THE BRITISH INTERNATIONAL SCHOOL
ABU DHABI
A NORD ANGLIA EDUCATION SCHOOL

Year 10 Chemistry
Mock Summer 2025

Revision Questions
Paper 1C

Total marks: 174 marks
Suggested time: 190 minutes

Name: _____

Suggestion

- Go through this paper, and complete all the questions you are able to in one colour **without** using resources
- Go back through and complete the remaining questions using your notes or resources
- Answer the questions in the spaces provided – there may be more space than you need
- You will probably **not** want to try to complete all questions in one session! If you want to time yourself, use the rough guide of **1 mark per minute**.

Information

- The marks for each question are shown in brackets – use this as a guide as to how much time to spend on each question.
- The questions roughly follow the order on the checklist

Marking

Marks achieved <u>without</u> resources	**Marks achieved <u>with</u> resources**	**Total marks achieved**
		/ 174

The Periodic Table of the Elements

1	2											3	4	5	6	7	0
							1 **H** hydrogen 1										4 **He** helium 2
7 **Li** lithium 3	9 **Be** beryllium 4											11 **B** boron 5	12 **C** carbon 6	14 **N** nitrogen 7	16 **O** oxygen 8	19 **F** fluorine 9	20 **Ne** neon 10
23 **Na** sodium 11	24 **Mg** magnesium 12											27 **Al** aluminium 13	28 **Si** silicon 14	31 **P** phosphorus 15	32 **S** sulfur 16	35.5 **Cl** chlorine 17	40 **Ar** argon 18
39 **K** potassium 19	40 **Ca** calcium 20	45 **Sc** scandium 21	48 **Ti** titanium 22	51 **V** vanadium 23	52 **Cr** chromium 24	55 **Mn** manganese 25	56 **Fe** iron 26	59 **Co** cobalt 27	59 **Ni** nickel 28	63.5 **Cu** copper 29	65 **Zn** zinc 30	70 **Ga** gallium 31	73 **Ge** germanium 32	75 **As** arsenic 33	79 **Se** selenium 34	80 **Br** bromine 35	84 **Kr** krypton 36
85 **Rb** rubidium 37	88 **Sr** strontium 38	89 **Y** yttrium 39	91 **Zr** zirconium 40	93 **Nb** niobium 41	96 **Mo** molybdenum 42	[98] **Tc** technetium 43	101 **Ru** ruthenium 44	103 **Rh** rhodium 45	106 **Pd** palladium 46	108 **Ag** silver 47	112 **Cd** cadmium 48	115 **In** indium 49	119 **Sn** tin 50	122 **Sb** antimony 51	128 **Te** tellurium 52	127 **I** iodine 53	131 **Xe** xenon 54
133 **Cs** caesium 55	137 **Ba** barium 56	139 **La*** lanthanum 57	178 **Hf** hafnium 72	181 **Ta** tantalum 73	184 **W** tungsten 74	186 **Re** rhenium 75	190 **Os** osmium 76	192 **Ir** iridium 77	195 **Pt** platinum 78	197 **Au** gold 79	201 **Hg** mercury 80	204 **Tl** thallium 81	207 **Pb** lead 82	209 **Bi** bismuth 83	[209] **Po** polonium 84	[210] **At** astatine 85	[222] **Rn** radon 86
[223] **Fr** francium 87	[226] **Ra** radium 88	[227] **Ac*** actinium 89	[261] **Rf** rutherfordium 104	[262] **Db** dubnium 105	[266] **Sg** seaborgium 106	[264] **Bh** bohrium 107	[277] **Hs** hassium 108	[268] **Mt** meitnerium 109	[271] **Ds** darmstadtium 110	[272] **Rg** roentgenium 111	Elements with atomic numbers 112–116 have been reported but not fully authenticated						

Key

relative atomic mass
atomic symbol
name
atomic (proton) number

**** The lanthanoids (atomic numbers 58–71) and the actinoids (atomic numbers 90–103) have been omitted.***

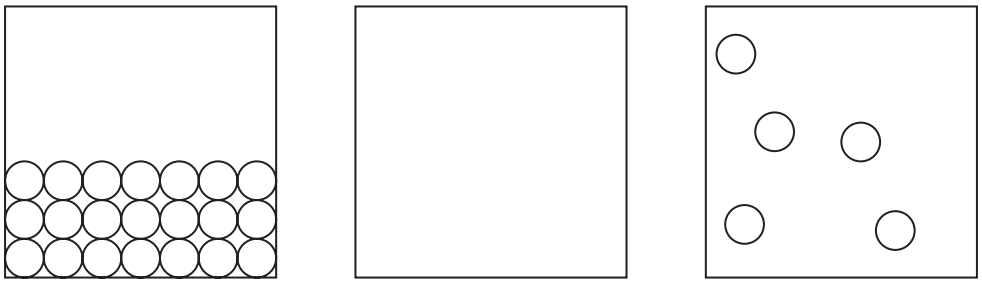
The relative atomic masses of copper and chlorine have not been rounded to the nearest whole number.

Answer ALL questions.

Some questions must be answered with a cross in a box ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

1 This question is about the three states of matter, solid, liquid and gas.

(a) The diagram shows how particles of a substance are arranged in two of these states.



solid liquid gas

(i) Complete the diagram to show how particles are arranged in the liquid state.

(1)

(ii) Identify the state of matter that contains particles with the least energy.

