction
nitrate of R	white solid	soluble	brown gas evolved
carbonate of R	white solid	insoluble	colourless gas evolved which turns limewater milky

Which statement is correct?

A Q is calcium and R is magnesium.

B Q is magnesium and R is sodium.

C Q is potassium and R is copper.

D Q is sodium and R is calcium.

Topic Chem 10 **3 Q# 113/** iG Extended/2017/w/Paper 22/

26 Aluminium is extracted from bauxite by electrolysis.

Which row shows the anode material and the anode reaction?

	anode material	anode reaction
A	carbon	$Al^{3+} + 3e^- \rightarrow Al$
B	carbon	$2O^{2-} \rightarrow O_2 + 4e^-$
C	steel	$Al^{3+} + 3e^- \rightarrow Al$
D	steel	$2O^{2-} \rightarrow O_2 + 4e^-$

27 Which statement about the metal zinc is **not** correct?

A It forms an oxide more readily than iron.

B It is manufactured by the electrolysis of zinc blende.

C It is used to make brass.

D It is used to prevent iron from rusting.

28 Calcium nitrate decomposes when it is heated.

What is the equation for the thermal decomposition of calcium nitrate?

A $2Ca(NO_3)_2 \rightarrow 2CaO + O_2 + 4NO_2$

B $Ca(NO_3)_2 \rightarrow Ca(NO_2)_2 + O_2$

C $Ca(NO_3)_2 \rightarrow Ca + O_2 + 2NO_2$

D $Ca(NO_3)_2 \rightarrow Ca + 3O_2 + N_2$

Topic Chem 10 **3 Q# 114/** iG Extended/2017/w/Paper 23/

26 Aluminium is obtained by the electrolysis of a mixture of aluminium oxide and cryolite.

Why is cryolite used?

A as a catalyst to speed up the process

B as a coolant to prevent the process getting too hot

C as a solvent for aluminium oxide

D as the main source of aluminium ions

27 Metal M is mixed with copper to produce brass.

What is M?

A chromium

B nickel

C vanadium

D zinc

28 Some metal nitrates and carbonates decompose when heated strongly.

Metal Q has a nitrate that decomposes to give a salt and a colourless gas only.

The carbonate of metal Q does not decompose when heated with a Bunsen burner.

What is metal Q?

A calcium

B copper

C sodium

D zinc

Topic Chem 10 **2 Q# 115/** iG Extended/2017/s/Paper 23/

25 Which equation from the zinc extraction process shows the metal being produced by reduction?

A $ZnO + C \rightarrow Zn + CO$

B $2ZnS + 3O_2 \rightarrow 2ZnO + 2SO_2$

C $Zn(g) \rightarrow Zn(l)$

D $Zn(l) \rightarrow Zn(s)$

27 The section of the reactivity series shown includes a newly discovered element, symbol X.

The only oxide of X has the formula XO.

Ca

Mg

Fe

X

H

Cu

Which equation shows a reaction which occurs?

A $Cu(s) + X^{2+}(aq) \rightarrow Cu^{2+}(aq) + X(s)$

B $2X(s) + Cu^{2+}(aq) \rightarrow 2X^{+}(aq) + Cu(s)$

C $X(s) + Fe_2O_3(s) \rightarrow 2Fe(s) + 3XO(s)$

D $X(s) + 2HCl(aq) \rightarrow XCl_2(aq) + H_2(g)$

25 Which process is involved in the extraction of zinc from zinc blende?

A Cryolite is added to lower the melting point of zinc blende.

B Molten zinc blende is electrolysed.

C Zinc blende is heated with carbon.

D Zinc blende is roasted in air.

26 Element E:

- forms an alloy
- has a basic oxide
- is below hydrogen in the reactivity series.

What is E?

A carbon

B copper

C sulfur

D zinc

27 A list of metals is shown.

aluminium

copper

iron

magnesium

silver

zinc

Which metal will displace all of the other metals from aqueous solutions of their salts?

A aluminium

B iron

C magnesium

D zinc

25 Metal X is added to a colourless aqueous solution of the sulfate of metal Y.

A coloured solution is formed and metal Y is deposited at the bottom of the beaker.

Which row describes elements X and Y and their relative reactivity?

	type of element	relative reactivity
A	X is a transition element	X is more reactive than Y
B	X is a transition element	Y is more reactive than X
C	Y is a transition element	X is more reactive than Y
D	Y is a transition element	Y is more reactive than X

26 Element E:

- forms an alloy
- has a basic oxide
- is below hydrogen in the reactivity series.

What is E?

A carbon

B copper

C sulfur

D zinc

27 Zinc metal is extracted from its ore zinc blende in a similar method to that used to extract iron from hematite.

In which way is zinc extraction different from iron extraction?

A Carbon and carbon monoxide are the main reducing agents.

B Hot air at the base of the furnace reacts with coke to keep the furnace hot.

C The metal is removed as a vapour at the top of the furnace.

D The metal oxide is added into the top of the furnace.

28 Stainless steel is an alloy of iron and other metals. It is strong and does not rust but it costs much more than normal steel.

What is **not** made from stainless steel?

A cutlery

B pipes in a chemical factory

C railway lines

D saucepans

Topic Chem 10 **4 Q# 118/** iG Extended/2017/m/Paper 22/

26 Which statement about **all** metals is correct?

A They are attracted to a magnet.

B They are weak and brittle.

C They may be used to form alloys.

D They react with water.

27 Which substance produces sulfur dioxide when roasted in air?

A bauxite

B cryolite

C hematite

D zinc blende

28 Which metal carbonate does **not** produce carbon dioxide when it is heated with a Bunsen burner?

A copper(II) carbonate

B magnesium carbonate

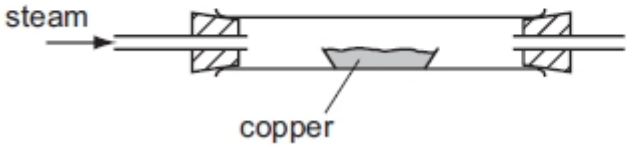
C sodium carbonate

D zinc carbonate

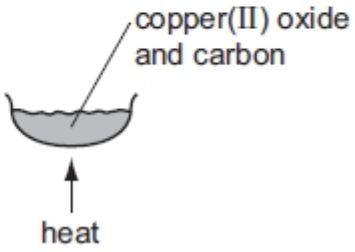
29 Two experiments are carried out.

In experiment 1, copper is heated with steam.

In experiment 2, copper(II) oxide is heated with carbon.



experiment 1



experiment 2

Which row describes what happens in experiments 1 and 2?

	experiment 1	experiment 2
A	no reaction	no reaction
B	no reaction	reaction
C	reaction	no reaction
D	reaction	reaction

Topic Chem 10 **4 Q# 119/** iG Extended/2016/w/Paper 23/

25 Basic oxides and oxygen are used to convert iron into steel.

Which statement is **not** correct?

A Carbon is converted into carbon dioxide.

B Silicon is converted into silicon(IV) oxide.

C The basic oxides react with acidic impurities to form slag.

D The oxygen reacts with the iron to produce hematite.

26 The results of two experiments are given.

1 Cobalt displaces manganese from an aqueous solution of a manganese salt.

2 Manganese displaces silver from an aqueous solution of a silver salt.

Three more experiments are carried out.

3 Cobalt is added to an aqueous solution of a silver salt.

4 Manganese is added to an aqueous solution of a cobalt salt.

5 Silver is added to an aqueous solution of a cobalt salt.

In which experiments does a reaction take place?

A 3 only **B** 3 and 4 **C** 4 and 5 **D** 5 only

27 Cryolite, Na_3AlF_6, is added to aluminium oxide in the electrolytic extraction of aluminium.

What is the reason for this?

A to decrease the melting point of the electrolyte

B to protect the anodes

C to produce more aluminium

D to stop the aluminium reacting with air

28 Different forms of steel contain different proportions of carbon.

Steel P contains a high proportion of carbon.

Steel Q contains a low proportion of carbon.

Which statement is correct?

A P is stronger and more brittle than Q.

B P is stronger and less brittle than Q.

C P is less strong and more brittle than Q.

D P is less strong and less brittle than Q.

Topic Chem 10 **4 Q# 120/** iG Extended/2016/w/Paper 22/

25 Impurities in iron obtained from the blast furnace include carbon, phosphorus and silicon.

Which impurities are removed from the molten iron as gases when it is made into steel?

A carbon and phosphorus

B carbon and silicon

C carbon only

D phosphorus and silicon

26 Y displaces X from its aqueous sulfate.

X does not displace W from its aqueous sulfate.

X displaces Z from its aqueous sulfate.

What is the order of reactivity of elements W, X, Y and Z?

	most reactive	→		least reactive
A	W	X	Y	Z
B	W	Y	X	Z
C	Z	X	Y	W
D	Z	W	Y	X

27 Which statement about the industrial extraction of aluminium from aluminium oxide is correct?

A Aluminium is extracted by heating its oxide with carbon.

B Aluminium is extracted using electrolysis and is collected at the anode.

C Aluminium is extracted using platinum electrodes and direct current.

D Molten cryolite is used as a solvent for aluminium oxide.

28 The alloy brass is a mixture of copper and another metal.

Brass is used to make the pins of electrical plugs.

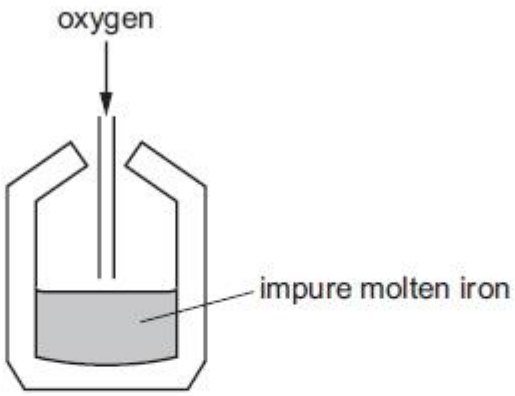
Copper is used to make electrical wiring.

Which row about brass is correct?

	hardness	electrical conductivity	other metal
A	harder than copper	better than copper	tin
B	harder than copper	worse than copper	zinc
C	softer than copper	better than copper	tin
D	softer than copper	worse than copper	zinc

Topic Chem 10 **4 Q# 121/** iG Extended/2016/w/Paper 21/

25 Impure iron from the blast furnace is converted to steel as shown.



Which statement about the process is correct?

A Acidic oxides are added to remove alkaline impurities.

B Coke is added as a reducing agent.

C Oxygen is blown in to oxidise the impure iron.

D The steel produced contains less carbon than the impure iron.

26 The ionic equations represent the reactions between four metals, P, Q, R and S, and solutions of the salts of the same metals.

$$P + Q^{2+} \rightarrow \text{no reaction}$$

$$R + P^{2+} \rightarrow R^{2+} + P$$

$$Q + S^{2+} \rightarrow Q^{2+} + S$$

$$S + P^{2+} \rightarrow S^{2+} + P$$

$$S + R^{2+} \rightarrow S^{2+} + R$$

$$S + Q^{2+} \rightarrow \text{no reaction}$$

What is the correct order of reactivity of the metals?

	most →			least
A	P	R	S	Q
B	Q	R	S	P
C	Q	S	R	P
D	S	Q	P	R

27 Aluminium is extracted by electrolysis.

From which ore is aluminium extracted and at which electrode is aluminium deposited during electrolysis?

	ore	electrode
A	bauxite	negative
B	bauxite	positive
C	cryolite	negative
D	cryolite	positive

28 Zinc oxide can be reacted with carbon to produce zinc metal.

Which equation for this reaction is correct?

A $2ZnO + C \rightarrow 2Zn + CO$

B $2ZnO + 2C \rightarrow 2Zn + 2CO_2$

C $ZnO + C \rightarrow Zn + CO$

D $ZnO + 2C \rightarrow Zn + 2CO_2$

Topic Chem 10 **3 Q# 122/** iG Extended/2016/s/Paper 23/

26 Four metals P, Q, R and S are added to separate aqueous solutions of their ions.

The results are shown.

metal	P^{2+}	Q^{2+}	R^{2+}	S^{2+}
P	✗	✗	✓	✓
Q	✓	✗	✓	✓
R	✗	✗	✗	✗
S	✗	✗	✓	✗

key

✓ = reaction occurs

✗ = reaction does not occur

What is the order of reactivity of the metals, most reactive first?

A $Q \rightarrow P \rightarrow S \rightarrow R$

B $Q \rightarrow S \rightarrow P \rightarrow R$

C $R \rightarrow P \rightarrow S \rightarrow Q$

D $R \rightarrow S \rightarrow P \rightarrow Q$

27 Copper is a transition element used to make saucepans.

Which property is **not** correct for copper?

A good conductor of heat

B insoluble in water

C low melting point

D malleable (can be hammered into shape)

28 Aluminium is extracted by electrolysis of a mixture of aluminium oxide and cryolite.

Which statement is **not** correct?

A The electrodes are made from graphite.

B The formula for aluminium oxide is Al_2O_3.

C The purpose of the cryolite is to lower the melting point of the mixture.

D The reaction taking place at the anode is $Al^{3+} + 3e^- \rightarrow Al$.

Topic Chem 10 **4 Q# 123/** iG Extended/2016/s/Paper 22/

25 Some magnesium compounds undergo thermal decomposition.

What are the products of thermal decomposition of magnesium nitrate, $Mg(NO_3)_2$, and magnesium hydroxide, $Mg(OH)_2$?

