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INTERNATIONAL GCSE Chemistry

Specification and Sample Assessment Material

Edexcel International GCSE in Chemistry (4CH0)

First examination June 2013

ALWAYS LEARNING

PEARSON

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Chemistry (4CH0)

Sample Assessment Material

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Contents

General Marking Guidance

- All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- Examiners should mark according to the mark scheme not according to their perception of where the grade boundaries may lie.
- There is no ceiling on achievement. All marks on the mark scheme should be used appropriately.
- All the marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, ie if the answer matches the mark scheme. Examiners should also be prepared to award zero marks if the candidate's response is not worthy of credit according to the mark scheme.
- Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.
- When examiners are in doubt regarding the application of the mark scheme to a candidate's response, the team leader must be consulted.
- Crossed out work should be marked UNLESS the candidate has replaced it with an alternative response.

Write your name here

Surname	Other names

Edexcel
International GCSE

Centre Number | | | | | |

Candidate Number | | | | |

Chemistry

Paper: 1C

Sample Assessment Material
Time: 2 hours

Paper Reference
4CH0/1C

You must have:
Ruler
Candidates may use a calculator.

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided
  – *there may be more space than you need.*
- Show all the steps in any calculations and state the units.

Information

- The total mark for this paper is **120**.
- The marks for **each** question are shown in brackets
  – *use this as a guide as to how much time to spend on each question.*

Advice

- Read each question carefully before you start to answer it.
- Keep an eye on the time.
- Write your answers neatly and in good English.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ▶

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S 4 1 6 4 6 A 0 1 2 8

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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 Lanthanides (atomic numbers 58-71) and the Actinides(atomic numbers 90-103) have been omitted.***

Cu and Cl have not been rounded to the nearest whole number.

Answer ALL questions.

1 The table shows the properties of four substances.

Use the information in the table to answer the following questions.

Substance	Melting point in °C	Boiling point in °C	Conducts electricity when	
			solid	liquid
A	1650	2230	no	no
B	1538	2862	yes	yes
C	– 7	59	no	no
D	801	1413	no	yes

Place a cross (☒) in the appropriate box to indicate your answer.

Choose from **A** to **D** a substance that could be:

(5)

(a) a metal

A ☒ **B** ☒ **C** ☒ **D** ☒

(b) a giant covalent structure

A ☒ **B** ☒ **C** ☒ **D** ☒

(c) an ionic compound

A ☒ **B** ☒ **C** ☒ **D** ☒

(d) a liquid at 25 °C

A ☒ **B** ☒ **C** ☒ **D** ☒

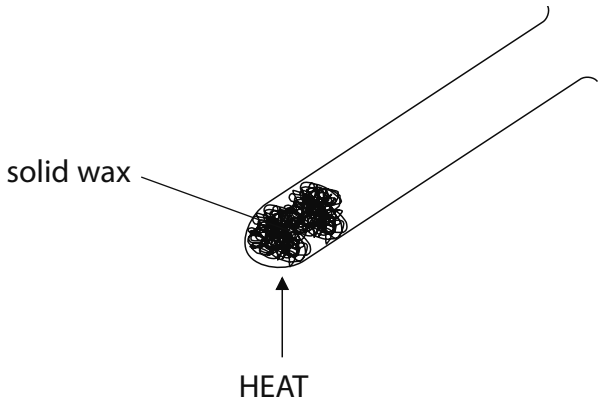
(e) a solid at 1600 °C

A ☒ **B** ☒ **C** ☒ **D** ☒

(Total for Question 1 = 5 marks)

2 A student investigated what happened when a sample of wax was heated using a Bunsen burner.

He set up the apparatus as shown in the diagram.



The student heated the solid wax strongly with a Bunsen burner until it turned into a liquid.

(a) Give the name of the process that occurs when a solid turns into a liquid.

(1)

.....

(b) Explain **one** change needed to make the experiment safer.

(2)

.....

.....

.....

.....

(c) Describe the changes in arrangement, movement and energy of the particles when the liquid wax cools to become a solid.

(3)

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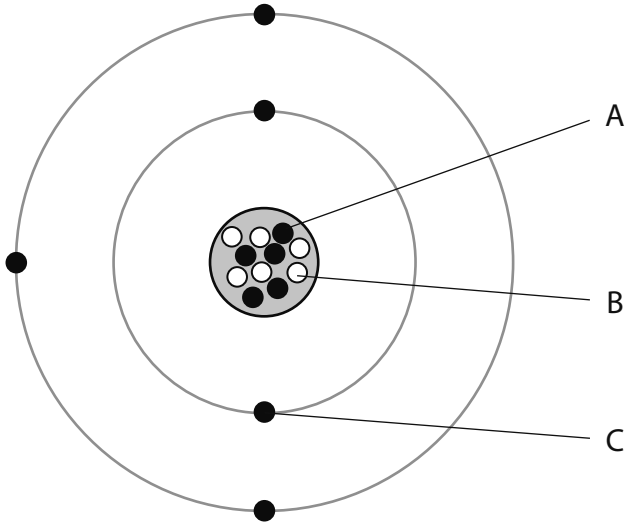
(Total for Question 2 = 6 marks)

3 The diagram represents an atom of an element.



(a) The diagram shows that there are equal numbers of particles **A** and **C**.

(i) State the name of each of the particles **A** and **B**.

(2)

A .....

B .....

(ii) State the atomic number and mass number of this atom.

(2)

Atomic number .....

Mass number .....

(b) (i) State the **name** of this element.

(1)

.....

(ii) State the electronic configuration of this element.

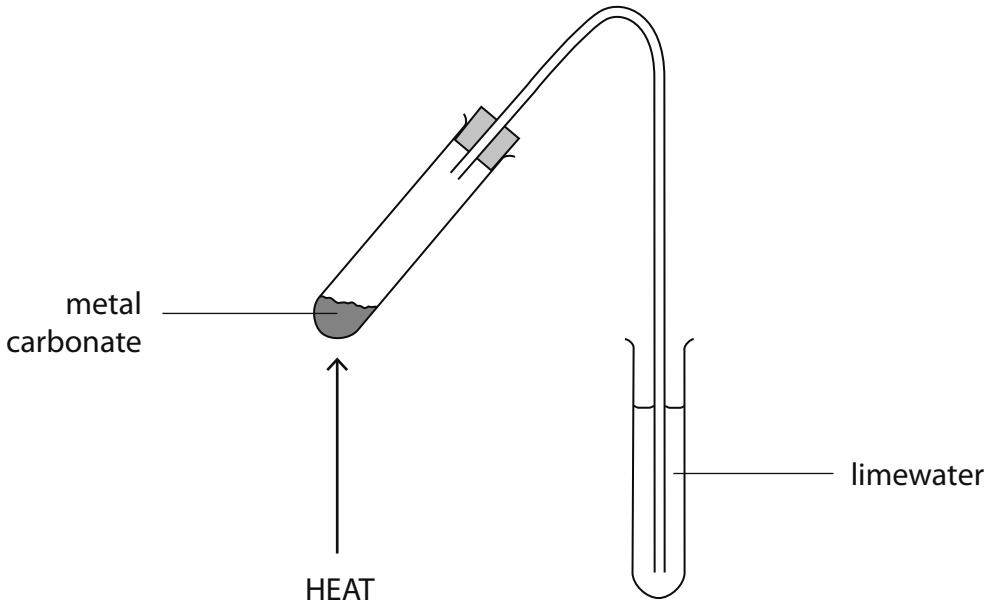
(1)

.....