(1)

(b) The table shows two changes of state.

Complete the table by giving the name of each change of state.

(2)

Change of state	Name
solid to liquid	
solid to gas	

(c) Explain why hot water evaporates more quickly than cold water.

(2)

(Total for Question 1 = 6 marks)

2 (a) Table 1 shows some relative masses and charges of subatomic particles.

Complete table 1 by giving the missing information.

(2)

	Electron	Proton	Neutron
Relative mass	0.0005		
Relative charge			0

Table 1

(b) Table 2 gives the number of protons, neutrons and electrons in atoms and ions of some elements.

The letters are **not** the symbols of the elements.

Atom or ion	Protons	Neutrons	Electrons
P	3	4	2
Q	5	5	5
R	5	6	5
S	7	7	7
T	8	8	8
U	8	8	10

Table 2

(i) What is the atomic number of P in table 2?

(1)

☒ **A** 2

☒ **B** 3

☒ **C** 4

☒ **D** 7

(ii) What is the mass number of U in table 2?

(1)

- ☒ **A** 8
- ☒ **B** 16
- ☒ **C** 18
- ☒ **D** 26

(iii) Give the letter in table 2 that represents an element in Group 5 of the Periodic Table.

(1)

.....

(c) Q and R represent isotopes of the same element.

(i) Explain, in terms of subatomic particles, why Q and R are isotopes.

(2)

.....

.....

.....

.....

(ii) A sample containing the isotopes Q and R has this percentage composition by mass.

Q = 20.6 % R = 79.4 %

Calculate the relative atomic mass (A_r) of this sample of the element.

Give your answer to one decimal place.

(3)

A_r = ...

(Total for Question 2 = 10 marks)

3 This question is about mixtures and compounds.

(a) The box gives some techniques used to separate mixtures.

crystallisation	filtration
fractional distillation	simple distillation

The table lists some substances and mixtures.

Complete the table using words from the box to show the best technique to obtain the named substance from each mixture.

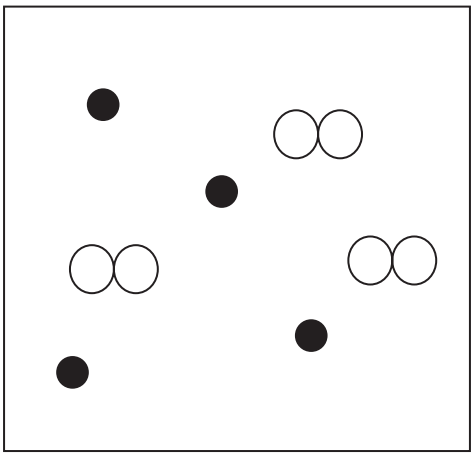
Each technique may be used once, more than once or not at all.

(3)

Substance	Mixture	Technique
solid sodium chloride	aqueous sodium chloride	
water	aqueous copper(II) sulfate	
sand	sand and water	

(b) State how the box represents a mixture.

(1)



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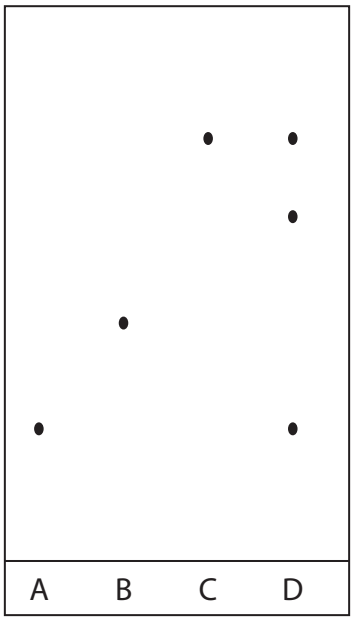
(c) Food colourings are mixtures of food dyes.

A student uses paper chromatography to separate the food dyes contained in food colouring D.

The student places spots of three food dyes A, B and C and food colouring D on chromatography paper.

The diagram shows the appearance of the paper after the experiment.



Describe the composition of food colouring D.

(2)

(d) A compound has the formula $Ca(HCO_3)_2$

(i) Determine the number of different elements in $Ca(HCO_3)_2$

(1)

(ii) Determine the number of atoms in the formula of $Ca(HCO_3)_2$

(1)

(Total for Question 3 = 8 marks)

4 The table gives some information about three substances, X, Y and Z.

Substance	Melting point	Conducts electricity when solid	Conducts electricity when molten	Type of bonding	Type of structure
X	low	no	no	covalent	simple molecular
Y	high	no	no		
Z	high	no	yes		

(a) Complete the table by giving the missing information.

(4)

(b) Explain why substance X has a low melting point.

(2)

(Total for Question 4 = 6 marks)

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Caffeine is a stimulant found in coffee, tea and some soft drinks.

(a) The molecular formula of caffeine is $C_8H_{10}N_4O_2$

(i) Determine the number of atoms in one molecule of caffeine.

(1)

(ii) Calculate the relative formula mass (M_r) of caffeine.