	$Mg(NO_3)_2$	$Mg(OH)_2$
A	MgO, NO_2 and O_2	MgO and H_2O
B	MgO, NO_2 and O_2	MgO and H_2
C	$Mg(NO_2)_2$ and O_2	MgO and H_2O
D	$Mg(NO_2)_2$ and O_2	MgO and H_2

26 Which property is **not** considered a typical metallic property?

A good conductor of heat

B low melting point

C malleable (can be hammered into shape)

D strong

27 Iron from a blast furnace is treated with oxygen and with calcium oxide to make steel.

Which substances in the iron are removed?

	oxygen removes	calcium oxide removes
A	carbon	acidic oxides
B	carbon	basic oxides
C	iron	acidic oxides
D	iron	basic oxides

28 Why is cryolite used during the extraction of aluminium by electrolysis?

A It is a catalyst for the reaction.

B It lowers the melting point of the electrolyte.

C It protects the anodes.

D It separates the aluminium from the electrolyte.

Topic Chem 10 **4 Q# 124/** iG Extended/2016/s/Paper 21/

25 A student investigated the reactions of four metals, R, S, T and U, with solutions of their salts.

The results are given in the table.

metal	metal salt	result
R	S nitrate	reacts
R	T nitrate	reacts
S	U nitrate	no reaction
T	U nitrate	reacts
U	R nitrate	no reaction

What is the order of reactivity of the metals, most reactive first?

A $R \rightarrow S \rightarrow U \rightarrow T$

B $R \rightarrow T \rightarrow U \rightarrow S$

C $S \rightarrow U \rightarrow T \rightarrow R$

D $U \rightarrow R \rightarrow T \rightarrow S$

26 Three students, X, Y and Z, were told that solid P reacts with dilute acids and also conducts electricity.

The table shows the students' suggestions about the identity of P.

X	Y	Z
copper	iron	graphite

Which of the students are correct?

A X, Y and Z **B** X only **C** Y only **D** Z only

27 Which statement about the uses of metals is correct?

A Aluminium is used in the manufacture of aircraft because of its strength and high density.

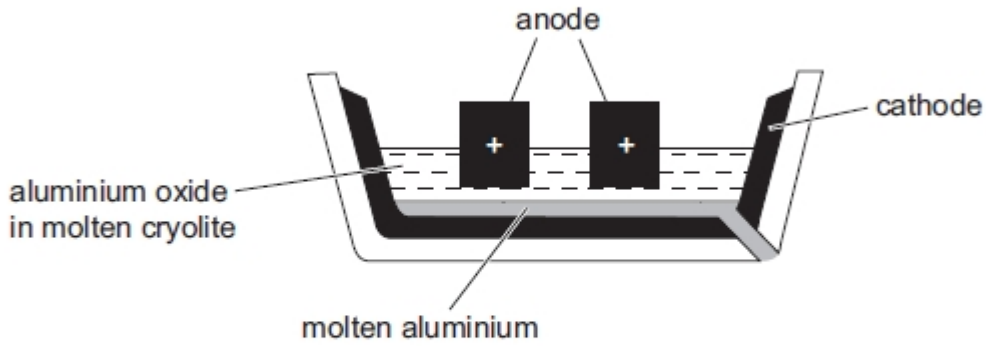
B Copper is used in electrical wiring because of its strength and high density.

C Mild steel is used in the manufacture of car bodies because of its strength and resistance to corrosion.

D Stainless steel is used in the construction of chemical plant because of its strength and resistance to corrosion.

28 Aluminium is manufactured by electrolysis of aluminium oxide.

The diagram shows the electrolysis cell.



Which statement about the process is **not** correct?

A Aluminium ions gain electrons during the electrolysis and are reduced.

B Cryolite is added to reduce the melting point of the aluminium oxide.

C The anode and cathode are made of graphite.

D The cathode has to be replaced regularly because it is burnt away.

Topic Chem 10 **1 Q# 125/** iG Extended/2016/m/Paper 22/

11 Which reaction does **not** occur in the extraction of aluminium?

A $Al^{3+} + 3e^- \rightarrow Al$

B $2Al_2O_3 + 3C \rightarrow 4Al + 3CO_2$

C $2O^{2-} \rightarrow O_2 + 4e^-$

D $C + O_2 \rightarrow CO_2$

Topic Chem 10 **3 Q# 126/** iG Extended/2016/m/Paper 22/

25 Brass is an alloy of two metals.

Which row gives a correct use for the two metals from which brass is made?

	metal 1	metal 2
A	used for electrical wiring	used for galvanising steel
B	used for galvanising steel	used for making aircraft
C	used for making aircraft	used for making cutlery
D	used for making cooking pans	used for electrical wiring

26 Iron is extracted from hematite in the blast furnace.

The hematite contains silicon(IV) oxide (sand) as an impurity.

What reacts with this impurity to remove it?

A calcium oxide

B carbon

C carbon dioxide

D slag

27 The reaction below is called the 'thermite reaction'.

$$2Al + Fe_2O_3 \rightarrow 2Fe + Al_2O_3$$

Which pair of substances reacts in a similar way?

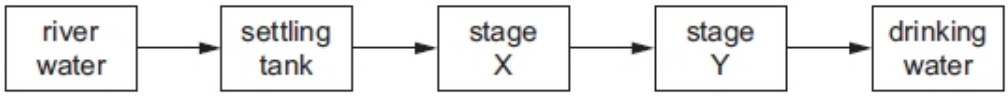
A Fe and MgO

B Fe and ZnO

C Mg and CuO

D Zn and Al_2O_3

29 The flow chart shows stages in the treatment of river water to produce drinking water.



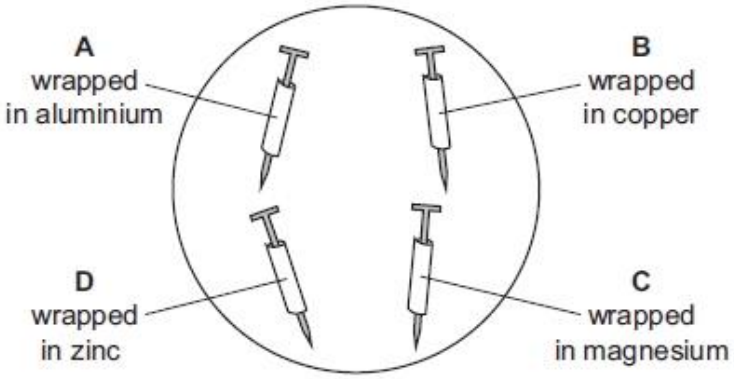
What occurs at stages X and Y?

	X	Y
A	distillation	chlorination
B	distillation	filtration
C	filtration	chlorination
D	filtration	distillation

30 Four iron nails had different metals wrapped around them.

The nails were placed in an open dish filled with water and left for a week.

Which iron nail has no protection against rusting?



31 Ammonia is made by the Haber process.

$$N_2 + 3H_2 \rightleftharpoons 2NH_3$$

What are the sources of the nitrogen and hydrogen used in the Haber process?

	nitrogen	hydrogen
A	fertilisers	reacting methane with steam
B	fertilisers	the air
C	the air	reacting methane with steam
D	the air	the air

32 Which process does **not** produce carbon dioxide?

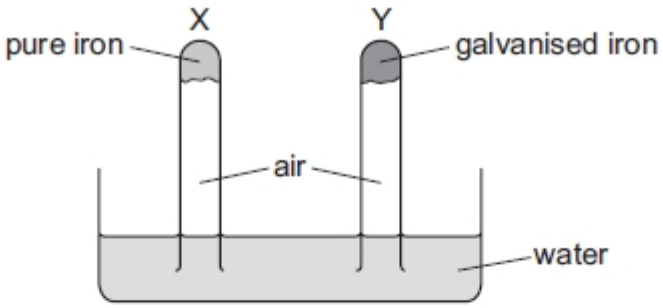
A combustion of alkanes

B photosynthesis

C respiration

D thermal decomposition of limestone

30 An experiment to investigate the effect of galvanising iron is shown.



The experiment is left for seven days.

What happens to the water level in tubes X and Y?

	tube X	tube Y
A	falls	rises
B	no change	no change
C	rises	falls
D	rises	no change

31 Which metal is used as a catalyst in the Haber process for the manufacture of ammonia?

A iron

B nickel

C platinum

D vanadium

32 Which process removes carbon dioxide from the atmosphere?

A combustion of fossil fuels

B decomposition of carbonates

C photosynthesis

D respiration

30 A piece of zinc is attached to the hull of a steel boat. Steel is an alloy of iron.

Which statement explains why the zinc prevents the iron from rusting?

A Zinc is less reactive than iron, and iron is less likely to lose electrons than zinc.

B Zinc is less reactive than iron, and iron is more likely to lose electrons than zinc.

C Zinc is more reactive than iron, and iron is less likely to lose electrons than zinc.

D Zinc is more reactive than iron, and iron is more likely to lose electrons than zinc.

31 The Haber process for making ammonia is carried out at a temperature of 450 °C and a pressure of 200 atmospheres in the presence of a catalyst.

Which statement is **not** correct?

A Lowering the pressure increases the rate at which ammonia is produced.

B Lowering the temperature slows down the rate at which ammonia is produced.

C Maintaining a very high pressure is very difficult and needs expensive equipment.

D The reaction is a reversible reaction which can proceed forwards and backwards.

Topic Chem 11 **3 Q# 130/** iG Extended/2017/s/Paper 23/

30 The carbon cycle describes how carbon dioxide gas is added to or removed from the atmosphere.

Which row describes the movement of carbon dioxide during each process?

	photosynthesis	combustion	respiration
A	added to the atmosphere	added to the atmosphere	removed from the atmosphere
B	added to the atmosphere	removed from the atmosphere	added to the atmosphere
C	removed from the atmosphere	added to the atmosphere	added to the atmosphere
D	removed from the atmosphere	added to the atmosphere	removed from the atmosphere

31 Which row gives the catalyst for the Haber process and the sources of the raw materials?

	catalyst	source of hydrogen	source of nitrogen
A	iron	electrolysis	fertiliser
B	iron	methane	air
C	vanadium pentoxide	methane	air
D	vanadium pentoxide	methane	fertiliser

32 Petrol burns in a car engine to produce waste gases which leave through the car exhaust.

One of these waste gases is an oxide of nitrogen.

Which statement describes how this oxide of nitrogen is formed?

A Carbon dioxide reacts with nitrogen in the catalytic converter.

B Nitrogen reacts with oxygen in the car engine.

C Nitrogen reacts with oxygen in the catalytic converter.

D Petrol combines with nitrogen in the car engine.

Topic Chem 11 **4 Q# 131/** iG Extended/2017/s/Paper 22/

30 The carbon cycle includes the processes combustion, photosynthesis and respiration.

Which row shows how each process changes the amount of carbon dioxide in the atmosphere?

	combustion	photosynthesis	respiration
A	decreases	decreases	increases
B	decreases	increases	decreases
C	increases	decreases	increases
D	increases	increases	decreases

31 Which statement about the conditions used in the Haber process is **not** correct?

A A high temperature is used because the forward reaction is exothermic.

B A high pressure is used because there are fewer moles of gas in the products than in the reactants.

C An iron catalyst is used to increase the rate of the forward reaction.

D The unreacted hydrogen and nitrogen are recycled to increase the amount of ammonia produced.

32 Which chemical reaction decreases pollution in the air?

A $S + O_2 \rightarrow SO_2$

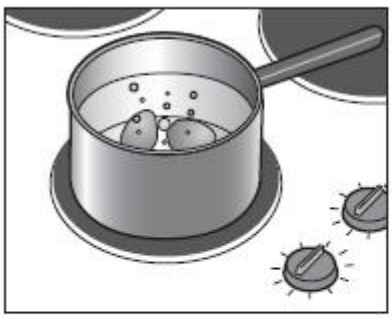
B $N_2 + O_2 \rightarrow 2NO$

C $2CH_4 + 3O_2 \rightarrow 2CO + 4H_2O$

D $2NO + 2CO \rightarrow 2CO_2 + N_2$

Topic Chem 11 **4 Q# 132/** iG Extended/2017/s/Paper 21/

29 The diagram shows some uses of water in the home.



1

2

3

For which uses is it important for the water to have been treated?

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

30 Oxides of nitrogen are found in polluted air.

Which statement about oxides of nitrogen is correct?

A Oxides of nitrogen are formed by the reaction of nitrogen with oxygen during the fractional distillation of liquid air.

B Oxides of nitrogen are formed in a car engine by the reaction of petrol with nitrogen from the air.

C Oxides of nitrogen are removed from exhaust gases by reaction with carbon dioxide in a catalytic converter.

D Oxides of nitrogen are removed from exhaust gases by reduction in a catalytic converter.

31 Photosynthesis and respiration are important natural processes.

Which statement is correct?

A Carbon dioxide is formed by the reaction of glucose with water during photosynthesis.

B Carbon dioxide is removed from the air by respiration.

C Glucose reacts with water to form oxygen during respiration.

D Photosynthesis produces glucose and oxygen.

32 Which row gives the conditions for the Haber process?

	temperature / °C	pressure / atm	catalyst
A	200	2	V_2O_5
B	200	450	Fe
C	450	200	Fe
D	500	250	V_2O_5

Topic Chem 11 **2 Q# 133/** iG Extended/2017/m/Paper 22/

30 Which two gases are obtained from liquid air by fractional distillation?

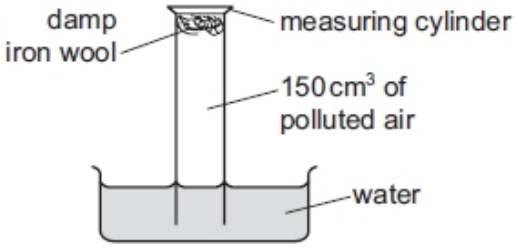
A carbon dioxide and oxygen

B carbon dioxide and water vapour

C nitrogen and oxygen

D nitrogen and water vapour

31 An experiment to find the percentage of oxygen in 150 cm^3 of polluted air is shown.



The apparatus is left for one week.

After this time, the volume of gas in the measuring cylinder is 122 cm^3.

What is the percentage of oxygen, to the nearest whole number, in the polluted air?