(Total for Question 3 = 6 marks)

4 A student wanted to find out how easily different metal carbonates decomposed on heating.

She placed a sample of a metal carbonate into a test tube and heated it, passing the gas given off through limewater using the apparatus shown in the diagram.



She heated three other metal carbonates in turn and measured the time taken for the limewater to turn milky.

Her results are given in the table.

Metal carbonate	Time taken in seconds
copper(II) carbonate	5
magnesium carbonate	25
lead(II) carbonate	15
sodium carbonate	does not turn milky

(a) State the name of the gas that causes the limewater to turn milky.

(1)

.....

(b) Use the results to identify, with a reason, which metal carbonate decomposed most easily.

(2)

.....

.....

.....

(c) What do the results suggest about the effect of heat on sodium carbonate?

(1)

.....

(d) State **two** things that the student must do to make sure the experiment is valid (a fair test).

(2)

1 .....

.....

2 .....

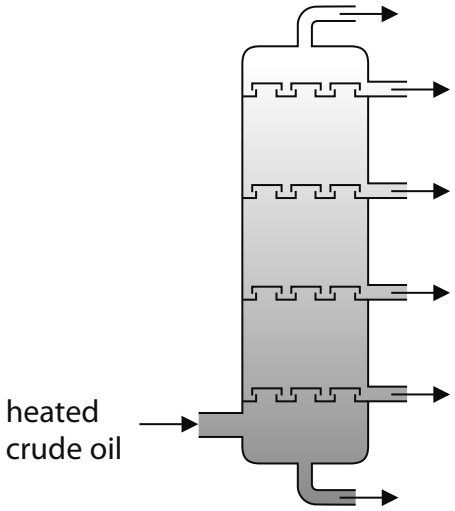
.....

(Total for Question 4 = 6 marks)

5 Fractional distillation is an important process in the oil industry.

In this process, the crude oil is separated into a number of fractions. Each fraction is a mixture of hydrocarbons.

The diagram shows the column used for fractional distillation.



(a) What is meant by the term **hydrocarbon**?

(2)

.....

.....

(b) Bitumen, diesel, gasoline and refinery gases are three of the fractions obtained from crude oil.

(i) Which one of these three fractions has the lowest boiling point?

(1)

.....

(ii) Which one of these three fractions is the most viscous?

(1)

.....

(c) Explain how the separation of crude oil into fractions takes place in the fractionating column.

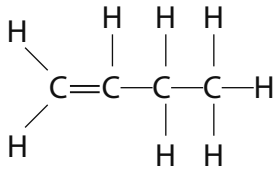
(4)

(Total for Question 5 = 8 marks)

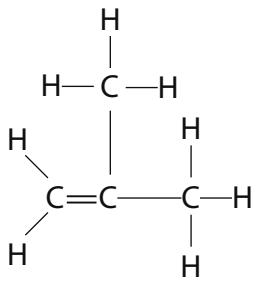
6 (a) Isomers are compounds that have the same molecular formula but different displayed formulae.

The molecular formula C_4H_8 represents several isomers.

The displayed formulae and names for two of these isomers are



but-1-ene



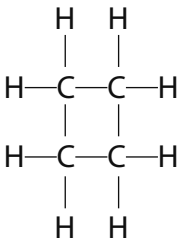
methylpropene

(i) Draw the displayed formula and give the name for another alkene with the molecular formula C_4H_8

(2)

Name .....

(ii) The displayed formula of another isomer of C_4H_8 is



cyclobutane

The general formula of cyclobutane is also C_nH_{2n}

State why cyclobutane is not an alkene.

(1)

.....

.....

(iii) Cyclobutane can be distinguished from but-1-ene by adding bromine water and shaking. Bromine water is orange.

State what you would see when bromine water is shaken separately with each compound.

(2)

Observation with cyclobutane

.....

Observation with but-1-ene

.....

(b) Cracking is used to break long alkane molecules into shorter alkanes and alkenes.

Explain why this process is of such importance in the petrochemical industry.

(2)

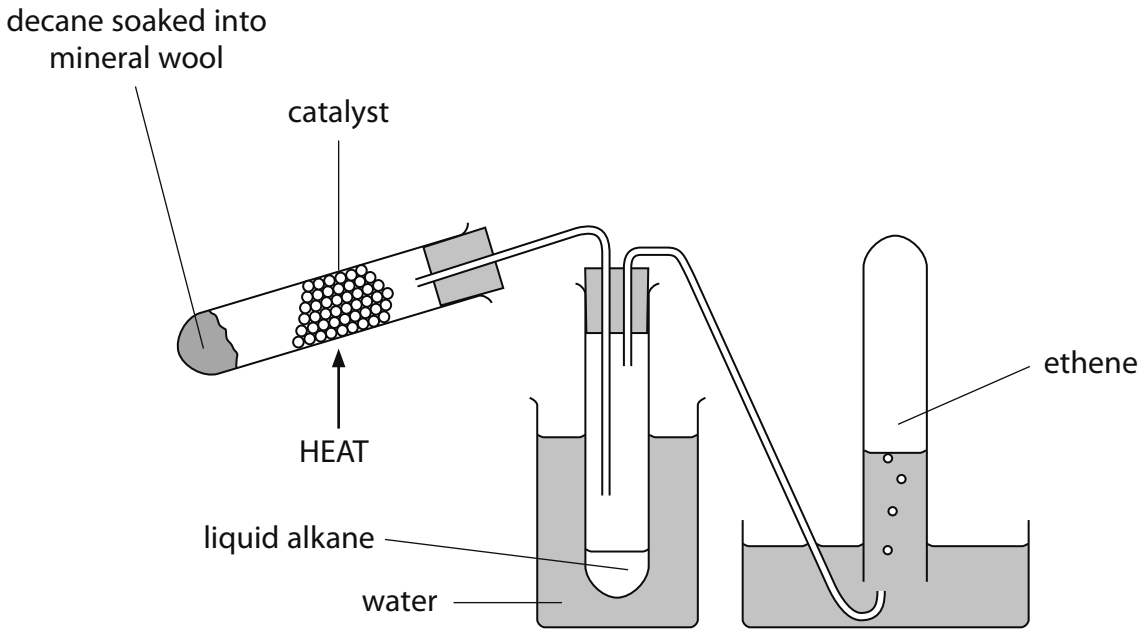
.....

.....

.....

.....

(c) Cracking can be carried out in the laboratory by passing the vapour of an alkane over a heated catalyst using the apparatus shown.



When decane ($C_{10}H_{22}$) is cracked, a shorter chain alkane and ethene (C_2H_4) can be produced.

(i) Write a chemical equation for the cracking of decane.

(2)

.....

(ii) The alkane produced can be used as a fuel for cars.

When this fuel is burned in a car engine, some incomplete combustion occurs. This produces carbon monoxide, which is dangerous to humans.

Explain why carbon monoxide is dangerous to humans.

(2)

.....

.....