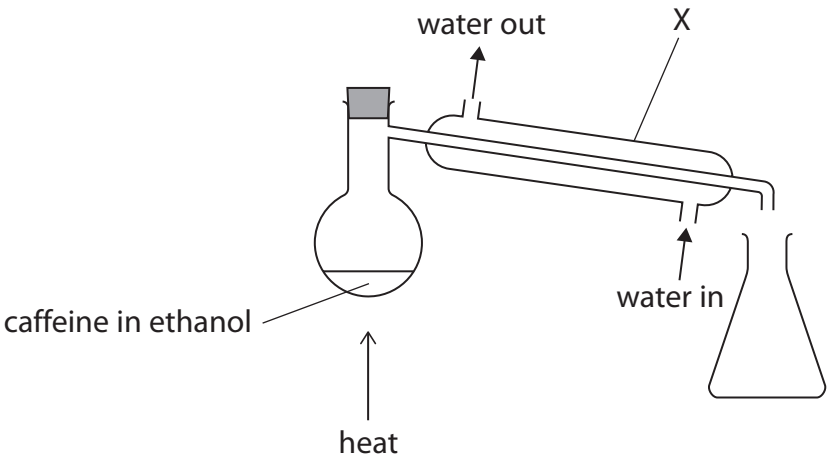
(2)

M_r = ...

(iii) Give the empirical formula for caffeine.

(1)

(b) Ethanol can be obtained from a solution of caffeine in ethanol using this apparatus.



(i) Give the name of the method of separation shown in the diagram.

(1)

(ii) Describe what happens to the ethanol vapour in apparatus X.

(2)

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(c) Calcium bromide is an ionic compound.

The table shows the formulae and melting points of caffeine and calcium bromide.

Name	Formula	Melting point in °C
caffeine	$C_8H_{10}N_4O_2$	235
calcium bromide	$CaBr_2$	730

The relative formula mass of calcium bromide is similar to the relative formula mass of caffeine.

Explain why calcium bromide has a much higher melting point than caffeine.

(5)

(Total for Question = 12 marks)

Chromatography is used to separate the components in a mixture.

(a) Diagram 1 shows the apparatus used to separate the different dyes in a food colouring.

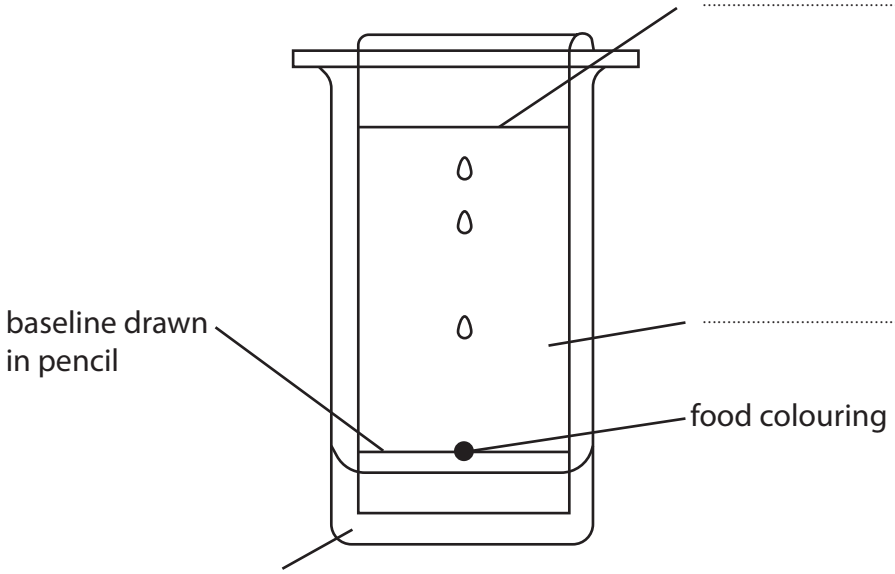


Diagram 1

(i) Complete the diagram by adding the missing labels.

(3)

(ii) Give a reason why the baseline is drawn in pencil.

(1)

(b) Diagram 2 shows a chromatogram produced from four different food colourings, W, X, Y and Z.

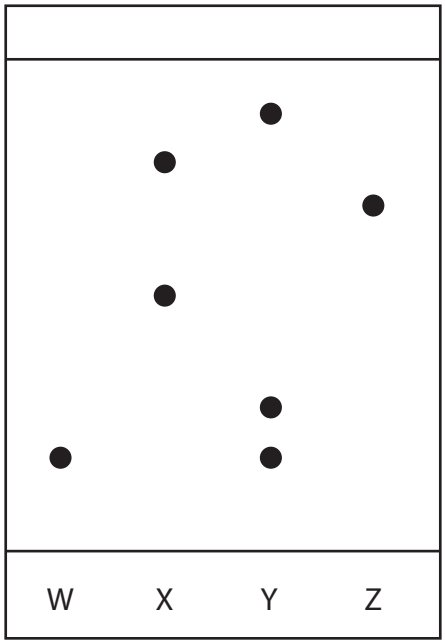


Diagram 2

(i) Which two food colourings contain the same dye?

(1)

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

(ii) Calculate the R_f value of the dye in food colouring W.