A 19% **B** 21% **C** 28% **D** 81%

Topic Chem 11 **3 Q# 134/** iG Extended/2016/w/Paper 23/

30 Which information about carbon dioxide and methane is correct?

		carbon dioxide	methane
A	formed when vegetation decomposes	✓	✗
B	greenhouse gas	✓	✓
C	present in unpolluted air	✗	✗
D	produced during respiration	✗	✓

key
✓ = true
✗ = false

31 A metal, X, is used to make oil pipelines.

X corrodes in air and water.

X can be protected from corrosion by attaching blocks of element Y.

Which statement is correct?

A This process is known as galvanising.

B Y forms positive ions more readily than X.

C Y is an unreactive metal.

D Y is an unreactive non-metal.

32 The Haber process for the manufacture of ammonia occurs at 450 °C and 250 atmospheres. The nitrogen and hydrogen are supplied in a 1:3 ratio by volume. The reaction is exothermic.

$$N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g) \qquad \Delta H = -92\,kJ/mol$$

Which change causes an increase in the yield of ammonia?

A decreasing the concentration of nitrogen

B decreasing the pressure

C decreasing the temperature

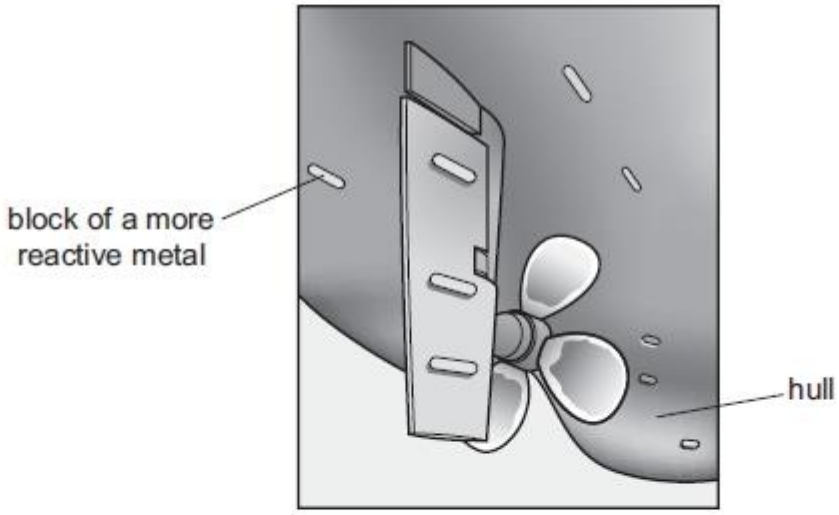
D using equal amounts of the two reactants

30 Which information about carbon dioxide and methane is correct?

		carbon dioxide	methane
A	formed when vegetation decomposes	✓	✗
B	greenhouse gas	✓	✓
C	present in unpolluted air	✗	✗
D	produced during respiration	✗	✓

key
✓ = true
✗ = false

31 Boats made from steel can be protected from rusting by attaching blocks of a more reactive metal to the hull of the boat.



Which statement is correct?

A Copper is used for the blocks because it does not react with water.

B Magnesium is not used for the blocks because it reacts with steel.

C The metal used for the blocks loses electrons more easily than steel.

D This form of protection from rusting is called galvanising.

32 Ammonia is manufactured by the Haber process, using an iron catalyst.

$$N_2 + 3H_2 \rightleftharpoons 2NH_3$$

It is not possible to obtain 100% yield.

What is the reason for this?

A A high pressure is used.

B Ammonia decomposes at high temperature.

C Some of the ammonia is recycled.

D The ammonia reacts with the catalyst.

29 Air is a mixture of gases.

Which gas is present in the largest amount?

A argon

B carbon dioxide

C nitrogen

D oxygen

30 Which information about carbon dioxide and methane is correct?

		carbon dioxide	methane
A	formed when vegetation decomposes	✓	✗
B	greenhouse gas	✓	✓
C	present in unpolluted air	✗	✗
D	produced during respiration	✗	✓

key

✓ = true

✗ = false

31 Underwater steel pipes can be protected from corrosion by attaching magnesium blocks to them.

Which equation represents the reaction that prevents corrosion?

A $Fe \rightarrow Fe^{2+} + 2e^-$

B $Fe^{2+} \rightarrow Fe^{3+} + e^-$

C $Mg \rightarrow Mg^{2+} + 2e^-$

D $Mg^{2+} + 2e^- \rightarrow Mg$

32 Ammonia is manufactured by the Haber process. The reaction is exothermic.

$$N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g) \qquad \Delta H = -92\,kJ/mol$$

Which statement about the Haber process is correct?

A The reaction is irreversible and produces only one product.

B The reaction is reversible and produces less ammonia at high pressure.

C The reaction is reversible and produces less ammonia at high temperature.

D The reaction is slow because a catalyst is not used in the Haber process.

Topic Chem 11 **2 Q# 137/** iG Extended/2016/s/Paper 23/

31 Catalytic converters are used to remove some gaseous pollutants from car exhaust fumes.

Which gas is removed from the fumes by oxidation?

A carbon dioxide

B carbon monoxide

C nitrogen

D nitrogen oxide

32 Ammonia is produced by the Haber process.

$$N_2(g) + 3H_2(g) \rightarrow 2NH_3(g).$$

Which statement about the Haber process is **not** correct?

A An iron catalyst is used to increase the rate of reaction.

B The reaction is carried out at high temperature to increase the rate of reaction.

C The reaction is carried out at low pressure to increase the yield of ammonia.

D The reaction is reversible.

Topic Chem 11 **2 Q# 138/** iG Extended/2016/s/Paper 22/

31 The gases coming from a car's engine contain oxides of nitrogen.

How are these oxides formed?

A Nitrogen reacts with carbon dioxide.

B Nitrogen reacts with carbon monoxide.

C Nitrogen reacts with oxygen.

D Nitrogen reacts with petrol.

32 Ammonia is manufactured by a reversible reaction.

$$N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$$

The forward reaction is exothermic.

What is the effect of increasing the pressure on the percentage yield and rate of formation of ammonia?

	percentage yield	rate of formation
A	decreases	decreases
B	decreases	increases
C	increases	decreases
D	increases	increases

31 Many car exhaust systems contain a catalytic converter.

Which change does **not** occur in a catalytic converter?

A carbon dioxide → carbon

B carbon monoxide → carbon dioxide

C nitrogen oxides → nitrogen

D unburnt hydrocarbons → carbon dioxide and water

32 Ammonia is formed by a reversible reaction.

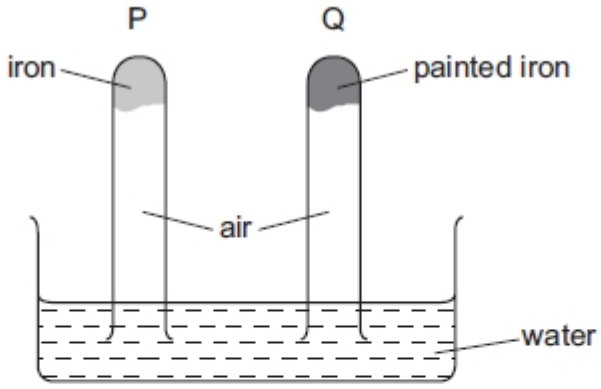
$$N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$$

The forward reaction is exothermic.

Which changes in conditions would increase the yield of ammonia?

	increase in pressure	increase in temperature
A	✓	✓
B	✓	✗
C	✗	✓
D	✗	✗

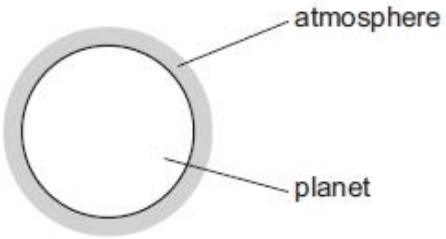
29 The diagram shows an experiment to investigate how paint affects the rusting of iron.



What happens to the water level in tubes P and Q?

	tube P	tube Q
A	falls	rises
B	no change	rises
C	rises	falls
D	rises	no change

30 A new planet has been discovered and its atmosphere has been analysed.



The table shows the composition of its atmosphere.

gas	percentage by volume
carbon dioxide	4
nitrogen	72
oxygen	24

Which gases are present in the atmosphere of the planet in a higher percentage than they are in the Earth's atmosphere?

A carbon dioxide and oxygen

B carbon dioxide only

C nitrogen and oxygen

D nitrogen only

34 A farmer's soil is very low in both nitrogen (N) and phosphorus (P).

Which fertiliser would improve the quality of this soil most effectively?

	percentage		
	nitrogen (N)	phosphorus (P)	potassium (K)
A	11	11	27
B	12	37	10
C	28	10	10
D	31	29	9

Topic Chem 11 **5 Q# 141/** iG Extended/2016/m/Paper 22/

28 One method of preventing the rusting of iron is to keep oxygen away from the surface of the metal.

Which way of rust prevention does **not** use this method?

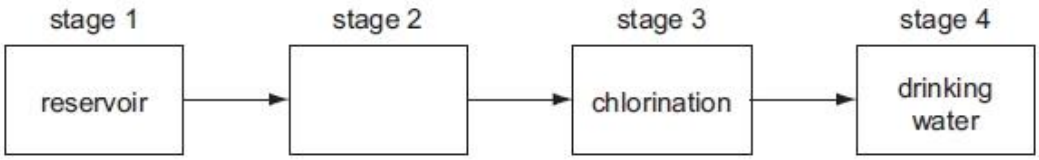
A coating the iron with grease

B connecting the iron to a more reactive metal

C covering the iron with plastic

D painting the iron

29 The diagram shows how water is treated to make it suitable for drinking.



What happens in stage 2?

A condensation

B distillation

C evaporation

D filtration

30 Nitrogen monoxide is produced in a car engine when petrol is burnt.

The gases from the car engine are passed through a catalytic converter.

In the catalytic converter the nitrogen monoxide reacts with carbon monoxide to form nitrogen and carbon dioxide.

Which statement is **not** correct?

A Carbon monoxide is oxidised in the catalytic converter.

B Carbon monoxide is produced by the complete combustion of petrol.

C Nitrogen monoxide is formed by the reaction of nitrogen and oxygen.

D Nitrogen monoxide is reduced in the catalytic converter.

31 Which pollutant gas can be produced as a result of incomplete combustion of octane, C_8H_{18}?

A carbon

B carbon dioxide

C carbon monoxide

D methane

32 Fertilisers are used to provide three elements needed to increase the yield of crops.

Which two compounds would provide all three of these elements?

A ammonium nitrate and calcium phosphate

B ammonium nitrate and potassium sulfate

C potassium nitrate and calcium phosphate

D potassium nitrate and potassium sulfate

Topic Chem 12 **1 Q# 142/** iG Extended/2017/w/Paper 21/

33 Which row shows the conditions used in the manufacture of sulfuric acid by the Contact process?

	temperature /°C	pressure / atm	catalyst
A	40	200	Fe
B	40	200	V_2O_5
C	400	2	Fe
D	400	2	V_2O_5

Topic Chem 12 **1 Q# 143/** iG Extended/2017/s/Paper 21/

33 Which statement about sulfuric acid is correct?

A It is made by the Haber process.

B It is made in the atmosphere by the action of lightning.

C It reacts with ammonia to produce a fertiliser.

D It reacts with copper metal to produce hydrogen gas.

Topic Chem 12 **1 Q# 144/** iG Extended/2017/m/Paper 22/

33 The ions present in ammonium sulfate are formed from the products of the Contact and Haber processes.

Both of these processes involve the use of a catalyst.

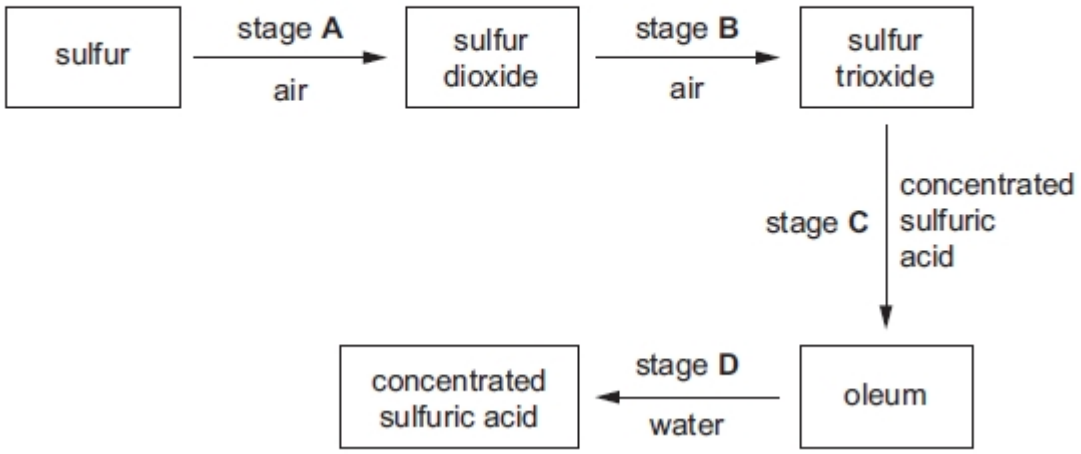
Which row is correct?

	ion	formed from	process	catalyst
A	ammonium	ammonia	Contact	iron
B	ammonium	ammonia	Haber	vanadium(V) oxide
C	sulfate	sulfuric acid	Contact	vanadium(V) oxide
D	sulfate	sulfuric acid	Haber	iron

Topic Chem 12 **1 Q# 145/** iG Extended/2016/w/Paper 23/

33 The following scheme shows four stages in the conversion of sulfur to sulfuric acid.

In which stage is a catalyst used?