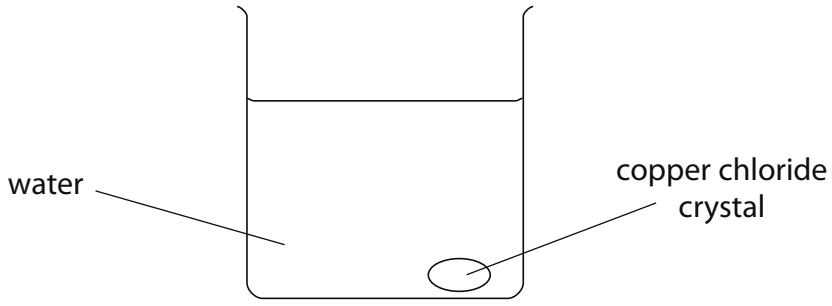
.....

.....

(Total for Question 6 = 11 marks)

7 Copper chloride is a soluble ionic compound. Solid copper chloride is green.

(a) A crystal of copper chloride was placed in a beaker containing water. It was left for several days.



Explain how the appearance of the liquid in the beaker changes after several days.

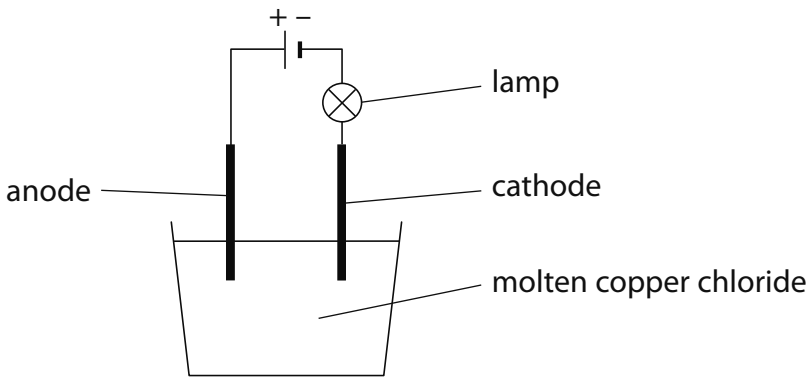
(2)

.....

.....

.....

(b) A chemist electrolyses a sample of molten copper chloride, $CuCl_2$.



Name the products formed at the electrodes.

(2)

Anode .....

Cathode .....

(c) Write an equation to show the formation of the product at the negative electrode.

(2)

.....

(Total for Question 7 = 6 marks)

8 Equal masses of iron, magnesium and zinc were placed in separate beakers, each containing 50 cm^3 of copper(II) sulfate solution.

The mass of copper displaced in each case was found and each experiment was performed three times. The results obtained are given in the table.

Metal	Mass of copper produced in grams		
	Experiment 1	Experiment 2	Experiment 3
iron	1.1	1.3	1.2
magnesium	2.3	3.2	2.2
zinc	0.9	0.8	1.10

(a) How can you tell that one of the results has been recorded to a greater precision than the others?

(1)

.....

.....

(b) Write a chemical equation for the reaction taking place between magnesium and copper(II) sulfate.

(2)

.....

.....

(c) (i) State, in terms of electrons, what happens when a copper ion becomes a copper atom.

(1)

.....

(ii) What name is given to the type of change occurring in (c)(i)?

(1)

.....

(iii) State **two** observations you would expect to make when magnesium is added to copper(II) sulfate solution.

(2)

.....

.....

(Total for Question 8 = 7 marks)

9 (a) An aqueous solution of hydrogen peroxide (H_2O_2) decomposes very slowly into water (H_2O) and oxygen (O_2) according to the following equation:

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

The reaction is faster when manganese(IV) oxide (MnO_2) is added. The manganese(IV) oxide remains chemically unchanged at the end of the reaction.

A student investigated the reaction in the presence of manganese(IV) oxide. He collected the oxygen gas produced and recorded its volume every five minutes. His results are shown in the table.

Time in minutes	0	5	10	15	20	25	30	35	40
Volume in cm^3	0	20	32	42	50	55	58	60	60

(i) The volume of gas given off between 5 and 10 minutes is 12 cm^3.

Calculate the volume of gas given off between 30 and 35 minutes.

(1)

Answer ..... cm^3

(ii) Explain, in terms of the changes in the rate of the reaction and collisions between particles, why your calculated volume is less than 12 cm^3.

(3)

.....

.....

.....

.....

.....

(iii) After how many minutes did the reaction finish?

(1)

.....

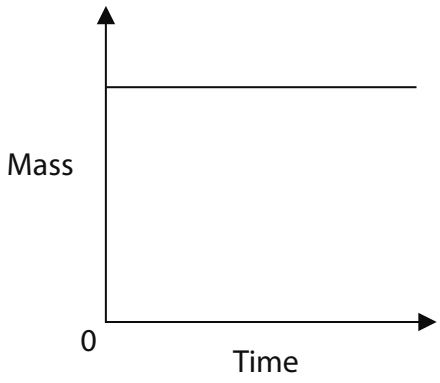
(b) What type of substance is manganese(IV) oxide in this experiment?

(1)

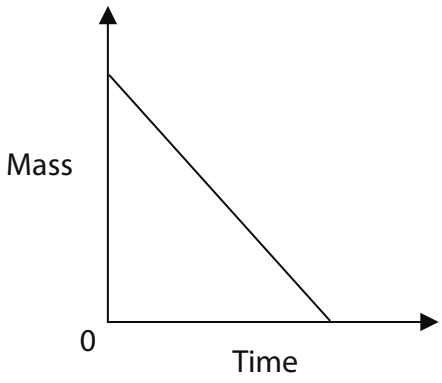
.....

(c) Some of the graphs **A** to **F** below could represent changes occuring during the decomposition of hydrogen peroxide.

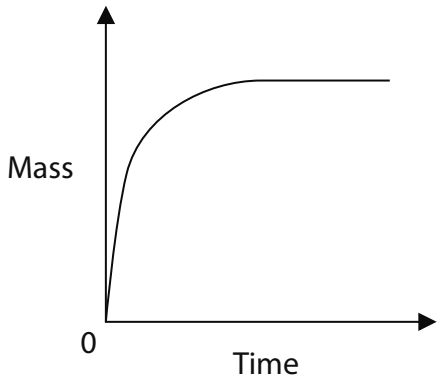
A



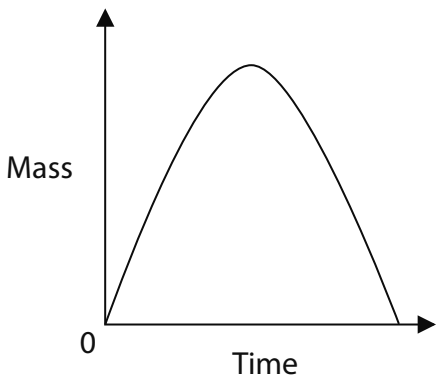
B



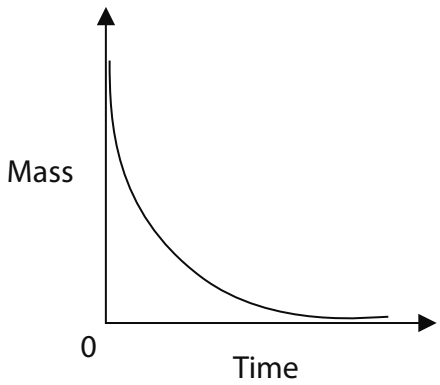
C



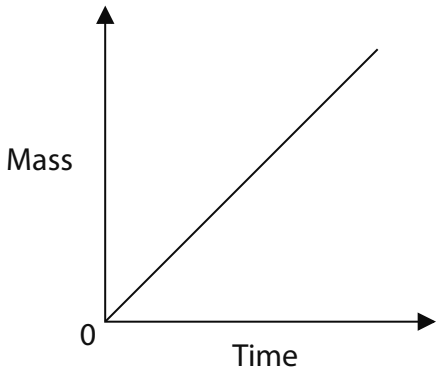
D



E



F



Answer the questions below by placing a cross (☒) in the appropriate box to indicate your answer.