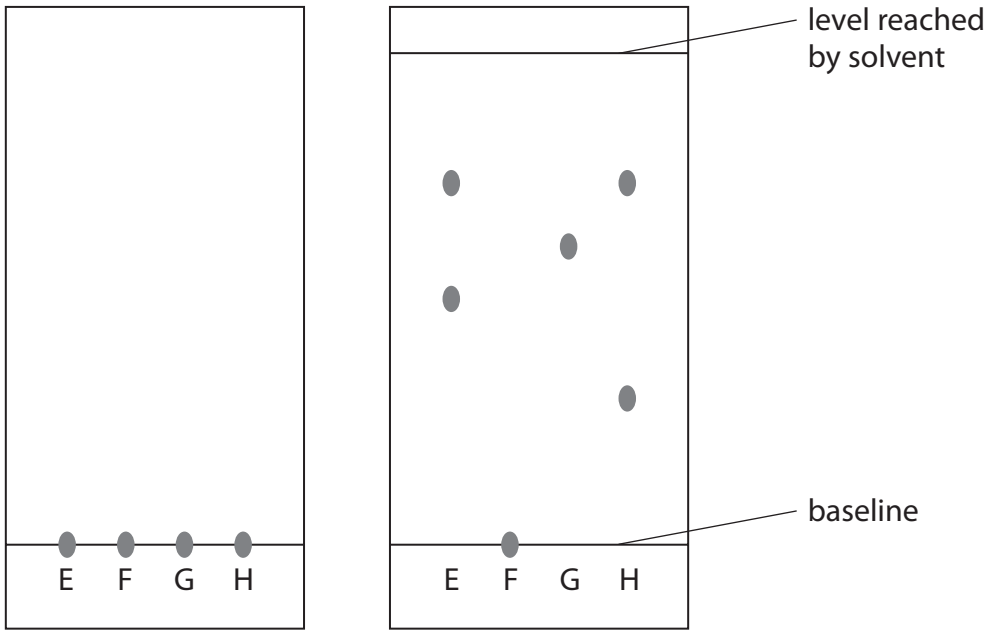
(2)

R_f = ...

(Total for Question = 7 marks)

7 A student uses paper chromatography in an experiment to separate the dyes in four different felt tip pens, E, F, G and H.

The diagram shows the appearance of the paper before and after the experiment.



(a) (i) The chromatography paper is placed in a solvent. Explain why the spots on the baseline are placed above the level of the solvent.

(2)

.....

.....

.....

.....

(ii) Explain which two felt tip pens contain the same dye.

(2)

.....

.....

.....

.....

(iii) The student thought that both F and G contained only one dye.

Explain why the student can only be certain about one of these dyes.

(2)

.....

.....

.....

.....

(b) Calculate the R_f value for the dye in G.

Show your working.

(3)

R_f value = ...

(Total for Question 7 = 9 marks)

This question is about ionic and covalent compounds.

(a) The table gives the formulae of some positive ions, some negative ions and some compounds containing these ions.

	NH_4^+	Zn^{2+}	Al^{3+}
Cl^-	NH_4Cl	$ZnCl_2$	
SO_4^{2-}	$(NH_4)_2SO_4$		$Al_2(SO_4)_3$
N^{3-}		Zn_3N_2	AlN

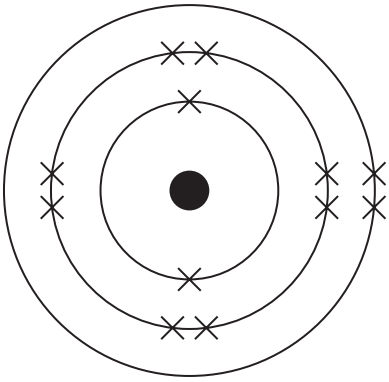
(i) Complete the table by giving the three missing formulae.

(3)

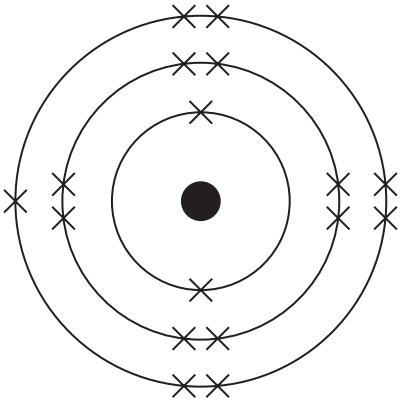
(ii) Give the name of the compound with the formula $Al_2(SO_4)_3$

(1)

(b) The diagram shows the arrangement of electrons in an atom of magnesium and an atom of chlorine.



Magnesium



Chlorine

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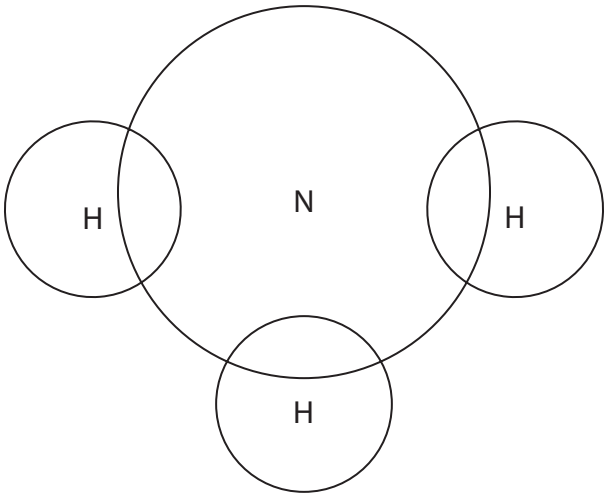
Describe, in terms of electrons, what happens when magnesium atoms and chlorine atoms form magnesium chloride.

(3)

(c) (i) Complete the dot-and-cross diagram to show the outer shell electrons in a molecule of ammonia.

(2)



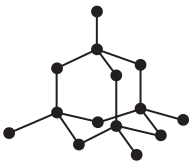
(ii) Describe the forces of attraction in a covalent bond.