Topic Chem 12 **1 Q# 146/** iG Extended/2016/w/Paper 22/

33 Sulfuric acid is manufactured by a series of chemical reactions, one of which is catalysed by vanadium(V) oxide.

What is the equation for the reaction catalysed by vanadium(V) oxide?

A $S + O_2 \rightarrow SO_2$

B $2S + 3O_2 \rightarrow 2SO_3$

C $2SO_2 + O_2 \rightarrow 2SO_3$

D $SO_3 + H_2O \rightarrow H_2SO_4$

Topic Chem 12 **1 Q# 147/** iG Extended/2016/w/Paper 21/

33 Sulfuric acid is manufactured by the Contact process.

The most important reaction takes place in the presence of a catalyst.

What are the reactants and the catalyst for this reaction?

	reactants	catalyst
A	sulfur and oxygen	vanadium(V) oxide
B	sulfur dioxide and oxygen	vanadium(V) oxide
C	sulfur dioxide and steam	iron
D	sulfur trioxide and water	platinum

Topic Chem 12 **1 Q# 148/** iG Extended/2016/s/Paper 23/

33 One step in the manufacture of sulfuric acid is the oxidation of sulfur dioxide to sulfur trioxide.

Which conditions are used for this step?

	temperature /°C	pressure /atmospheres	catalyst
A	450	1.5	iron
B	450	1.5	vanadium(V) oxide
C	450	200	iron
D	450	200	vanadium(V) oxide

Topic Chem 12 **1 Q# 149/** iG Extended/2016/s/Paper 22/

33 The Contact process is used for the manufacture of sulfuric acid.

Which statement about this process is **not** correct?

A A catalyst of iron is used.

B Oxygen from the air is used to react with sulfur dioxide.

C Sulfur trioxide dissolves in sulfuric acid to form oleum.

D The temperature used is around 450 °C.

Topic Chem 12 **1 Q# 150/** iG Extended/2016/s/Paper 21/

33 The equation for an exothermic reaction in the Contact process is shown.

$$2SO_2(g) + O_2(g) \rightarrow 2SO_3(g)$$

Which effects do increasing the temperature and using a catalyst have on the rate of formation of sulfur trioxide, SO_3?

	increasing the temperature	using a catalyst
A	rate decreases	rate decreases
B	rate decreases	rate increases
C	rate increases	rate decreases
D	rate increases	rate increases

Topic Chem 12 **1 Q# 151/** iG Extended/2016/m/Paper 22/

33 What is a property of concentrated sulfuric acid but **not** of dilute sulfuric acid?

A It is a dehydrating agent.

B It neutralises alkalis.

C It produces a white precipitate with barium nitrate.

D It reacts with metals to give a salt and hydrogen.

Topic Chem 13 **1 Q# 152/** iG Extended/2017/w/Paper 21/

34 Some marble chips (calcium carbonate) are heated strongly and substances X and Y are formed.

Substance X is a white solid that reacts with water, giving out heat. Substance Y is a colourless gas.

What are substances X and Y?

	X	Y
A	calcium chloride	oxygen
B	calcium hydroxide	carbon dioxide
C	calcium oxide	carbon dioxide
D	calcium sulfate	oxygen

Topic Chem 13 **1 Q# 153/** iG Extended/2017/s/Paper 23/

34 Two equations are shown.

reaction 1 $CaCO_3 \rightarrow CaO + CO_2$

reaction 2 $CaO + H_2O \rightarrow Ca(OH)_2$

Which terms describe reactions 1 and 2?

	reaction 1	reaction 2
A	reduction	hydration
B	reduction	hydrolysis
C	thermal decomposition	hydration
D	thermal decomposition	hydrolysis

Topic Chem 13 **1 Q# 154/** iG Extended/2017/s/Paper 22/

34 Statements about methods of manufacture and uses of calcium oxide are shown.

1 It is manufactured by reacting acids with calcium carbonate.

2 It is manufactured by heating calcium carbonate.

3 It is used to desulfurise flue gases.

4 It is used to treat alkaline soil.

Which statements are correct?

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

Topic Chem 13 **1 Q# 155/** iG Extended/2017/s/Paper 21/

34 Which statement is **not** correct?

A Converting limestone into lime is a thermal decomposition reaction.

B Flue gas desulfurisation is a neutralisation reaction.

C In the extraction of iron, calcium carbonate is converted into calcium oxide.

D Slaked lime is added to soil as a fertiliser.

Topic Chem 13 **1 Q# 156/** iG Extended/2017/m/Paper 22/

32 Two reactions, X and Y, produce carbon dioxide.

$$CH_4 \xrightarrow{X} CO_2 \xleftarrow{Y} CaCO_3$$

Which types of reaction are X and Y?

	X	Y
A	combustion	combustion
B	combustion	thermal decomposition
C	thermal decomposition	combustion
D	thermal decomposition	thermal decomposition

Topic Chem 13 **1 Q# 157/** iG Extended/2016/w/Paper 23/

34 Slaked lime is used to neutralise an acidic soil.

How does the pH of the soil change?

	from	to
A	6	7
B	7	8
C	8	7
D	8	6

Topic Chem 13 **1 Q# 158/** iG Extended/2016/w/Paper 22/

34 Which substance gives off carbon dioxide on heating?

A lime

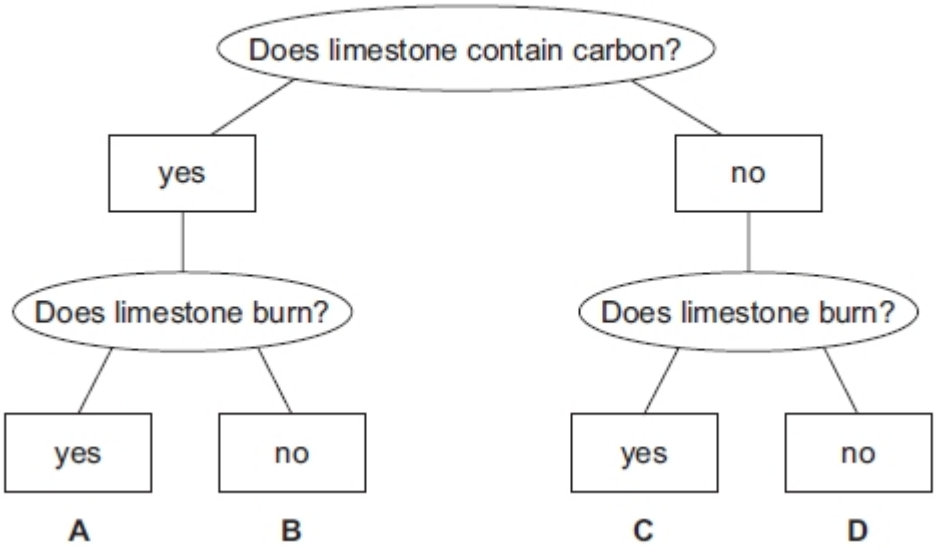
B limestone

C limewater

D slaked lime

Topic Chem 13 **1 Q# 159/** iG Extended/2016/w/Paper 21/

34 Which box corresponds to limestone?



Topic Chem 13 **1 Q# 160/** iG Extended/2016/s/Paper 23/

34 Which process is used to make lime (calcium oxide) from limestone (calcium carbonate)?

A chromatography

B electrolysis

C fractional distillation

D thermal decomposition

Topic Chem 13 **1 Q# 161/** iG Extended/2016/s/Paper 22/

34 Lime (calcium oxide) is used to treat waste water from a factory.

Which substance is removed by the lime?

A ammonia

B sodium chloride

C sodium hydroxide

D sulfuric acid

Topic Chem 13 **1 Q# 162/** iG Extended/2016/m/Paper 22/

33 What is a property of concentrated sulfuric acid but **not** of dilute sulfuric acid?

A It is a dehydrating agent.

B It neutralises alkalis.

C It produces a white precipitate with barium nitrate.

D It reacts with metals to give a salt and hydrogen.

34 Why does a farmer put lime (calcium oxide) on the soil?

A to act as a fertiliser

B to kill pests

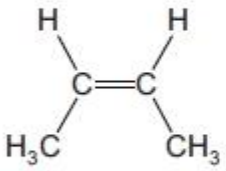
C to make the soil less acidic

D to make the soil less alkaline

Topic Chem 14 **6 Q# 163/** iG Extended/2017/w/Paper 21/

35 The structures of some organic molecules are shown.

1



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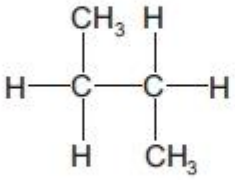

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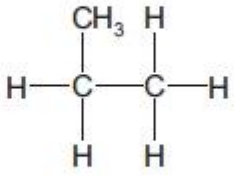

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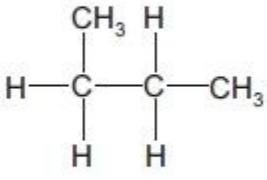


Which structures represent an alkane with four carbon atoms?

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

36 Some of the fractions obtained from the fractional distillation of petroleum are used as fuels for vehicles.

Which two fractions are used as fuels for vehicles?

A bitumen fraction and gasoline fraction

B bitumen fraction and naphtha fraction

C gasoline fraction and kerosene fraction

D kerosene fraction and lubricating fraction

37 X, Y and Z are three hydrocarbons.

X $CH_2=CH_2$ Y $CH_3–CH=CH_2$ Z $CH_3–CH_2–CH=CH_2$

What do compounds X, Y and Z have in common?

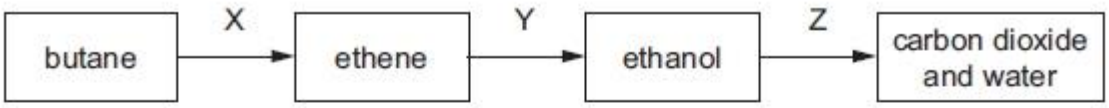
1 They are all alkenes.

2 They are all part of the same homologous series.

3 They all have the same boiling point.

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

38 The diagram shows a reaction sequence.



Which row names the processes X, Y and Z?

	X	Y	Z
A	cracking	fermentation	respiration
B	cracking	hydration	combustion
C	distillation	fermentation	respiration
D	distillation	hydration	combustion

39 Which pair of compounds can be used to prepare $CH_3CH_2COOCH_2CH_3$?

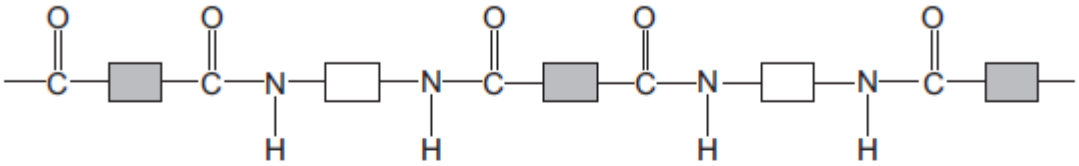
A ethanoic acid and ethanol

B ethanoic acid and propanol

C propanoic acid and ethanol

D propanoic acid and propanol

40 The structure of a synthetic polymer is shown.



The structure shows that it is a .....1..... . It is formed by .....2..... polymerisation.

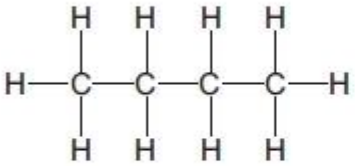
Which words complete gaps 1 and 2?

	1	2
A	polyamide	addition
B	polyamide	condensation
C	polyester	addition
D	polyester	condensation

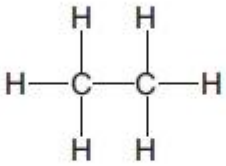
Topic Chem 14 **4 Q# 164/** iG Extended/2017/w/Paper 22/

35 The structures of four organic compounds are shown.

S



T



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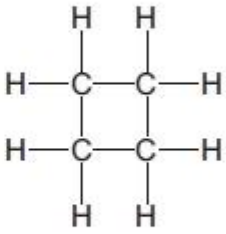
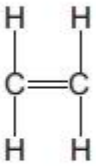


V



Which compounds are unsaturated?

A S only **B** T and U **C** U only **D** V only

36 Which statement is **not** correct?

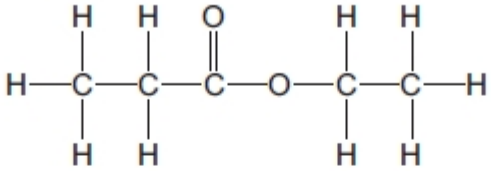
A Petroleum is a mixture of hydrocarbons.

B The main constituent of natural gas is ethane.

C The naphtha fraction of petroleum is used for making chemicals.

D When natural gas burns in air, carbon dioxide and water are formed.

39 The structure of an ester is shown.



Which substances react to form this ester?

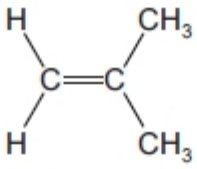
A ethanol and ethanoic acid

B ethanol and propanoic acid

C propanol and ethanoic acid

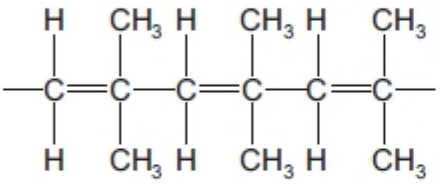
D propanol and propanoic acid

40 A polymer can be made from methyl propene.

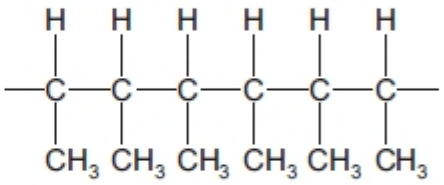


Which diagram shows the structure of the polymer?