Which graph could represent

(i) the total mass of oxygen given off as the experiment in (a) proceeds?

(1)

☒ **A** ☒ **B** ☒ **C** ☒ **D** ☒ **E** ☒ **F**

(ii) the mass of hydrogen peroxide remaining as the experiment in (a) proceeds?

(1)

☒ **A** ☒ **B** ☒ **C** ☒ **D** ☒ **E** ☒ **F**

(iii) the mass of the manganese(IV) oxide as the experiment in (a) proceeds?

(1)

☒ **A** ☒ **B** ☒ **C** ☒ **D** ☒ **E** ☒ **F**

(Total for Question 9 = 9 marks)

10 When potassium iodide solution is mixed with lead(II) nitrate solution, a reaction occurs to form the insoluble salt, lead(II) iodide.

The equation for this reaction is:

$$2KI(aq) + Pb(NO_3)_2(aq) \rightarrow PbI_2(s) + 2KNO_3(aq)$$

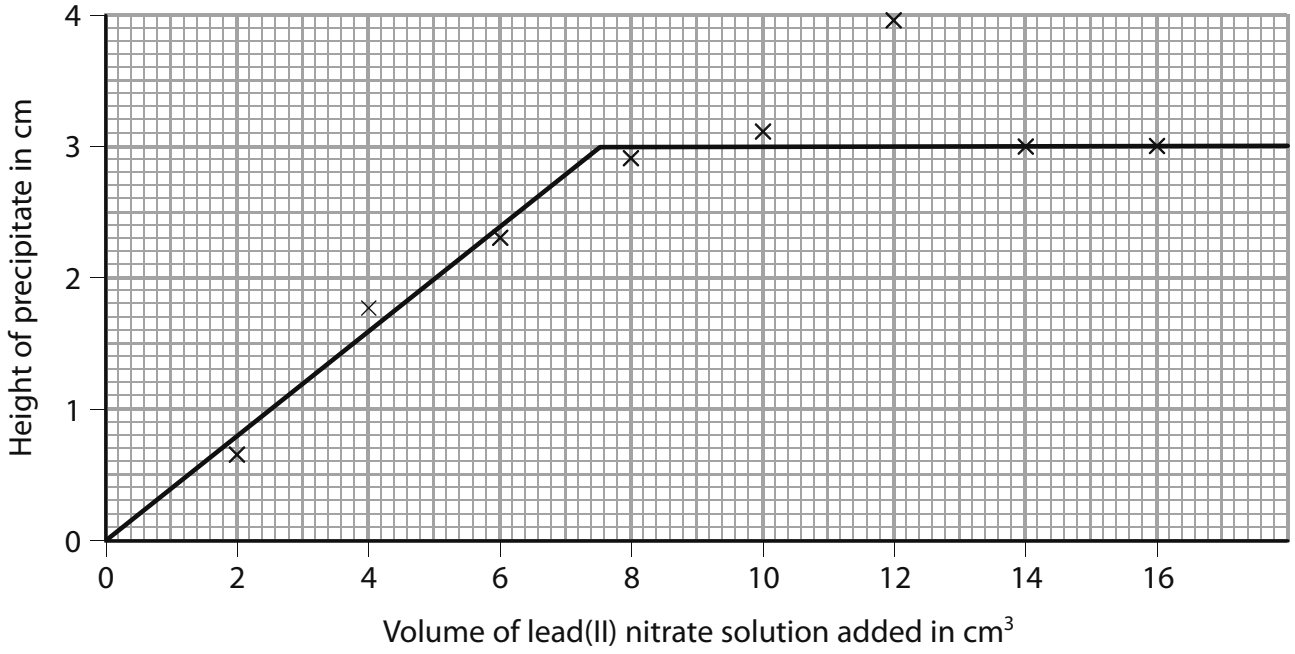
A student carried out an investigation to find how much precipitate was formed with different volumes of lead(II) nitrate solution.

- He used a measuring cylinder to transfer 15 cm^3 of potassium iodide solution into a clean boiling tube.
- Using a different measuring cylinder, he measured out 2 cm^3 of lead(II) nitrate solution and added this to the potassium iodide solution in the boiling tube.
- A yellow precipitate formed in the tube and was allowed to settle.
- The student then measured the height (in cm) of the precipitate using a ruler.

He repeated the experiment using different volumes of lead(II) nitrate solution.

In each experiment, the potassium iodide solution and lead(II) nitrate solution he used were of the same concentration.

The graph shows the results he obtained.



(a) Explain why the line on the graph rises to a maximum level, but then does not change.

(2)

.....

.....

.....

.....

(b) (i) On the graph, circle the point which seems to be anomalous.

(1)

(ii) Explain **two** things that the student may have done in the experiment to give this anomalous result.

(4)

1 .....

.....

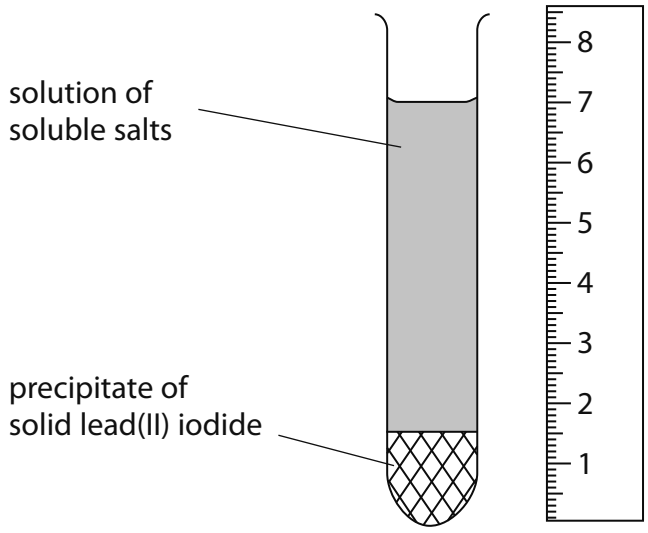
.....

2 .....

.....

.....

(c) The diagram shows a result of an identical experiment.



(i) How much precipitate has been made in the tube?

(1)

..... cm

(ii) Use the graph to find the voume of lead(II) nitrate solution needed to make this amount of precipitate.

(1)

..... cm^3

(Total for Question 10 = 9 marks)

11 Fluorine and chlorine are two elements in Group 7 of the Periodic Table.

Fluorine reacts with most elements in the Periodic Table, but it does not react with neon.

Neon is in Group 0 of the Periodic Table.

(a) Explain, in terms of the arrangement of electrons in its atoms, why neon is very unreactive.