(2)

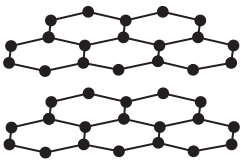
(Total for Question = 11 marks)

Diamond and graphite are made of carbon atoms, joined together by covalent bonds.

The diagram shows their structures.



diamond



graphite

(a) State, in terms of electrostatic attractions, what is meant by a covalent bond.

(2)

(b) Explain why diamond has a high melting point.

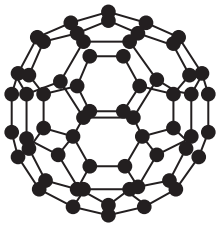
(3)

(c) Explain why graphite is a good conductor of electricity.

(2)

(d) C_{60} fullerene is a molecule made of 60 carbon atoms.

The diagram shows the structure of C_{60} fullerene.



One mole of atoms contains 6.0×10^{23} atoms.

Determine the number of atoms in one mole of C_{60} fullerene.

Give your answer in standard form.

(2)

number of atoms = ...

(Total for Question = 9 marks)

1 This question is about some Group 1 elements and their compounds.

(a) A teacher adds a small piece of sodium to a trough of water.

(i) Give two observations that are made when sodium reacts with water.

(2)

1 .....

2 .....

(ii) After the reaction has stopped, the teacher adds a few drops of phenolphthalein to the solution in the trough.

Explain the colour of the phenolphthalein after it is added to the solution.

(2)

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(c) Potassium aluminium sulfate can be used in baking.

Anhydrous potassium aluminium sulfate has the formula $KAl(SO_4)_2$

(i) Give the formula of each ion in potassium aluminium sulfate.

(2)

potassium ion

.....

aluminium ion

.....

sulfate ion

.....

(ii) Potassium aluminium sulfate is normally found as a hydrated salt, with the formula $KAl(SO_4)_2.xH_2O$

When 23.7 g of the hydrated salt is heated to remove all the water, 12.9 g of the anhydrous salt is formed.

Calculate the value of x.

[for $KAl(SO_4)_2$, $M_r = 258$ for H_2O, $M_r = 18$]

(4)

x = ...

(Total for Question 1 = 1 marks)

11 This question is about the reaction between magnesium and dilute nitric acid.

(a) A student reacts dilute nitric acid with an excess of magnesium powder as a first step in the preparation of dry crystals of hydrated magnesium nitrate.

This is the equation for the reaction.

$$Mg(s) + 2HNO_3(aq) \rightarrow Mg(NO_3)_2(aq) + H_2(g)$$

(i) Explain why it is important that magnesium is in excess.

(2)

.....

.....

.....

.....

(ii) The student adds 0.75 g of magnesium to 0.025 mol of nitric acid.

Calculate the mass of magnesium, in grams, that remains at the end of the reaction.

[for magnesium, $A_r = 24$]

(3)