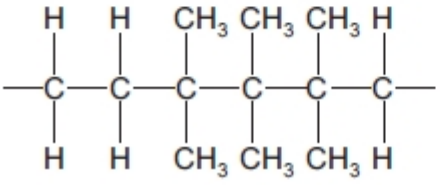
A



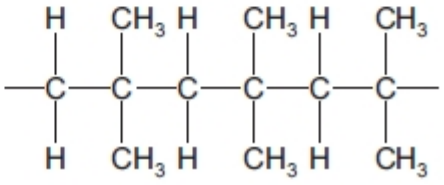
B



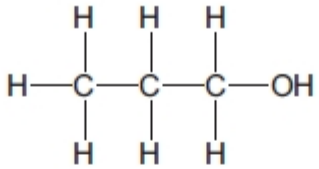
C



D



35 The structure of compound R is shown.



What is R?

A propane

B propanoic acid

C propanol

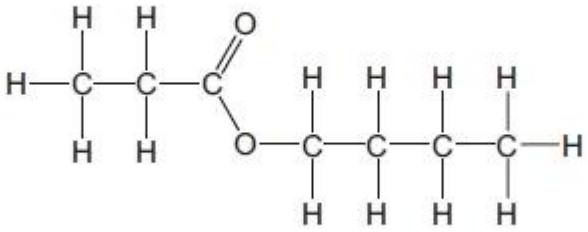
D propene

36 Fuel oil and naphtha are two fractions obtained from petroleum.

What are the major uses of these fractions?

	fuel oil	naphtha
A	jet fuel	making chemicals
B	jet fuel	making roads
C	ship fuel	making chemicals
D	ship fuel	making roads

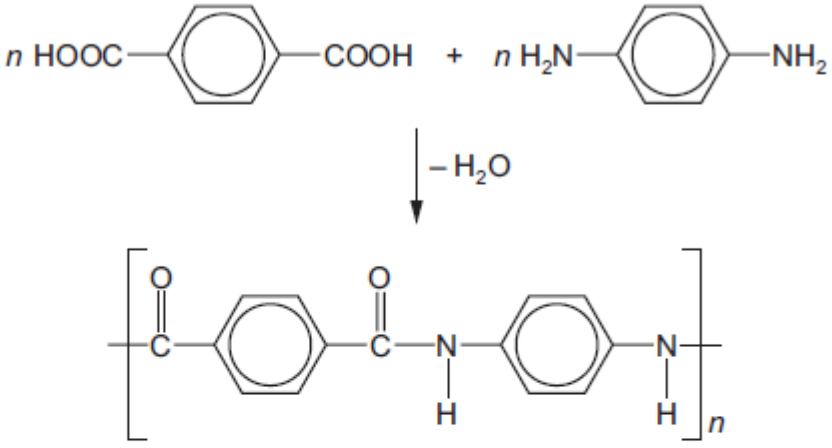
39 The structure of an ester is shown.



Which combination of carboxylic acid and alcohol produces this ester?

	carboxylic acid	alcohol
A	butanoic acid	ethanol
B	butanoic acid	propanol
C	ethanoic acid	butanol
D	propanoic acid	butanol

40 The equation shows the formation of a polymer called *Kevlar*.



Which row describes *Kevlar*?

	how the polymer is formed	type of polymer
A	addition polymerisation	polyamide
B	addition polymerisation	polyester
C	condensation polymerisation	polyamide
D	condensation polymerisation	polyester

Topic Chem 14 **5 Q# 166/** iG Extended/2017/s/Paper 23/

35 Fuel oil, gasoline, kerosene and naphtha are four fractions obtained from the fractional distillation of petroleum.

What is the order of the boiling points of these fractions?

	highest boiling point → lowest boiling point
A	fuel oil → kerosene → gasoline → naphtha
B	fuel oil → kerosene → naphtha → gasoline
C	gasoline → naphtha → kerosene → fuel oil
D	naphtha → gasoline → kerosene → fuel oil

36 Butane and methylpropane are isomers with molecular formula C_4H_{10}.

Which statements are correct?

1 They have similar chemical properties.

2 They have the same general formula.

3 They have the same structural formula.

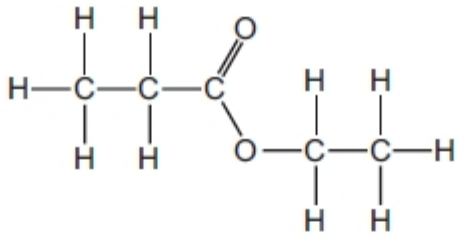
A 1, 2 and 3 **B** 1 and 2 only **C** 1 and 3 only **D** 2 and 3 only

38 Ethanol can be produced by fermentation or by the catalytic addition of steam to ethene.

Which row shows an advantage and a disadvantage for each process?

	fermentation		catalytic addition of steam to ethene	
	advantage	disadvantage	advantage	disadvantage
A	batch process	slow reaction	continuous process	fast reaction
B	fast reaction	continuous process	pure ethanol formed	renewable raw material
C	renewable raw material	batch process	pure ethanol formed	slow reaction
D	renewable raw material	impure ethanol formed	fast reaction	finite raw material

39 The structure of an ester is shown.



Which alcohol and carboxylic acid produce this ester?

	alcohol	carboxylic acid
A	ethanol	ethanoic acid
B	ethanol	propanoic acid
C	propanol	ethanoic acid
D	propanol	propanoic acid

40 How can the amino acids in a protein be separated and identified?

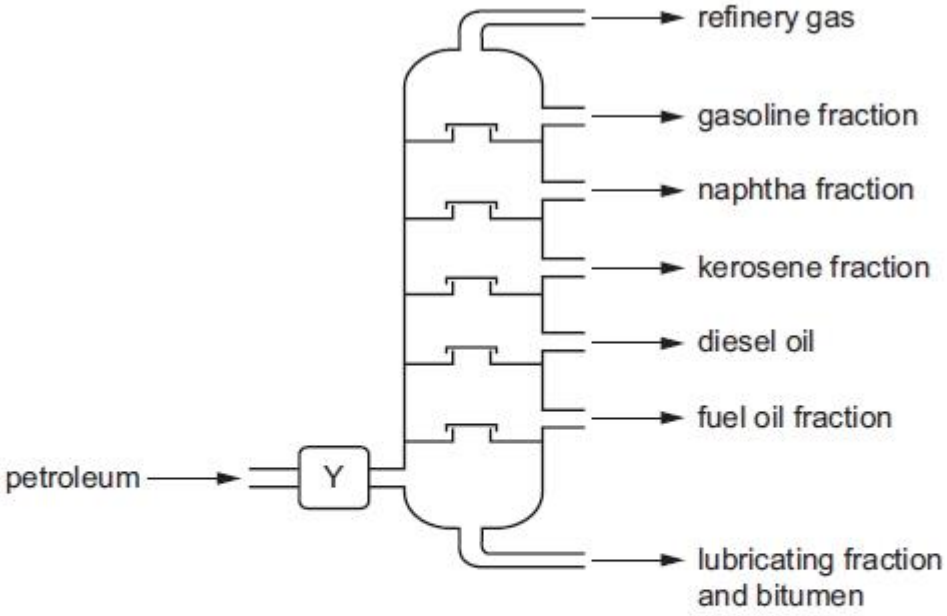
A Add a locating agent to the protein.

B Hydrolyse the protein and then use chromatography.

C Polymerise the protein and then add a locating agent.

D Use chromatography on a solution of the protein.

35 The industrial fractional distillation of petroleum is shown.



Which process happens at Y?

A burning

B condensation

C cracking

D evaporation

36 Which statement about homologous series is **not** correct?

A Alkenes have the same general formula, C_nH_{2n+2}.

B Each member of the homologous series of alkanes differs from the next by CH_2.

C The members of a homologous series all have similar chemical properties.

D The members of a homologous series all have the same functional group.

38 Ethanol is manufactured by fermentation or by the catalytic addition of steam to ethene.

What is an advantage of ethanol manufacture by fermentation instead of by the catalytic addition of steam to ethene?

A Ethanol manufactured by fermentation is purified by distillation.

B Ethanol manufacture by fermentation produces purer ethanol.

C Ethanol manufacture by fermentation uses large areas of land.

D Ethanol manufacture by fermentation uses renewable resources.

39 The formula of an ester is $CH_3CH_2CH_2COOCH_2CH_2CH_3$.

Which acid and alcohol react together to make the ester?

	acid	alcohol
A	butanoic acid	butanol
B	butanoic acid	propanol
C	propanoic acid	butanol
D	propanoic acid	propanol

40 Polyesters and polyamides are types of synthetic polymer.

Which statements are correct?

1 They are made by addition polymerisation.

2 They are made by condensation polymerisation.

3 The monomers from which they are made are unsaturated hydrocarbons.

4 The monomers from which they are made contain reactive functional groups at their ends.

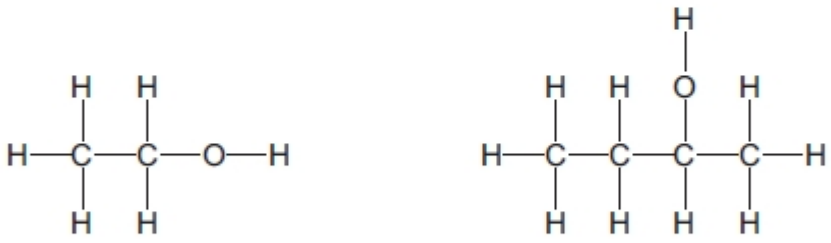
A 1 and 3 **B** 1 and 4 **C** 2 and 3 **D** 2 and 4

Topic Chem 14 **6 Q# 168/** iG Extended/2017/s/Paper 21/

35 Which fraction of petroleum is **not** matched to its correct use?

	fraction	use
A	bitumen	making roads
B	gasoline	fuel for cars
C	kerosene	fuel for ships
D	naphtha	chemical industry

36 The diagram shows the structures of two organic molecules.



Which statement about these molecules is **not** correct?

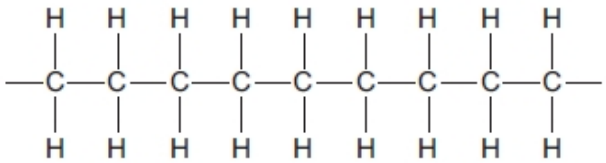
A They are both alcohols.

B They both produce carbon dioxide and water when they burn in oxygen.

C They contain different functional groups.

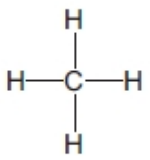
D They have the same general formula.

37 The diagram shows part of the molecule of a polymer.

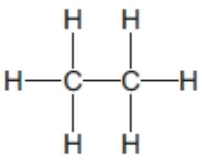


Which diagram shows the monomer from which this polymer could be manufactured?

A



B



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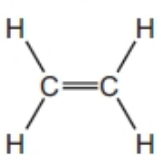

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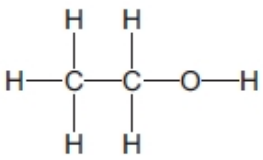


38 Ethanol is manufactured by fermentation or by the catalytic addition of steam to ethene.

Which statement is correct?

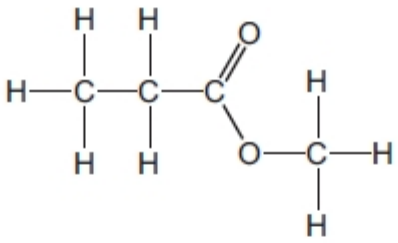
A Fermentation uses a higher temperature than the catalytic addition of steam to ethene.

B Fermentation uses a non-renewable resource.

C The catalytic addition of steam to ethene produces purer ethanol than fermentation.

D The catalytic addition of steam to ethene uses a biological catalyst.

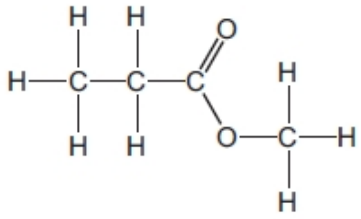
39 The structure of an ester is shown.



Which row is correct?

	name of ester	names of the carboxylic acid and the alcohol used to form the ester
A	methyl propanoate	methanoic acid and propanol
B	methyl propanoate	methanol and propanoic acid
C	propyl methanoate	methanoic acid and propanol
D	propyl methanoate	methanol and propanoic acid

39 The structure of an ester is shown.



Which row is correct?

	name of ester	names of the carboxylic acid and the alcohol used to form the ester
A	methyl propanoate	methanoic acid and propanol
B	methyl propanoate	methanol and propanoic acid
C	propyl methanoate	methanoic acid and propanol
D	propyl methanoate	methanol and propanoic acid

40 Keratin is a protein that is found in human hair.

Keratin is chemically broken down to produce amino acids.

What is the name of this chemical process?

A catalysis

B hydration

C hydrolysis

D polymerisation

Topic Chem 14 **6 Q# 169/** iG Extended/2017/m/Paper 22/

34 The table shows the composition of four different types of petroleum.

fraction	Arabian Heavy /%	Arabian Light /%	Iranian Heavy /%	North Sea /%
gasoline	18	21	21	23
kerosene	11	15	13	15
diesel oil	18	21	20	24
fuel oil	53	43	46	38

Which type of petroleum is best for the motor vehicle industry?

A Arabian Heavy

B Arabian Light

C Iranian Heavy

D North Sea

35 Which reaction of ethene is **not** an addition reaction?

A reaction with bromine

B reaction with hydrogen

C reaction with oxygen

D reaction with steam

36 Ethanol is a fuel used in cars. It can be made from petroleum.

$C_4H_{10} \rightarrow C_2H_4 + C_2H_6$ cracking

$C_2H_4 + H_2O \rightarrow C_2H_5OH$ producing ethanol

$C_2H_5OH + 3O_2 \rightarrow 2CO_2 + 3H_2O$ burning

Compounds of how many homologous series appear in these equations?

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

37 Ethanol is produced from either ethene or sugar.

Which type of chemical reaction is used in each case?

	ethene → ethanol	sugar → ethanol
A	addition	fermentation
B	addition	fractional distillation
C	distillation	fermentation
D	distillation	fractional distillation

38 The structural formula of an organic compound is shown.

$CH_3CH_2COOCH_3$

What is the name of this compound?