(2)

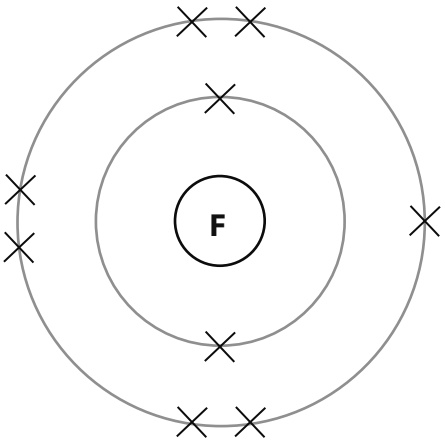
.....

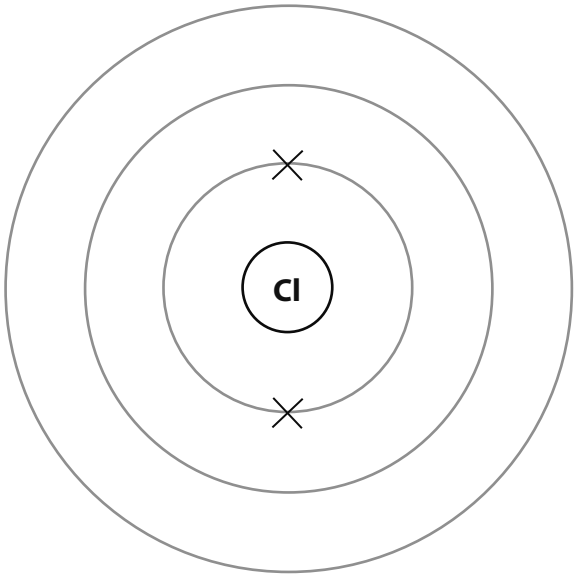
.....

(b) The diagram on the left shows the arrangement of the electrons in a fluorine atom.

Use the Periodic Table to help you to complete the diagram on the right to show the arrangement of electrons in a chlorine atom.

(2)





(c) When chlorine gas is bubbled into an aqueous solution of potassium iodide, the colourless solution turns brown.

(i) Complete the following ionic equation for the reaction that takes place.

(2)

$Cl_2(g)$ + ...$I^-(aq)$ → ..... (aq) + ... (aq)

(ii) What is the name given to this type of reaction?

(1)

.....

(iii) Why does the solution turn brown?

(1)

.....

(d) When chlorine reacts with concentrated sodium hydroxide solution, a compound is formed that contains 21.6% by mass of sodium and 33.3% by mass of chlorine. The rest is oxygen.

Calculate the empirical formula of this compound.

(4)

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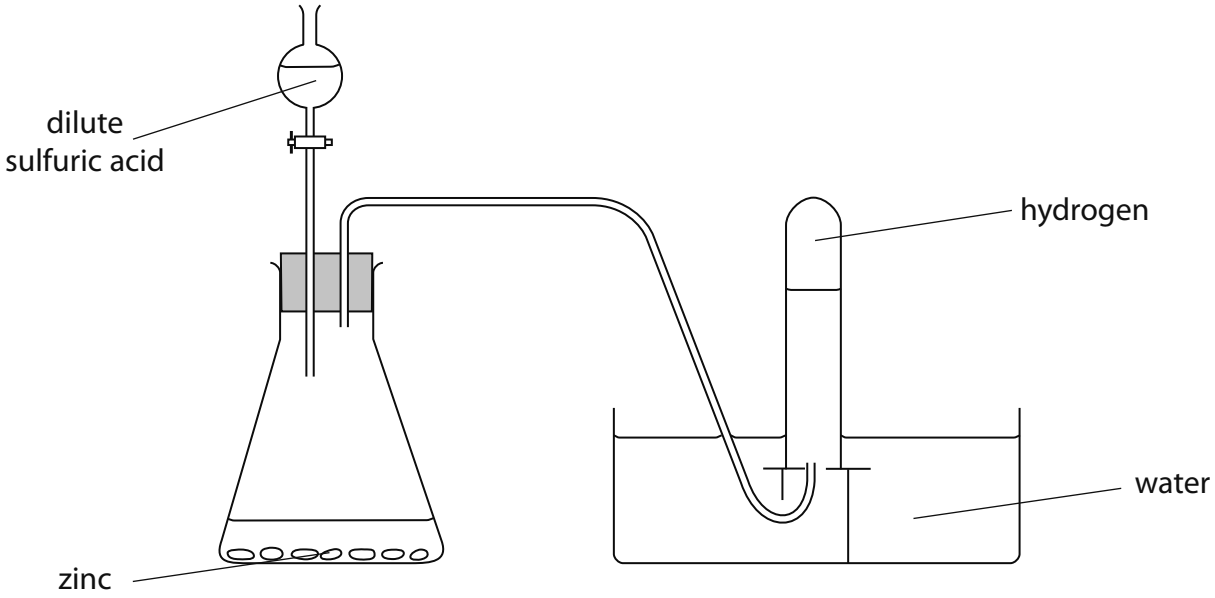
(Total for Question 11 = 12 marks)

12 Hydrogen can be prepared in the laboratory by reacting zinc with dilute sulfuric acid using the apparatus shown.



The equation for the reaction is:

$$Zn(s) + H_2SO_4(aq) \rightarrow ZnSO_4(aq) + H_2(g)$$

The reaction is fairly slow but, when copper(II) sulfate solution is added, bubbles of hydrogen form much more quickly.

A student decided to investigate how copper(II) sulfate solution increased the rate of this reaction.

She set up the apparatus as shown, without copper(II) sulfate present, and counted the number of bubbles of hydrogen produced every 15 seconds.

She then repeated the experiment with copper(II) sulfate present.

(a) Explain why her method of counting the number of bubbles of hydrogen might not give accurate results in her second experiment, with copper(II) sulfate present.

(2)

(b) Describe how she should change the experiment to allow the collection of more precise results.

(2)

.....

.....

.....

.....

.....

.....

The student then decided that she wanted to show that the gas collected was hydrogen. She burned a sample in oxygen and collected the colourless liquid that formed on cooling. If the gas were hydrogen then the colourless liquid should be pure water.

(c) Describe a **physical** test that she could perform to show that the colourless liquid is pure water.

(2)

.....

.....

The student's teacher said that even if the colourless liquid were pure water then it does not necessarily mean that the gas was hydrogen.

(d) Suggest the name of another **gas** that produces water when it is burned in oxygen.

(1)

.....

(Total for Question 12 = 7 marks)

13 Ammonia (NH_3) is manufactured in the exothermic reaction between nitrogen gas (N_2) and hydrogen gas (H_2) in the presence of an iron catalyst.

$$N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g) \quad \Delta H = -92 \text{ kJ/mol}$$

The nitrogen and hydrogen mixture is passed into a reaction chamber at a pressure of 200 atmospheres and a temperature of 450 °C.

The reaction is reversible and, if left for long enough, can reach a position of dynamic equilibrium.

(a) Why is a catalyst needed in this reaction?

(1)

.....

(b) What is meant by the term **dynamic equilibrium**?

(2)

.....

.....

(c) A scientist working in the factory making ammonia suggested changing the reaction conditions to a pressure of 1000 atmospheres and a temperature of 250 °C.

Use your knowledge of equilibrium reactions and reaction rates to explain whether the scientist's suggestion was a good one.

(4)

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(d) The mixture of gases leaving the reaction chamber contains unreacted nitrogen and hydrogen as well as ammonia.

(i) Explain how the ammonia can be separated from the unreacted nitrogen and hydrogen after the mixture has left the reaction chamber.