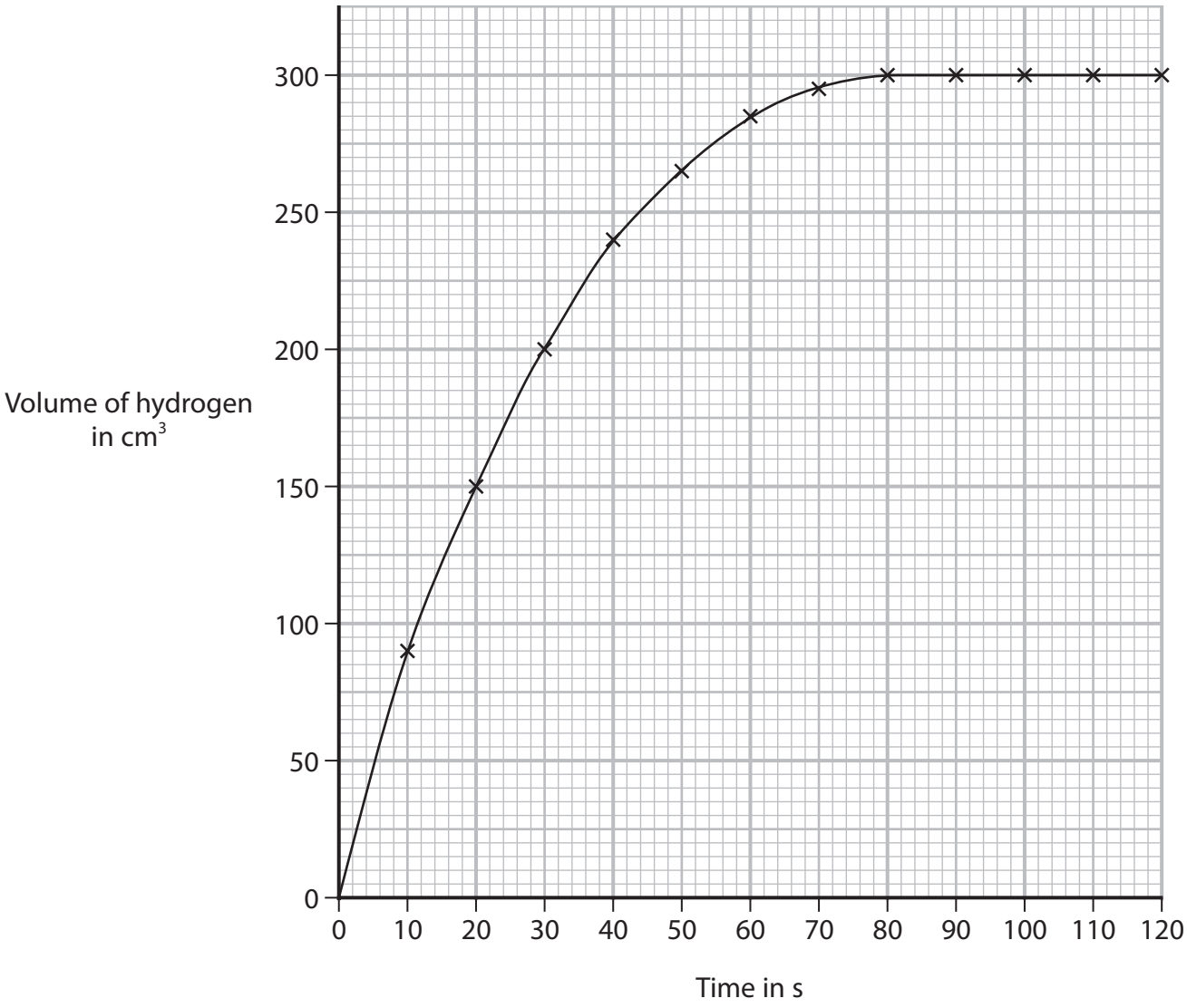
mass of magnesium = ... g

(iii) Describe how the student can obtain dry crystals of hydrated magnesium nitrate from the mixture at the end of the reaction.

(5)

(b) The student repeats the experiment and records the volume of hydrogen gas collected.

The graph shows the student's results.



Use the graph to calculate the rate of reaction, in cm^3/s, at t = 40 s.

Show your working on the graph.

(3)

rate of reaction = ... cm^3/s

(Total for Question 11 = 13 marks)

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12 This question is about gases in the atmosphere.

(a) (i) Name the most abundant gas in the atmosphere.

(1)

.....

(ii) Name the noble gas that makes up about 1% of the atmosphere.

(1)

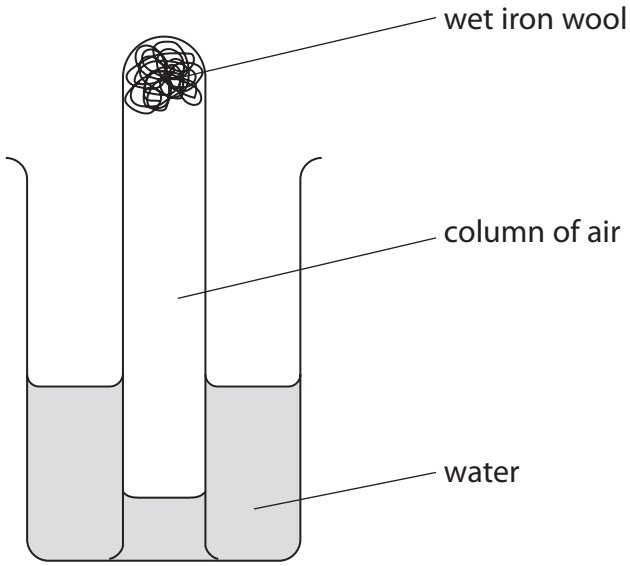
.....

(iii) Name a greenhouse gas in the atmosphere.

(1)

.....

(b) A student uses this apparatus to determine the percentage of oxygen in a sample of air.



This is the student's method.

- measure the initial length of the column of air in the tube
- leave the apparatus for one week
- measure the final length of the column of air

The table shows the student's results.

initial length of column of air in mm	84
final length of column of air in mm	69

(i) State the appearance of the iron wool after one week.

(1)

.....

(ii) Use the student's results to show that the percentage of oxygen in the sample of air is approximately 18%.

(2)

(iii) The actual percentage of oxygen in air is approximately 21%.

Give a reason why the percentage of air calculated from the student's results is less than 21%.

(1)

.....

.....

.....

(Total for Question 12 = 7 marks)

13 This question is about the reactions of iron.

(a) Iron rusts when exposed to water and oxygen.

(i) Give the chemical name of the compound that forms when iron rusts.

(1)

(ii) What type of reaction occurs when iron rusts?

(1)

- ☒ **A** combustion
- ☒ **B** decomposition
- ☒ **C** neutralisation
- ☒ **D** oxidation

(iii) Galvanising is a method used to prevent iron from rusting.

Give the name of the metal used to galvanise iron.

(1)

(b) When iron reacts with dilute sulfuric acid, the products are iron(II) sulfate and hydrogen.

(i) Give a chemical equation for the reaction between iron and sulfuric acid.

(1)

(ii) Give a test for hydrogen.

(1)

(c) An excess of iron is added to copper(II) sulfate solution.

(i) Name the type of reaction that occurs.

(1)

.....

(ii) State the appearance of the solid that forms in the reaction.

(1)

.....

(d) Give the reason why no reaction occurs when iron is added to magnesium sulfate solution.

(1)

.....

.....

(Total for Question 13 = 8 marks)

14 This question is about iron.

(a) One problem with iron is that it rusts.

(i) Name the two substances that iron reacts with when it rusts.

(2)

1 .....

2 .....

(ii) State what type of reaction occurs when iron rusts.

(1)

.....

(b) Iron can be prevented from rusting by painting or by coating with zinc.