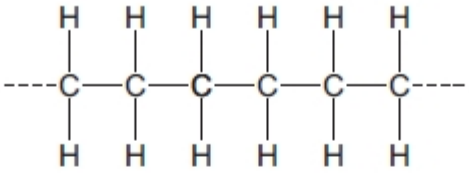
A butanoic acid

B ethyl ethanoate

C methyl propanoate

D propyl methanoate

39 The diagram shows the structure of an important product.



This product is formed by ..... 1 ..... of an ..... 2 ..... .

Which words complete gaps 1 and 2?

	1	2
A	addition polymerisation	alkane
B	addition polymerisation	alkene
C	cracking	alkane
D	cracking	alkene

40 Which pair of compounds reacts to form a condensation polymer?

A CH_3COOH and $C_2H_5NH_2$

B $HCOOH$ and HOC_2H_4OH

C $HOC_6H_{12}OH$ and $HOOCC_3H_6COOH$

D $H_2NC_2H_4NH_2$ and HOC_3H_6OH

Topic Chem 14 **3 Q# 170/** iG Extended/2016/w/Paper 23/

35 Which list shows the fractions obtained from distilling petroleum, in order of increasing boiling point?

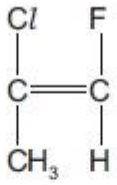
A bitumen → diesel oil → fuel oil → lubricating oil

B diesel oil → gasoline → naphtha → kerosene

C gasoline → naphtha → kerosene → diesel oil

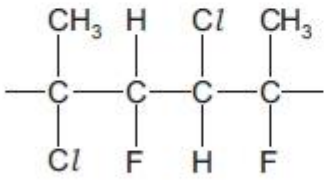
D kerosene → lubricating oil → naphtha → refinery gas

39 The organic compound shown can be polymerised.

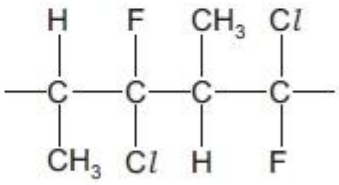


Which diagram represents a section of the polymer?

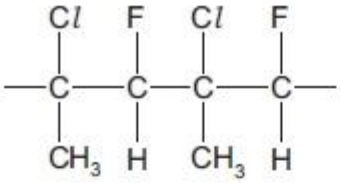
A



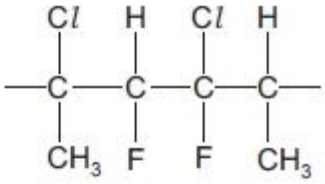
B



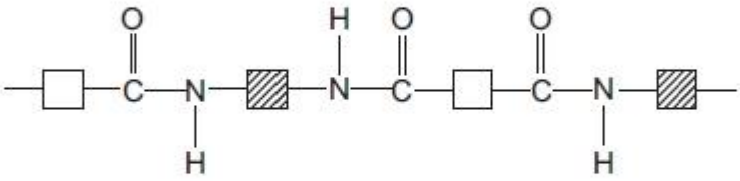
C



D



40 The partial structure of a polymer is shown.



Which type of polymer is represented?

A a carbohydrate

B a polyamide

C a polyester

D an addition polymer

Topic Chem 14 **3 Q# 171/** iG Extended/2016/w/Paper 22/

35 Petroleum is separated into fractions.

Which statement is **not** correct?

A Each fraction contains a mixture of hydrocarbon molecules.

B Fuel oil burns easily and is used as fuel in cars.

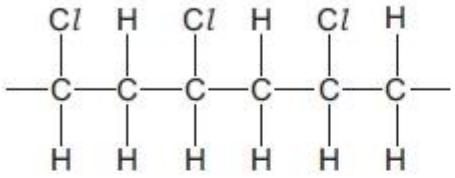
C Refinery gas is the fraction containing the smallest molecules.

D The fractions are separated depending on their boiling point range.

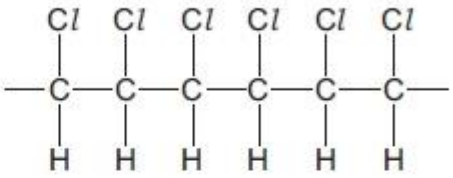
39 Chloroethene, $CH_2=CHCl$, can be polymerised.

Which diagram represents a section of the polymer?

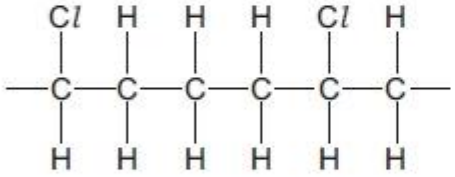
A



B



C



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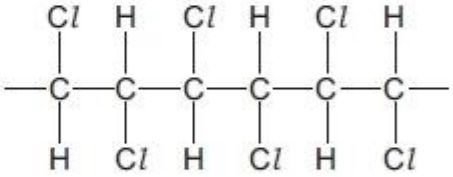


40 *Terylene* is a synthetic polymer.

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

A It contains amide linkages.

B It contains carbon and oxygen atoms.

C It is made from small units called monomers.

D It is formed by condensation polymerisation.

Topic Chem 14 **6 Q# 172/** iG Extended/2016/w/Paper 21/

35 Petroleum is an important fossil fuel.

Which row correctly describes petroleum?

	type of substance	composition
A	compound	mainly hydrocarbons
B	compound	only hydrogen and carbon
C	mixture	mainly hydrocarbons
D	mixture	only hydrogen and carbon

36 Butane reacts as shown.

$$\text{butane} \xrightarrow[\text{and heat}]{\text{catalyst}} \text{butene} + \text{hydrogen}$$

What is this type of reaction?

A combustion

B cracking

C polymerisation

D reduction

37 Substance Z has the following characteristics.

1 It burns in an excess of oxygen to form carbon dioxide and water.

2 It is oxidised by air to form a liquid smelling of vinegar.

3 It reacts with carboxylic acids to form esters.

What is substance Z?

A ethane

B ethanoic acid

C ethanol

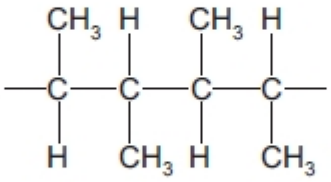
D ethyl ethanoate

38 Ethanol is manufactured by the catalytic addition of steam to ethene and by fermentation.

Which row shows an advantage and a disadvantage of using the catalytic addition of steam to ethene compared to fermentation?

	advantage	disadvantage
A	fast	the product is impure
B	fast	uses non-renewable materials
C	the product is pure	slow
D	uses renewable materials	slow

39 The partial structure of addition polymer X is shown.



Which monomer is used to form polymer X?

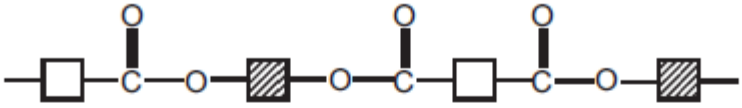
A $CH_2=CH_2$

B $CH_3CH=CH_2$

C $CH_3CH=CHCH_3$

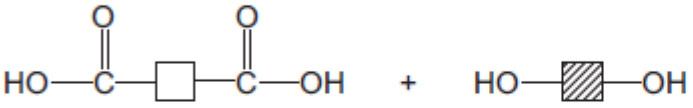
D $CH_3CH_2CH=CH_2$

40 The diagram shows the partial structure of *Terylene*.



From which pair of compounds is it made?

A



B

C

D

Topic Chem 14 **6 Q# 173/** iG Extended/2016/s/Paper 23/

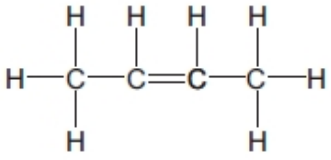
vv

36 Which compound does **not** belong to the same homologous series as the other three compounds?

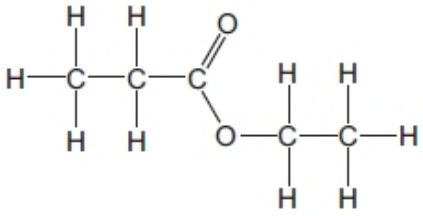
A CH_3OH **B** C_2H_5COOH **C** C_2H_5OH **D** $C_7H_{15}OH$

37 The structure of an alkene and the structure of an ester are shown.

P



Q



What are the names of P and Q?

	P	Q
A	but-1-ene	ethyl propanoate
B	but-1-ene	propyl ethanoate
C	but-2-ene	ethyl propanoate
D	but-2-ene	propyl ethanoate

38 What is an advantage of producing ethanol by fermentation of sugar compared to the catalytic addition of steam to ethene?

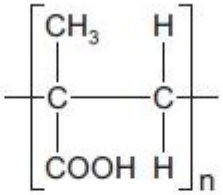
A The alcohol produced is purer.

B The process is faster.

C The process uses high temperature.

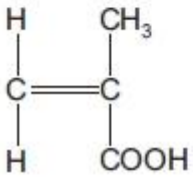
D The process uses renewable raw materials.

39 A polymer has the formula shown.



From which monomers can it be formed?

R



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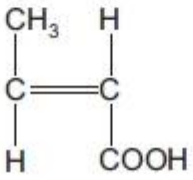

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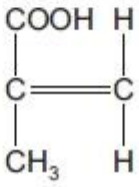
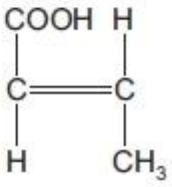


U



A R and S **B** R and T **C** S and U **D** T and U

40 Which row shows a natural polymer with the same linkages as a synthetic polymer?

	natural polymer	synthetic polymer
A	complex carbohydrate	nylon
B	complex carbohydrate	*Terylene*
C	protein	nylon
D	protein	*Terylene*

Topic Chem 14 **6 Q# 174/** iG Extended/2016/s/Paper 22/

36 Which compound is **not** an alkane, C_nH_{2n+2}?

A $CH_3CH_2CH_2CH_3$

B $(CH_3)_2CHCH_3$

C $CH_3CHCHCH_3$

D $(CH_3)_3CH$

37 An ester is formed when a carboxylic acid reacts with an alcohol.

Which ester is formed when propanoic acid and ethanol react?

A $CH_3CO_2CH_2CH_3$

B $CH_3CO_2CH_2CH_2CH_3$

C $CH_3CH_2CO_2CH_3$

D $CH_3CH_2CO_2CH_2CH_3$

38 What is an advantage of producing ethanol by fermentation of sugar compared to the catalytic addition of steam to ethene?

A The alcohol produced is purer.

B The process is faster.

C The process uses high temperature.

D The process uses renewable raw materials.

39 In which row are the monomer and polymer chain correctly matched?

	monomer	part of the polymer chain
A	$CH_3CH=CHCH_3$	$-CH(CH_3)-CH(CH_3)-CH(CH_3)-CH(CH_3)-$
B	$CH_2=CHCl$	$-CHCl-CHCl-CHCl-CHCl-$
C	$CH_3CH=CH_2$	$-CH_3-CH-CH_2-CH_3-CH-CH_2-$
D	$CH_2=CHCH_2CH_3$	$-CH_2-CH_2-CH_2-CH(CH_2CH_3)-$

40 Which two polymers have the same linkages bonding the monomers together?

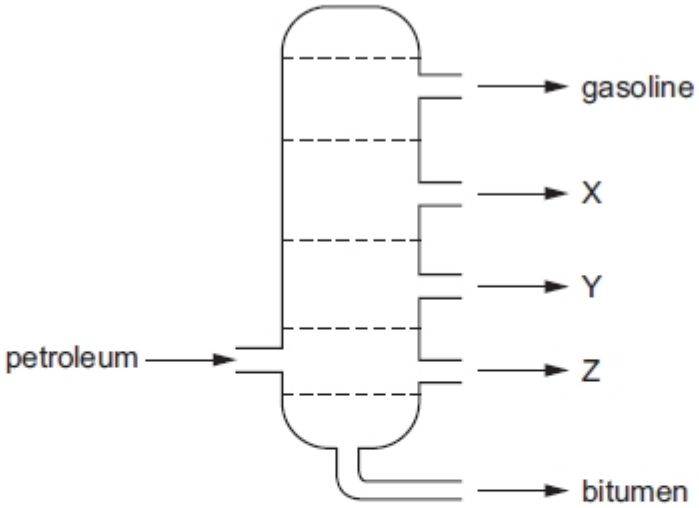
A nylon and complex carbohydrate

B nylon and protein

C *Terylene* and complex carbohydrate

D *Terylene* and protein

35 The diagram shows the separation of petroleum into fractions.



What could X, Y and Z represent?

	X	Y	Z
A	diesel oil	lubricating fraction	paraffin
B	lubricating fraction	diesel oil	paraffin
C	paraffin	lubricating fraction	diesel oil
D	paraffin	diesel oil	lubricating fraction

36 Which of the compounds shown are in the same homologous series?

1 CH_3OH

2 CH_3CH_2OH

3 CH_3COOH

4 $CH_3CH_2CH_2OH$

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

37 Which compounds contain the same number of carbon, hydrogen and oxygen atoms?

W	X	Y	Z
ethyl methanoate	methyl ethanoate	methyl methanoate	ethyl ethanoate

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

38 What is an advantage of producing ethanol by fermentation of sugar compared to the catalytic addition of steam to ethene?

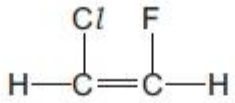
A The alcohol produced is purer.

B The process is faster.

C The process uses high temperature.

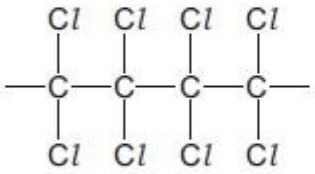
D The process uses renewable raw materials.