(2)

(ii) What happens to the unreacted nitrogen and hydrogen after it has been separated from the ammonia?

(1)

(e) Ammonia is used to make the fertiliser ammonium nitrate (NH_4NO_3) by reacting ammonia with nitric acid.

Write a chemical equation for the reaction between ammonia and nitric acid.

(1)

(f) Describe a chemical test that you could perform to show that ammonium nitrate contains ammonium ions.

(3)

(Total for Question 13 = 14 marks)

14 Zinc phosphide (Zn_3P_2) is found in some rat poisons. It is an ionic compound manufactured by heating zinc and phosphorus together.

(a) (i) The formula of the zinc ion is Zn^{2+}.

Deduce the formula of the phosphide ion.

(1)

.....

(ii) Explain why zinc phosphide does **not** conduct electricity when solid, but **does** when molten.

(2)

.....

.....

.....

.....

(b) Calculate the relative formula mass (M_r) of zinc phosphide.

(2)

Relative formula mass = ...

(c) A bag containing 51.4 kg (51 400 g) of zinc phosphide stored in a factory warehouse was accidentally contaminated with water.

Zinc phosphide reacts with water to form zinc hydroxide and phosphine gas, PH_3.

The equation for the reaction is:

$$Zn_3P_2(s) + 6H_2O(l) \rightarrow 3Zn(OH)_2(s) + 2PH_3(g)$$

(i) Calculate the minimum mass of water, in kg, needed to react with all of the zinc phosphide in the bag.

(3)

Mass of water needed = ... kg

(ii) The factory was evacuated because phosphine can burst into flames immediately when it comes into contact with oxygen in the air.

What does this suggest about the activation energy for the reaction between phosphine and oxygen?

(1)

.....

(iii) Is the reaction between phosphine and oxygen endothermic or exothermic? Use information from part (ii) to justify your answer.

(1)

.....

.....

.....

(d) (i) Phosphine is similar to ammonia (NH_3) in the way its atoms are bonded.

Draw a dot and cross diagram to show the arrangement of electrons in a molecule of phosphine. You should show only the outer electrons of each atom.

(2)

(ii) Explain why phosphine has a low boiling point.

(2)

.....

.....

.....

.....

(Total for Question 14 = 14 marks)

TOTAL FOR PAPER = 120 MARKS

Paper 1C

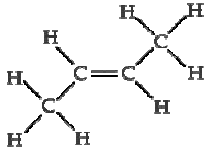
Question number	Answer	Notes	Marks
1 (a)	B		1
(b)	A		1
(c)	D		1
(d)	C		1
(e)	A		1
			Total: 5

Question number	Answer	Notes	Marks
2 (a)	melting		1
(b)	An explanation linking the following : • heat with electric heater / in water bath / sand bath • because wax may catch fire / prevent liquid wax boiling over or spitting	ACCEPT • use test tube holder / clamp • to prevent being burned by hot test tube	2
(c)	A description including the following: • (becomes) regular arrangement / pattern (of particles) • particles slow down / vibrate (in fixed positions) • particles lose (kinetic) energy	ACCEPT closer together ACCEPT stop moving around (freely)	3
			Total: 6

Question number	Answer	Notes	Marks
3 (a) (i)	A = proton(s) B = neutron(s)	Award 1 mark for two correct particles in the wrong order	2
(ii)	atomic number = 5 mass number = 11	No mark for two numbers transposed	2
(b) (i)	boron		1
(ii)	2, 3	ACCEPT any other punctuation marks, such as '.' '/' '-' or no punctuation	1
			Total: 6

Question number	Answer	Notes	Marks
4 (a)	carbon dioxide	ALLOW CO_2	1
(b)	copper(II) / copper (carbonate) (because) limewater turned milky in **least** time / **most** quickly		2
(c)	(sodium carbonate / it) does not decompose	ALLOW no carbon dioxide / gas given off	1
(d)	Any **two** from: • same volume / concentration of limewater • same flame e.g. "always roaring flame" • same amount of solid • same distance of flame to tube • same form / state of division of solid e.g. "all powders"	ACCEPT: • same amount of limewater • same temperature / Bunsen setting • same mass of solid	max 2
			Total: 6

Question number	Answer	Notes	Marks
5 (a)	compounds / substances containing hydrogen and carbon <u>only</u>	DO NOT ACCEPT atoms/elements in place of compounds/substances	2
(b) (i)	refinery gases		1
(ii)	bitumen		1
(c)	An explanation linking any **four** of the following: • crude oil / vapour rises through the (fractionating) column • idea of temperature gradient in column e.g. hotter at the bottom than the top • different fractions have different boiling point • condense when they get to part of the column that has lower temperature than their boiling point • vapour passes through bubble caps / one-way valves OR idea that liquid fractions cannot trickle back down because of bubble caps	ALLOW vaporising point / condensing temperature	max 4
			Total: 8

Question number	Answer	Notes	Marks
6 (a) (i)	 but-2-ene	1 mark for formula 1 mark for name	2
(ii)	no double bond / saturated		1
(iii)	cyclobutane: no change / remains orange but-1-ene: (bromine) turns (from orange to) colourless / decolourised	 IGNORE starting colour of bromine	2
(b)	An explanation linking the following points: • crude oil contains too many long chain hydrocarbons • which are economically less useful / need converting to more economically useful smaller hydrocarbons	ACCEPT • alkenes need in polymer industry • to make useful plastics	2
(c) (i)	$C_{10}H_{22} \rightarrow C_8H_{18} + C_2H_4$ 1 mark for correct formula for alkane 1 mark for balanced equation	ALLOW equations which finish: $\rightarrow C_6H_{14} + 2C_2H_4$ $\rightarrow C_4H_{10} + 3C_2H_4$ $\rightarrow C_2H_6 + 4C_2H_4$	2
(ii)	An explanation linking the following points: • toxic / poisonous • (because) it restricts blood carrying oxygen	ACCEPT comments about binding to haemoglobin / forming carboxyhaemoglobin	2
			Total: 11

Question number	Answer	Notes	Marks
7 (a)	An explanation linking the following points: • green colour spreads throughout liquid • (because of) diffusion	ACCEPT dark green at bottom and light green at top	2
(b)	Anode = copper Cathode = chlorine	Award 1 mark for both correct products, but at incorrect electrodes	2
(c)	$2Cl^- \rightarrow Cl_2 + 2e$ 1 mark for correct species 1 mark for balance	ALLOW $2Cl^- - 2e \rightarrow Cl_2$	2
			Total: 6

Question number	Answer	Notes	Marks
8 (a)	extra decimal place / trailing zero / to 0.01 g		1
(b)	$Mg + CuSO_4 \rightarrow MgSO_4 + Cu$	1 mark for reactants 1 mark for products	2
(c) (i)	gains (two) electrons		1
(ii)	reduction		1
(iii)	Any **two** from: • (blue) colour of solution fades /solution turns colourless • brown/pink/pink(y)-brown solid forms • gets warm/hot	NOT solution turns clear ALLOW precipitate ALLOW fizzing / bubbles	max 2
			Total: 7