(i) Explain how painting prevents iron from rusting.

(2)

.....

.....

.....

.....

(ii) Name the process used to coat iron with zinc.

(1)

.....

(iii) Explain why a layer of zinc protects iron from rusting, even if the layer of zinc is scratched.

(2)

(c) Iron is formed when aluminium reacts with iron(III) oxide.

This is the equation for the reaction.

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

(i) Explain what this reaction shows about the relative reactivities of aluminium and iron.

(2)

(ii) Explain which substance acts as an oxidising agent in this reaction.

(2)

(Total for Question 14 = 12 marks)

1 This question is about the oxides of some elements in Group 4 of the Periodic Table.

(a) When 5.34 g of lead(II) carbonate are heated, lead(II) oxide and carbon dioxide are formed.

This is the equation for the reaction.

$$PbCO_3(s) \rightarrow PbO(s) + CO_2(g)$$

(i) Give the name for this type of reaction.

(1)

.....

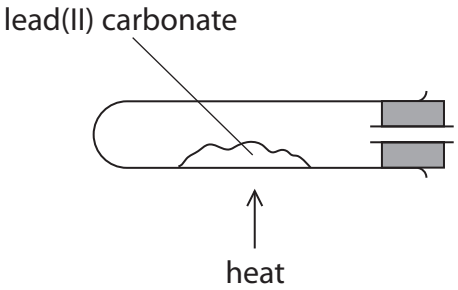
(ii) Calculate the maximum mass of lead(II) oxide that can be formed from 5.34 g of lead(II) carbonate.

[for $PbCO_3$, $M_r = 267$ for PbO, $M_r = 223$]

(2)

maximum mass = ... g

(b) The diagram shows apparatus used to heat lead(II) carbonate.



(i) Complete the diagram to show what needs to be added to the apparatus to test that the gas released is carbon dioxide.

(2)

(ii) Give the result of the test.

(1)

.....

.....

(c) Silicon dioxide (SiO_2) and carbon dioxide both contain covalent bonds.

Silicon dioxide is a solid with a high melting point. Carbon dioxide is a gas at room temperature.

Explain why silicon dioxide has a much higher melting point than carbon dioxide.

Refer to structure and bonding in your answer.

(6)

(Total for Question 1 = 12 marks)

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1 This question is about the reactions of some compounds of lead.

(a) Lead can be extracted from lead(II) sulfide, PbS, in two stages.

Stage 1 lead(II) sulfide is heated in air and reacts with oxygen to produce lead(II) oxide, PbO, and sulfur dioxide

Stage 2 lead(II) oxide is heated with carbon in a furnace

(i) Write a chemical equation for the reaction in stage 1.

(2)

.....

(ii) Give a reason why sulfur dioxide should not be released into the atmosphere.

(1)

.....

.....

.....

(iii) This is the equation for stage 2.

$$2PbO + C \rightarrow 2Pb + CO_2$$

A mass of 892 tonnes of lead(II) oxide is heated in a furnace with an excess of carbon.

Calculate the maximum mass, in tonnes, of carbon dioxide that could be released into the atmosphere.

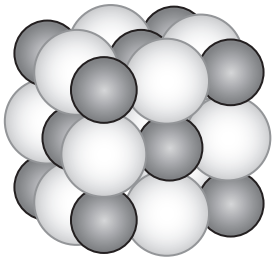
[1 tonne = 1×10^6 g]

[for PbO, $M_r = 223$ for CO_2, $M_r = 44$]

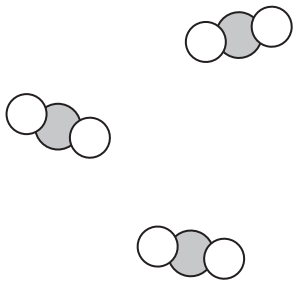
(3)

mass = ... tonnes

(iv) The diagram shows the structures of lead(II) sulfide and sulfur dioxide.



Lead(II) sulfide



Sulfur dioxide

Explain, in terms of bonding and structure, why lead(II) sulfide is a solid with a very high melting point at room temperature and why sulfur dioxide is a gas at room temperature.

(5)

lead(II) sulfide

sulfur dioxide

(b) A different oxide of lead contains 90.7% by mass of lead and 9.3% by mass of oxygen.

Determine the empirical formula of this oxide of lead.

(4)

empirical formula = ...

(Total for Question 1 = 15 marks)

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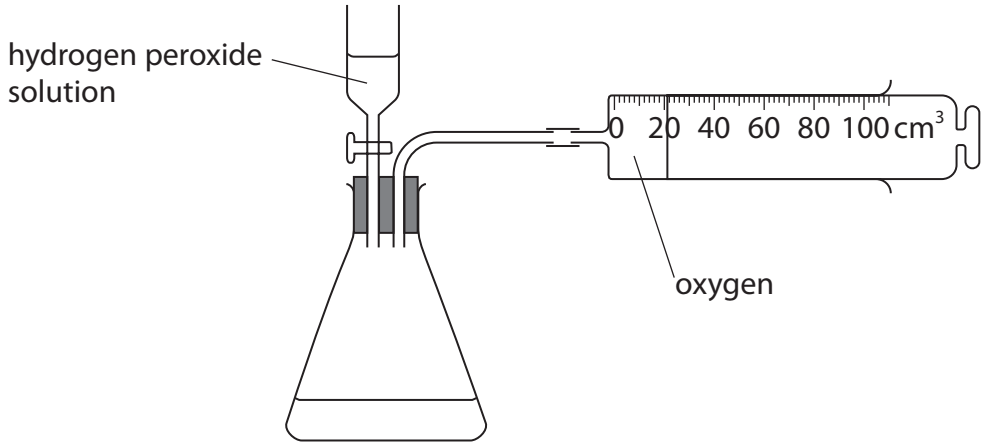
17 A student uses this apparatus to investigate the rate of reaction when hydrogen peroxide solution decomposes.