39 The structure of a monomer is shown.

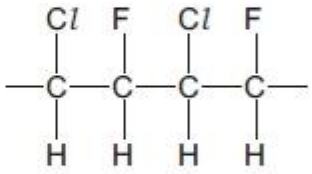


Which polymer can be made from this monomer?

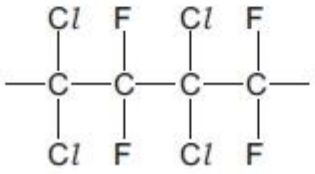
A



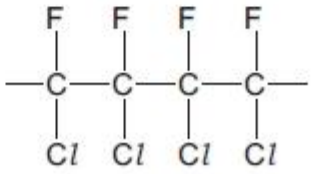
B



C

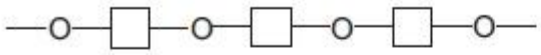


D

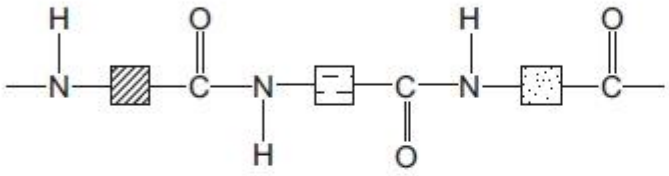


40 Which formula represents a polyester?

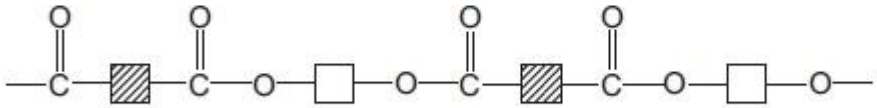
A



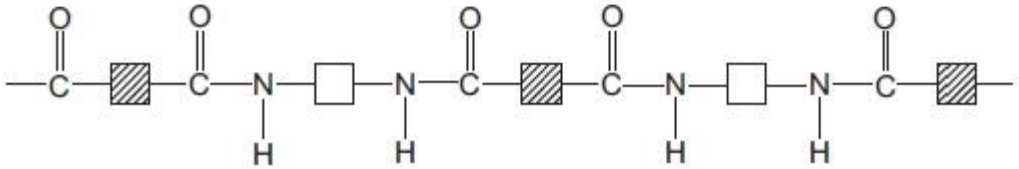
B



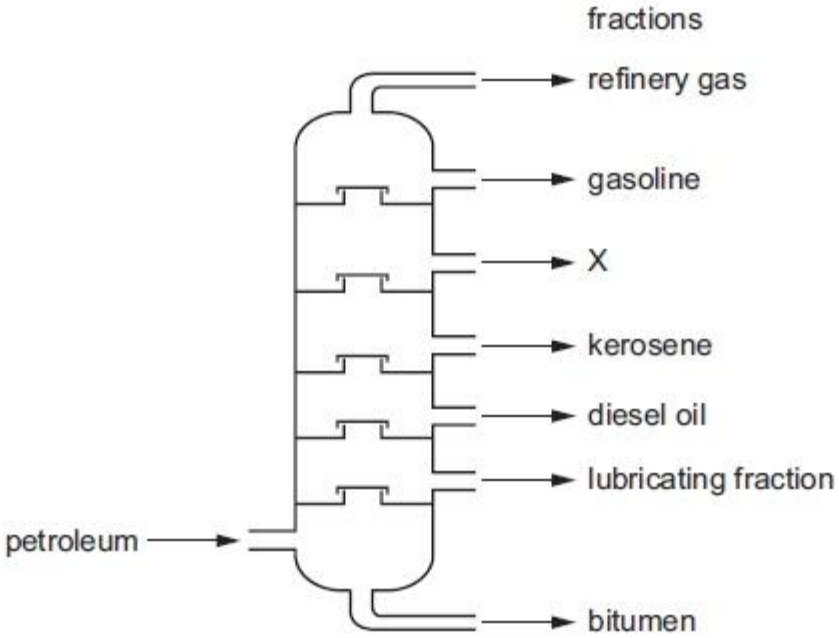
C



D



35 What is the name of fraction X?



A alcohol

B fuel oil

C naphtha

D paraffin

36 Which compounds are alkanes?

compound	W	X	Y	Z
formula	C_4H_{10}	C_5H_{10}	C_6H_{12}	C_6H_{14}

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

37 The statements below are about the alcohol homologous series.

The alcohols have the same .....1..... formula.

The alcohols have .....2..... chemical properties because they have the same .....3..... .

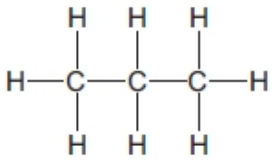
The melting points of the alcohols .....4..... as the number of carbon atoms increases.

Which words correctly complete gaps 1–4?

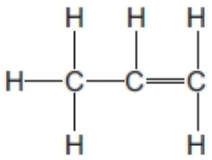
	1	2	3	4
A	general	different	functional group	decrease
B	general	similar	electronic structure	increase
C	general	similar	functional group	increase
D	molecular	similar	functional group	increase

38 Which structure represents a compound that dissolves in water to form an acidic solution?

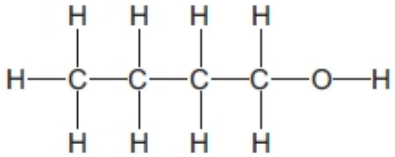
A



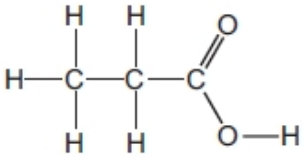
B



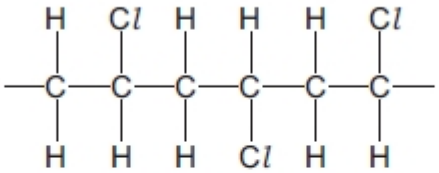
C



D

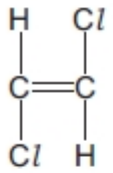


39 The partial structure of an addition polymer is shown.

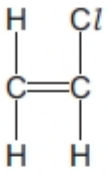


What is the structure of the monomer used to make this polymer?

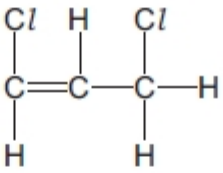
A



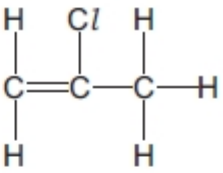
B



C



D



40 Which statement about polymers is correct?

A Addition polymers are all biodegradable.

B Condensation polymers can all be hydrolysed to give amino acids.

C Condensation polymers only exist in nature.

D Forming addition polymers produces only one product.