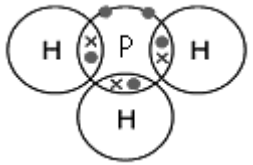
Question number	Answer	Notes	Marks
9 (a) (i)	2 (cm^3)		1
(ii)	An explanation linking the following points: • reaction rate slows down • (because there are) fewer **hydrogen peroxide** particles • (therefore) less **frequent** collisions/fewer collisions **per second**	ACCEPT hydrogen peroxide is less concentrated	3
(iii)	35 (minutes)	ACCEPT any number **between** 30 and 35	1
(b)	catalyst		1
(c) (i)	C		1
(ii)	E		1
(iii)	A		1
			Total: 9

Question number	Answer	Notes	Marks
10 (a)	An explanation linking the following points: • more precipitate as more lead(II) nitrate present (to react with potassium iodide) • but eventually all potassium iodide used up / lead(II) nitrate becomes in excess / the reaction finishes		2
(b) (i)	correct point circled (at 12cm^3 of lead(II) nitrate added)	ACCEPT any way in which this point is indicated	1
(ii)	Any **two** of the following pairs of statements: • not left long enough • therefore precipitate / solid not fully settled **OR** • too much potassium iodide added • so more precipitate made **OR** • tube not vertical when precipitate was settling • so precipitate not level in the tube	ACCEPT reasonable alternatives, as long as they explain why the height is **too high**	max 4
(c) (i)	1.5 ± 0.1 (cm)	ACCEPT 0.8 cm (for candidates who use their own ruler)	1
(ii)	3.7 – 3.8 (cm^3)	ALLOW consequential on answer to (c)(i)	1
			Total: 9

Question number	Answer	Notes	Marks
11 (a)	An explanation linking the following points: • 8 electrons in **outer(most)** shell • does not **easily/readily** gain or lose electrons	ACCEPT full **outer(most)** shell ACCEPT argument based on energy required	2
(b)	8 electrons in middle shell 7 electrons in outer shell	ACCEPT dots, circles, crosses or e to represent electrons	2
(c) (i)	$2(I^-)$ and $2\ Cl^- + I_2$	1 mark – correct formulae 1 mark – correct balancing	2
(ii)	displacement / redox	ACCEPT oxidation **and** reduction	1
(iii)	iodine (formed, and it is brown in solution)	I_2	1
(d)	calculation of % O = 45.1 dividing by A_r values: Na 21.6/23 Cl = 33.3/35.5 O = 45.1/16 simplest whole number ratio = 1:1:3 translating this ratio to a formula = $NaClO_3$	If division by atomic number, neither 2nd nor 3rd mark can be scored – although 4th mark can (probably $NaClO_3$ or $Na_8Cl_8O_{23}$) Final answer consequential on slips in calculation above	4
			Total: 12

Question number	Answer	Notes	Marks
12 (a)	An explanation linking the following points: • reaction rate is faster • (therefore) counting bubbles is more difficult / bubbles may form continuous stream	ACCEPT: • bubbles may be different size • so not valid / poor comparison with first experiment	2
(b)	A description linking the following points: • measure the volume of gas produced • using a graduated test-tube / gas syringe / inverted measuring cylinder	ACCEPT: answers which lead to decreased rate to allow bubble counting to work e.g. • reduced concentration of acid / larger pieces of zinc • to slow rate / make bubbles smaller	2
(c)	measure the boiling point / freezing point 100°C / 0°C	boils at 100°C OR freezes at 0°C are worth 2 marks	2
(d)	any named **gas** that burns in oxygen to form water as a product e.g. methane, ethane	ACCEPT correct formula for gas	1
			Total: 7

Question number	Answer	Notes	Marks
13 (a)	to speed up the reaction **OR** to allow a lower temperature to be used but still have a reasonably / acceptably fast reaction	ACCEPT to lower the activation energy / achieve a better balance of yield and rate	1
(b)	forward and reverse reactions **are** occurring at same rate/speed	ACCEPT amounts of reactants / products / macroscopic properties remain constant	2
(c)	An explanation linking **four** of the following points: • increased pressure favours forward reaction / increases yield • increased pressure also increases rate • decreased temperature favours forward reaction / increases yield • decreased temperature decreases rate • concluding comment e.g. greater yield, but probably at reduced rate / increase in rate due to pressure cancels decrease in rate due to temperature change **Concluding comment must be present to score full 4 marks, but can be agreement or disagreement with scientist's idea.**	ACCEPT moves equilibrium to right ACCEPT moves equilibrium to right ACCEPT good idea but increased pressure increases cost	max 4
(d) (i)	An explanation linking the following points: • ammonia has low boiling point / liquefies • (therefore) mixture is cooled		2
(ii)	recirculated / recycled / re-used / returned to reaction chamber / used to make more ammonia		1
(e)	$NH_3 + HNO_3 \rightarrow NH_4NO_3$		1
(f)	A description linking the following points: • add aqueous sodium hydroxide (and warm) • gas / ammonia (given off) • turns (damp) red litmus blue	ACCEPT forms white smoke with HCl	3
			Total: 14

Question number	Answer	Notes	Marks
14 (a) (i)	P^{3-}	ACCEPT P^{-3}	1
(ii)	An explanation linking the following points: • ions are not free to move in solid (IGNORE ref to electrons) • (however) ions are free to move when molten	REJECT any mention of electron movement	2
(b)	(65 × 3) + (31 × 2) = 257	Award 1 mark for correct use of Mr of Zn and P	2
(c) (i)	• moles phosphine = 51400 / 257 • moles water = moles phosphine × 6 • mass water = moles water × 18 = 21600 g / 21.6 kg **OR** • 6 × 18 = 108 • 257 / 108 = 51.4 / mass water • mass water = 21.6 kg	Mark consequentially on (b) ACCEPT answer in g or kg, as long as unit matches value	3
(ii)	low / small		1
(iii)	exothermic, because it burst into flames	NOT just 'exothermic'	1
(d) (i)		1 mark for 3 bonding pairs 1 mark for non-bonding pair	2
(ii)	An explanation linking any **two** of the following points: • small molecules • weak (attractive) forces between molecules • (therefore) little energy required to overcome forces / separate molecules	ACCEPT "weak bonds", but not "weak covalent bonds"	max 2
			Total: 14

Write your name here

Surname	Other names

Edexcel
International GCSE

Centre Number | | | | | |

Candidate Number | | | | |

Chemistry

Paper: 2C

Sample Assessment Material
Time: 1 hour

Paper Reference
4CH0/2C

You must have:
Ruler
Candidates may use a calculator

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided
  – *there may be more space than you need.*
- Show all the steps in any calculations and state the units.

Information

- The total mark for this paper is 60.
- The marks for **each** question are shown in brackets
  – *use this as a guide as to how much time to spend on each question.*

Advice

- Read each question carefully before you start to answer it.
- Keep an eye on the time.
- Write your answers neatly and in good English.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ▶

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S 4 1 6 4 7 A 0 1 1 5

PEARSON

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 Lanthanides (atomic numbers 58-71) and the Actinides(atomic numbers 90-103) have been omitted.***

Cu and Cl have not been rounded to the nearest whole number.

Answer ALL questions.

1 Lithium sulfate (Li_2SO_4) is used in some medicines. The presence of lithium sulfate in a medicine can be shown by two tests.

(a) A flame test can be used to show that the medicine contains lithium ions.

State the colour that lithium ions produce in a flame.

(1)

.....

(b) A sample of a medicine containing lithium sulfate is dissolved in water.

(i) Describe how you would test the solution for the presence of sulfate ions.

(3)

.....

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.....