This is the equation for the reaction.

$$2H_2O_2 \rightarrow 2H_2O + O_2$$

(a) Give a reason why the gas that collects in the gas syringe is not pure oxygen.

(1)

.....

.....

(b) The rate of reaction can be increased by adding a catalyst to the hydrogen peroxide solution.

Describe how a catalyst increases the rate of a reaction.

(2)

.....

.....

.....

.....

(c) These solids catalyse the decomposition of hydrogen peroxide solution.

- lead(IV) oxide
- manganese(IV) oxide

Describe a method that the student could use to find out which solid is the more effective catalyst.

(5)

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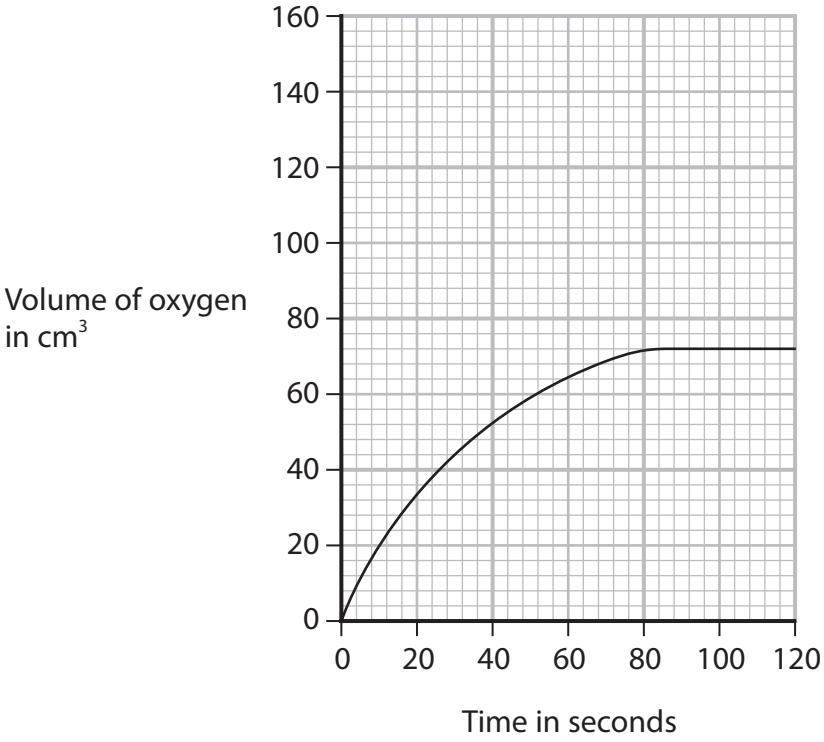
(d) A student investigates the decomposition of a solution of hydrogen peroxide at different temperatures.

The graph shows how the total volume of oxygen collected in the syringe changes with time when the solution is at a temperature of 20 °C.



On the grid, draw the curve the student would obtain at a temperature of 40 °C when all other conditions are kept the same.

(2)

(Total for Question 17 = 10 marks)

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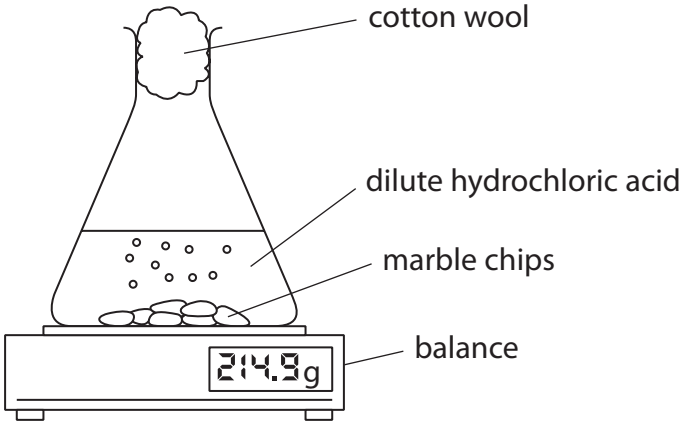
18 A student uses this apparatus to investigate the rate of reaction between marble chips and dilute hydrochloric acid.



This is the equation for the reaction.

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

(a) Give a reason why the reading on the balance decreases during the reaction.

(1)

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(b) Explain why the rate of reaction is greatest at the start.

(2)

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(c) After 10 minutes, the reaction stops even though there are marble chips remaining.

Give a reason why the reaction stops.

(1)

.....

.....

(d) The student repeats the experiment with hydrochloric acid at a higher temperature to investigate the effect on the rate of reaction.

(i) Give two variables that should be controlled to make sure the results are valid.

(2)

1 .....

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2 .....

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(ii) Explain the effect of increasing the temperature of hydrochloric acid on the rate of reaction.

(3)

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(Total for Question 18 = 9 marks)

TOTAL FOR PAPER = 174 MARKS

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