MARK SCHEMES SECTION

Mark Scheme Topic Chem 1 Q# 1/

iG Extended/2017/w/Paper 21/

1	D
2	C
3	B

Topic Chem 1 **Q# 2/** iG Extended/2017/w/Paper 22/

1	C
2	B
3	B

Topic Chem 1 **Q# 3/** iG Extended/2017/w/Paper 23/

1	C
2	C
3	C

Topic Chem 1 **Q# 4/** iG Extended/2017/s/Paper 23/

2	D
3	B

Topic Chem 1 **Q# 5/** iG Extended/2017/s/Paper 22/

2	C
3	A

Topic Chem 1 **Q# 6/** iG Extended/2017/s/Paper 21/

1	D
2	C
3	D

Topic Chem 1 **Q# 7/** iG Extended/2017/m/Paper 22/

1	A
2	B
3	C

Topic Chem 1 **Q# 8/** iG Extended/2016/w/Paper 23/

3	**D**

Topic Chem 1 **Q# 9/** iG Extended/2016/w/Paper 22/

3	**C**

Topic Chem 1 **Q# 10/** iG Extended/2016/w/Paper 21/

1	**C**
2	**B**
3	**C**

Topic Chem 1 **Q# 11/** iG Extended/2016/s/Paper 23/

1	**B**
2	**C**
3	**B**

Topic Chem 1 **Q# 12/** iG Extended/2016/s/Paper 22/

1	**D**
2	**A**
3	**D**

Topic Chem 1 **Q# 13/** iG Extended/2016/s/Paper 21/

1	**C**
2	**C**
3	**D**

Topic Chem 1 **Q# 14/** iG Extended/2016/m/Paper 22/

1	**B**
2	**C**
3	**A**

Mark Scheme Topic Chem 3 Q# 15/

iG Extended/2017/w/Paper 21/

4	A
5	C
6	B
7	A

Topic Chem 3 **Q# 16/** iG Extended/2017/w/Paper 22/

4	B
5	B
6	C

Topic Chem 3 **Q# 17/** iG Extended/2017/w/Paper 23/

4	D
5	B
6	A
7	A

Topic Chem 3 **Q# 18/** iG Extended/2017/s/Paper 23/

4	C
5	C
6	C

Topic Chem 3 **Q# 19/** iG Extended/2017/s/Paper 22/

4	A
5	B
6	B

Topic Chem 3 **Q# 20/** iG Extended/2017/s/Paper 21/

4	B
5	C
6	D

Topic Chem 3 **Q# 21/** iG Extended/2017/m/Paper 22/

4	C
5	C
6	C
7	A

Topic Chem 3 **Q# 22/** iG Extended/2016/w/Paper 23/

4	**A**
5	**A**
6	**B**
7	**D**

Topic Chem 3 **Q# 23/** iG Extended/2016/w/Paper 22/

4	**C**
5	**C**
6	**C**
7	**B**

Topic Chem 3 **Q# 24/** iG Extended/2016/w/Paper 21/

4	**B**
5	**B**
6	**C**
7	**A**

Topic Chem 3 **Q# 25/** iG Extended/2016/s/Paper 23/

7	**C**

Topic Chem 3 **Q# 26/** iG Extended/2016/s/Paper 22/

4	**B**
5	**C**
6	**C**
7	**D**

Topic Chem 3 **Q# 27/** iG Extended/2016/s/Paper 21/

4	**B**
5	**C**
6	**C**
7	**A**

Topic Chem 3 **Q# 28/** iG Extended/2016/m/Paper 22/

4	**C**
5	**A**
6	**B**
7	**C**

Mark Scheme Topic Chem 4

Q# 29/ iG Extended/2017/w/Paper 21/

8	B

Topic Chem 4 **Q# 30/** iG Extended/2017/w/Paper 22/

7	A
8	B

Topic Chem 4 **Q# 31/** iG Extended/2017/w/Paper 23/

8	B

Topic Chem 4 **Q# 32/** iG Extended/2017/s/Paper 23/

7	C
8	A

Topic Chem 4 **Q# 33/** iG Extended/2017/s/Paper 22/

7	B
8	A

Topic Chem 4 **Q# 34/** iG Extended/2017/s/Paper 21/

7	B
8	A

Topic Chem 4 **Q# 35/** iG Extended/2017/m/Paper 22/

8	A
9	D

Topic Chem 4 **Q# 36/** iG Extended/2016/w/Paper 23/

8	**C**
9	**B**

Topic Chem 4 **Q# 37/** iG Extended/2016/w/Paper 22/

8	**A**
9	**A**

Topic Chem 4 **Q# 38/** iG Extended/2016/w/Paper 21/

8	**D**
9	**B**

Topic Chem 4 **Q# 39/** iG Extended/2016/s/Paper 23/

8	**B**
9	**A**

Topic Chem 4 **Q# 40/** iG Extended/2016/s/Paper 22/

8	**B**
9	**D**

Topic Chem 4 **Q# 41/** iG Extended/2016/s/Paper 21/

8	**D**
9	**C**

Topic Chem 4 **Q# 42/** iG Extended/2016/m/Paper 22/

8	**D**
9	**D**

Mark Scheme Topic Chem 5 **Q# 43/**

iG Extended/2017/w/Paper 21/

9	A
10	D

Topic Chem 5 **Q# 44/** iG Extended/2017/s/Paper 22/

9	B

Topic Chem 5 **Q# 45/** iG Extended/2017/s/Paper 21/

10	B

Topic Chem 5 **Q# 46/** iG Extended/2017/m/Paper 22/

10	D
11	B

Topic Chem 5 **Q# 47/** iG Extended/2016/w/Paper 23/

11	**B**

Topic Chem 5 **Q# 48/** iG Extended/2016/w/Paper 22/

10	**A**
11	**A**

Topic Chem 5 **Q# 49/** iG Extended/2016/w/Paper 21/

10	**A**
11	**A**

Topic Chem 5 **Q# 50/** iG Extended/2016/s/Paper 23/

10	**A**
12	**B**

Topic Chem 5 **Q# 51/** iG Extended/2016/s/Paper 22/

10	**A**
12	**D**

Topic Chem 5 **Q# 52/** iG Extended/2016/s/Paper 21/

10	**A**	12	**C**

Topic Chem 5 **Q# 53/** iG Extended/2016/m/Paper 22/

10	**B**

Mark Scheme Topic Chem 6 **Q# 54/**

iG Extended/2017/w/Paper 21/

11	B
12	B

Topic Chem 6 **Q# 55/** iG Extended/2017/w/Paper 22/

11	B
12	B

Topic Chem 6 **Q# 56/** iG Extended/2017/w/Paper 23/

11	C
12	B

Topic Chem 6 **Q# 57/** iG Extended/2017/s/Paper 23/

11	D
13	D

Topic Chem 6 **Q# 58/** iG Extended/2017/s/Paper 22/

11	B
12	C
13	B

Topic Chem 6 **Q# 59/** iG Extended/2017/s/Paper 21/

11	B
12	C
13	B

Topic Chem 6 **Q# 60/** iG Extended/2017/m/Paper 22/

12	D
13	B

Topic Chem 6 **Q# 61/** iG Extended/2016/w/Paper 23/

12	**A**
13	**B**

Topic Chem 6 **Q# 62/** iG Extended/2016/w/Paper 22/

12	**B**
13	**D**

Topic Chem 6 **Q# 63/** iG Extended/2016/w/Paper 21/

12	**D**

Topic Chem 6 **Q# 65/** iG Extended/2016/s/Paper 23/

13	**A**

Topic Chem 6 **Q# 66/** iG Extended/2016/s/Paper 22/

13	**B**

Topic Chem 6 **Q# 67/** iG Extended/2016/s/Paper 21/

11	**D**
13	**C**

Topic Chem 6 **Q# 68/** iG Extended/2016/m/Paper 22/

12	**D**
13	**A**

Mark Scheme Topic Chem 7 **Q# 69/**

iG Extended/2017/w/Paper 21/

13	B
14	B
15	C
16	C

Topic Chem 7 **Q# 70/** iG Extended/2017/w/Paper 22/

13	B
14	D
15	C
16	B

Topic Chem 7 **Q# 71/** iG Extended/2017/w/Paper 23/

13	B
14	D
15	A
16	A

Topic Chem 7 **Q# 72/** iG Extended/2017/s/Paper 23/

14	B
16	C

Topic Chem 7 **Q# 73/** iG Extended/2017/s/Paper 22/

14	A
16	A

Topic Chem 7 **Q# 74/** iG Extended/2017/s/Paper 21/

14	C
15	A
16	C
17	D

Topic Chem 7 **Q# 75/** iG Extended/2017/m/Paper 22/

14	B
15	A
16	A
17	D

Topic Chem 7 **Q# 76/** iG Extended/2016/w/Paper 23/

14	**B**
15	**D**
16	**A**
17	**A**

Topic Chem 7 **Q# 77/** iG Extended/2016/w/Paper 22/

14	**A**
15	**B**
16	**B**
17	**D**

Topic Chem 7 **Q# 78/** iG Extended/2016/w/Paper 21/

13	**A**
14	**A**
15	**B**
16	**C**
17	**C**

Topic Chem 7 **Q# 79/** iG Extended/2016/s/Paper 23/

15	**A**
16	**B**

Topic Chem 7 **Q# 80/** iG Extended/2016/s/Paper 22/

15	**C**
16	**B**

Topic Chem 7 **Q# 81/** iG Extended/2016/s/Paper 21/

14	**D**
15	**A**
16	**B**
17	**C**

Topic Chem 7 **Q# 82/** iG Extended/2016/m/Paper 22/

14	**D**
15	**B**
16	**B**
17	**D**

Mark Scheme Topic Chem 8 **Q# 83/**

iG Extended/2017/w/Paper 21/

17	B
18	B
19	A
20	B

Topic Chem 8 **Q# 84/** iG Extended/2017/w/Paper 22/

17	B
18	B
19	B
20	A

Topic Chem 8 **Q# 85/** iG Extended/2017/w/Paper 23/

17	B
18	B
19	C
20	B
21	B
22	A
23	A

Topic Chem 8 **Q# 86/** iG Extended/2017/s/Paper 23/

18	A
19	D
20	D
21	C

Topic Chem 8 **Q# 87/** iG Extended/2017/s/Paper 22/

18	B
19	B
20	A
21	A

Topic Chem 8 **Q# 88/** iG Extended/2017/s/Paper 21/

18	A
19	C
20	D
21	D

Topic Chem 8 **Q# 89/** iG Extended/2017/m/Paper 22/

18	B
19	C
20	D
21	B

Topic Chem 8 **Q# 90/** iG Extended/2016/w/Paper 23/

23	**D**

Topic Chem 8 **Q# 91/** iG Extended/2016/w/Paper 22/

23	**A**

Topic Chem 8 **Q# 92/** iG Extended/2016/w/Paper 21/

18	**B**
19	**C**
20	**C**

Topic Chem 8 **Q# 93/** iG Extended/2016/w/Paper 21/

23	**A**

Topic Chem 8 **Q# 94/** iG Extended/2016/s/Paper 23/

18	**D**
19	**D**
20	**D**

Topic Chem 8 **Q# 95/** iG Extended/2016/s/Paper 22/

20	**A**

Topic Chem 8 **Q# 96/** iG Extended/2016/s/Paper 21/

18	**D**
19	**D**
20	**A**

Topic Chem 8 **Q# 97/** iG Extended/2016/m/Paper 22/

18	**D**
19	**A**
20	**D**
21	**C**

Mark Scheme Topic Chem 9

Topic Chem 9 **Q# 98/** iG Extended/2017/w/Paper 21/

21	C
22	A
23	B
23	B
24	D

Topic Chem 9 **Q# 99/** iG Extended/2017/w/Paper 22/

21	B
22	B
23	A
24	D

Topic Chem 9 **Q# 100/** iG Extended/2017/w/Paper 23/

21	B
22	A
23	A
23	A
24	D

Topic Chem 9 **Q# 101/** iG Extended/2017/s/Paper 23/

22	A
23	D
24	D

Topic Chem 9 **Q# 102/** iG Extended/2017/s/Paper 22/

23	B

Topic Chem 9 **Q# 103/** iG Extended/2017/s/Paper 21/

22	A
23	C
24	D

Topic Chem 9 **Q# 104/** iG Extended/2017/m/Paper 22/

22	C
23	C
24	B
25	D

Topic Chem 9 **Q# 105/** iG Extended/2016/w/Paper 23/

24	**C**

Topic Chem 9 **Q# 106/** iG Extended/2016/w/Paper 22/

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

Topic Chem 9 **Q# 107/** iG Extended/2016/w/Paper 21/

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

Topic Chem 9 **Q# 108/** iG Extended/2016/s/Paper 23/

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

Topic Chem 9 **Q# 109/** iG Extended/2016/s/Paper 22/

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

Topic Chem 9 **Q# 110/** iG Extended/2016/s/Paper 21/

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

Topic Chem 9 **Q# 111/** iG Extended/2016/m/Paper 22/

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

Mark Scheme Topic Chem 10

Topic Chem 10 **Q# 112/** iG Extended/2017/w/Paper 21/

25	A
26	A
27	D
28	D

Topic Chem 10 **Q# 113/** iG Extended/2017/w/Paper 22/

25	A
26	B
27	B
28	A

Topic Chem 10 **Q# 114/** iG Extended/2017/w/Paper 23/

25	A
26	C
27	D
28	C

Topic Chem 10 **Q# 115/** iG Extended/2017/s/Paper 23/

25	A
27	D

Topic Chem 10 **Q# 116/** iG Extended/2017/s/Paper 22/

25	D
26	B
27	C
28	C

Topic Chem 10 **Q# 117/** iG Extended/2017/s/Paper 21/

25	A
26	B
27	C
28	C

Topic Chem 10 **Q# 118/** iG Extended/2017/m/Paper 22/

26	C
27	D
28	C
29	B

Topic Chem 10 **Q# 119/** iG Extended/2016/w/Paper 23/

25	**D**
26	**A**
27	**A**
28	**A**

Topic Chem 10 **Q# 120/** iG Extended/2016/w/Paper 22/

25	**C**

26	**B**
27	**D**
28	**B**

Topic Chem 10 **Q# 121/** iG Extended/2016/w/Paper 21/

25	**D**

26	**C**
27	**A**
28	**C**

Topic Chem 10 **Q# 122/** iG Extended/2016/s/Paper 23/

26	**A**
27	**C**
28	**D**

Topic Chem 10 **Q# 123/** iG Extended/2016/s/Paper 22/

25	**A**

26	**B**
27	**A**
28	**B**

Topic Chem 10 **Q# 124/** iG Extended/2016/s/Paper 21/

25	**B**

26	**C**
27	**D**
28	**D**

Topic Chem 10 **Q# 125/** iG Extended/2016/m/Paper 22/

11	**B**

Topic Chem 10 **Q# 126/** iG Extended/2016/m/Paper 22/

25	**A**

26	**A**
27	**C**

Mark Scheme Topic Chem 11 **Q# 127/** iG Extended/2017/w/Paper 21/

29	C
30	B
31	C
32	B

Topic Chem 11 **Q# 128/** iG Extended/2017/w/Paper 22/

29	C
30	D
31	A
32	C

Topic Chem 11 **Q# 129/** iG Extended/2017/w/Paper 23/

29	C
30	C
31	A
32	B

Topic Chem 11 **Q# 130/** iG Extended/2017/s/Paper 23/

30	C
31	B
32	B

Topic Chem 11 **Q# 131/** iG Extended/2017/s/Paper 22/

29	A
30	C
31	A
32	D

Topic Chem 11 **Q# 132/** iG Extended/2017/s/Paper 21/

29	A
30	D
31	D
32	C

Topic Chem 11 **Q# 133/** iG Extended/2017/m/Paper 22/

30	C
31	A

Topic Chem 11 **Q# 134/** iG Extended/2016/w/Paper 23/

30	**B**

31	**B**
32	**C**

Topic Chem 11 **Q# 135/** iG Extended/2016/w/Paper 22/

30	**B**

31	**C**
32	**B**

Topic Chem 11 **Q# 136/** iG Extended/2016/w/Paper 21/

29	**C**
30	**B**

31	**C**
32	**C**

Topic Chem 11 **Q# 137/** iG Extended/2016/s/Paper 23/

31	**B**
32	**C**

Topic Chem 11 **Q# 138/** iG Extended/2016/s/Paper 22/

31	**C**
32	**D**

Topic Chem 11 **Q# 139/** iG Extended/2016/s/Paper 21/

31	**A**
32	**B**

Topic Chem 11 **Q# 140/** iG Extended/2016/s/Paper 21/

29	**D**
30	**A**
34	**D**

Topic Chem 11 **Q# 141/** iG Extended/2016/m/Paper 22/

28	**B**
29	**D**
30	**B**

31	**C**
32	**C**

Mark Scheme Topic Chem 12 **Q# 142/** iG Extended/2017/w/Paper 21/

33	D

Topic Chem 12 **Q# 143/** iG Extended/2017/s/Paper 21/

33	C

Topic Chem 12 **Q# 144/** iG Extended/2017/m/Paper 22/

33	C

Topic Chem 12 **Q# 145/** iG Extended/2016/w/Paper 23/

33	**B**

Topic Chem 12 **Q# 146/** iG Extended/2016/w/Paper 22/

33	**C**

Topic Chem 12 **Q# 147/** iG Extended/2016/w/Paper 21/

33	**B**

Topic Chem 12 **Q# 148/** iG Extended/2016/s/Paper 23/

33	**B**

Topic Chem 12 **Q# 149/** iG Extended/2016/s/Paper 22/

33	**A**

Topic Chem 12 **Q# 150/** iG Extended/2016/s/Paper 21/

33	**D**

Topic Chem 12 **Q# 151/** iG Extended/2016/m/Paper 22/

33	**A**
34	**C**

Mark Scheme Topic Chem 13 **Q# 152/** iG Extended/2017/w/Paper 21/

34	C

Topic Chem 13 **Q# 153/** iG Extended/2017/s/Paper 23/

34	C

Topic Chem 13 **Q# 154/** iG Extended/2017/s/Paper 22/

34	C

Topic Chem 13 **Q# 155/** iG Extended/2017/s/Paper 21/

34	D

Topic Chem 13 **Q# 156/** iG Extended/2017/m/Paper 22/

32	B

Topic Chem 13 **Q# 157/** iG Extended/2016/w/Paper 23/

34	**A**

Topic Chem 13 **Q# 158/** iG Extended/2016/w/Paper 22/

34	**B**

Topic Chem 13 **Q# 159/** iG Extended/2016/w/Paper 21/

34	**B**

Topic Chem 13 **Q# 160/** iG Extended/2016/s/Paper 23/

34	**D**

Topic Chem 13 **Q# 161/** iG Extended/2016/s/Paper 22/

34	**D**

Topic Chem 13 **Q# 162/** iG Extended/2016/m/Paper 22/

33	**A**
34	**C**

Mark Scheme Topic Chem 14 **Q# 163/** iG Extended/2017/w/Paper 21/

35	C
36	C
37	B
38	B
39	C
40	B

Topic Chem 14 **Q# 164/** iG Extended/2017/w/Paper 22/

35	D
36	B
37	B
38	B
39	B
40	D

Topic Chem 14 **Q# 165/** iG Extended/2017/w/Paper 23/

35	C
36	C
37	B
38	B
39	D
40	C

Topic Chem 14 **Q# 166/** iG Extended/2017/s/Paper 23/

35	B
36	B
38	D
39	B
40	B

Topic Chem 14 **Q# 167/** iG Extended/2017/s/Paper 22/

35	D
36	A
38	D
39	B
40	D

Topic Chem 14 **Q# 168/** iG Extended/2017/s/Paper 21/

35	C
36	C
37	C
38	C
39	B
40	C

Topic Chem 14 **Q# 169/** iG Extended/2017/m/Paper 22/

34	D
35	C
36	C
37	A
38	C
39	B
40	C

Topic Chem 14 **Q# 170/** iG Extended/2016/w/Paper 23/

35	**C**
39	**C**
40	**B**

Topic Chem 14 **Q# 171/** iG Extended/2016/w/Paper 22/

35	**B**
39	**A**
40	**A**

Topic Chem 14 **Q# 172/** iG Extended/2016/w/Paper 21/

35	**C**
36	**B**
37	**C**
38	**B**
39	**C**
40	**A**

Topic Chem 14 **Q# 173/** iG Extended/2016/s/Paper 23/

35	**D**
36	**B**
37	**C**
38	**D**
39	**B**
40	**C**

Topic Chem 14 **Q# 174/** iG Extended/2016/s/Paper 22/

35	**D**
36	**C**
37	**D**
38	**D**
39	**A**
40	**B**

Topic Chem 14 **Q# 175/** iG Extended/2016/s/Paper 21/

35	**D**
36	**B**
37	**A**
38	**D**
39	**B**
40	**C**

Topic Chem 14 **Q# 176/** iG Extended/2016/m/Paper 22/

35	**C**
36	**B**
37	**C**
38	**D**
39	**B**
40	**D**