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.....

.....

(ii) Write a chemical equation for the reaction occurring in (b)(i).

(2)

.....

(Total for Question 1 = 6 marks)

2 Ethanol can be manufactured by two different methods. The table gives some information about these two methods.

	Raw material	Quality of ethanol produced
Method **A**	crude oil	pure
Method **B**	sugar cane	impure

(a) In method **A**, ethanol is formed in the final step.

(i) Identify the **two** compounds that react together to form ethanol.

(2)

..... and .....

(ii) State **two** conditions used in this reaction.

(2)

.....

.....

(b) The equation for the reaction that occurs in method **B** is

$$C_6H_{12}O_6 \rightarrow 2C_2H_5OH + 2CO_2$$

(i) Name the compound with the formula $C_6H_{12}O_6$.

(1)

.....

(ii) Identify the main impurity in the ethanol formed in this reaction.

(1)

.....

.....

(c) Some of the ethanol produced by method **B** is converted into ethene by heating it with a catalyst.

(i) Name the catalyst used in this reaction.

(1)

.....

(ii) Name the type of reaction.

(1)

.....

(iii) Write the chemical equation for this reaction.

(1)

.....

(d) Some of the ethanol produced by method **B** is used as a fuel. Balance the chemical equation for the complete combustion of ethanol.

(1)

C_2H_5OH + ...O_2 → .....CO_2 + ...H_2O

(Total for Question 2 = 10 marks)

3 Margaret goes on holiday to the seaside.

She notices some iron railings on the beach that are often in contact with the seawater. They are very rusty.

The iron railings in front of her hotel, some distance from the sea, are much less rusty.

Margaret predicts that seawater makes iron rust faster than rain water.

(a) Describe an experiment that Margaret could carry out to test her prediction.

(5)

(b) Why is rusting described as an oxidation reaction?

(1)

(Total for Question 3 = 6 marks)

4 The gas hydrogen chloride, HCl, dissolves in water. The solution in water turns blue litmus paper red.

(a) (i) This solution of hydrogen chloride in water contains two ions.

Give the **formula** of each ion.

(2)

..... and .....

(ii) What is the name given to a solution of hydrogen chloride in water?

(1)

(b) Hydrogen chloride gas also dissolves in methylbenzene. This solution has no effect on blue litmus paper.

A student sets up two test tubes, one containing a solution of hydrogen chloride in water and the other containing a solution of hydrogen chloride in methylbenzene.

He adds a piece of magnesium ribbon to each test tube.

Compare the results that he would observe in both test tubes.

(3)

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(Total for Question 4 = 6 marks)

5 Polymers can be classified as addition polymers or condensation polymers.

(a) An addition polymer can be formed from the monomer C_3H_6

(i) Name this monomer and the addition polymer it forms.

(1)

Monomer .....

Polymer .....

(ii) Explain why there are problems with the disposal of addition polymers.

(2)

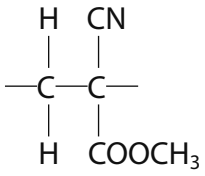
.....

.....

.....

.....

(b) Superglues are liquid adhesives that easily form addition polymers, giving a solid that sticks objects together firmly. The repeat unit of a superglue polymer is shown below.



Draw the structure of the monomer used to make this polymer.

(1)

(c) Nylon is an example of a condensation polymer.

Describe one difference between a condensation polymer and an addition polymer.

(2)

.....

.....

.....

.....

(Total for Question 5 = 6 marks)

6 Potassium chloride is a soluble salt. It can be prepared by reacting together solutions of potassium hydroxide and hydrochloric acid.

(a) A student did a titration to find the volume of hydrochloric acid needed to react with 25.0 cm^3 of potassium hydroxide solution, KOH.

Exactly 25.0 cm^3 of potassium hydroxide solution and a few drops of methyl orange indicator were added to a conical flask.

Hydrochloric acid was then added until a colour change was seen.

(i) State the type of reaction occurring between potassium hydroxide and hydrochloric acid.

(1)

.....

(ii) Write a chemical equation for this reaction.

(1)

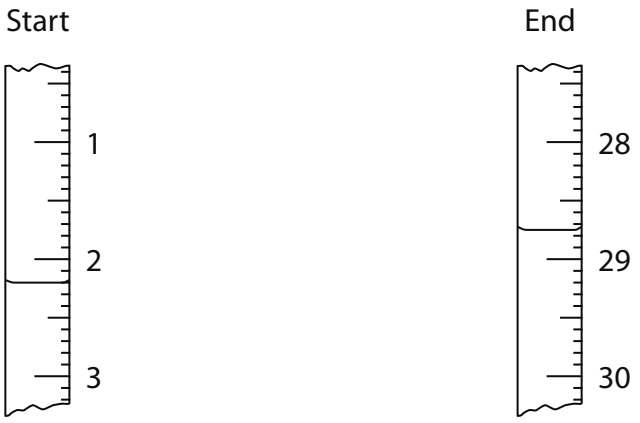
.....

(iii) State the final colour of methyl orange in the titration.

(1)

.....

(iv) The diagrams show the readings on the burette at the start and at the end of a titration.



Use these diagrams to complete the table, entering all values to the nearest 0.05 cm^3.

(3)

Burette reading at end in cm^3	
Burette reading at start in cm^3	
Volume of acid added in cm^3	

(b) Another student did the titration and recorded these results.

Burette reading at end in cm^3	27.35	28.50	27.30	29.15
Burette reading at start in cm^3	0.20	1.80	1.20	2.65
Volume of acid added in cm^3	27.15	26.70	26.10	26.50
Titration results to be used (✓)				

(i) Concordant results are those that differ from each other by 0.20 cm^3 or less.

Identify the concordant results by placing ticks (✓) in the table as shown.

(1)

(ii) Use your ticked results to calculate the average volume of acid added.

(2)

Average volume = ... cm^3

(c) A student was asked to suggest a method of obtaining pure, dry crystals of potassium chloride from the dilute solution of potassium chloride formed in the titration.

This is her suggested method.

- Pour the neutral potassium chloride solution from the conical flask into an evaporating basin.
- Heat the solution until it has been bubbling for a few minutes.
- Stop heating and leave it until crystals start to form.
- Pour the liquid away so the crystals are left behind.
- Scrape the crystals onto some blotting paper and to dry them.

Identify **two** problems with the student's method. For each problem, suggest an improvement to the method to overcome the problem.

You may assume that the student is working safely.

(4)

Problem 1.....

.....

.....

Improvement.....

.....

.....

.....

.....

Problem 2.....

.....

.....

Improvement.....

.....

.....

.....

.....

(d) In another titration, some potassium hydroxide solution was neutralised by sulfuric acid. The equation for the reaction is

$$2KOH + H_2SO_4 \rightarrow K_2SO_4 + 2H_2O$$

A 25.0 cm^3 sample of 0.200 mol/dm^3 potassium hydroxide was neutralised by 28.40 cm^3 of sulfuric acid.

(i) Calculate the amount, in moles, of potassium hydroxide used.

(2)

(ii) Calculate the amount, in moles, of sulfuric acid used.

(1)

(iii) Calculate the concentration, in mol/dm^3, of the sulfuric acid.

(2)

(Total for Question 6 = 18 marks)

7 Lansfordite is the common name for a form of hydrated magnesium carbonate, $MgCO_3.xH_2O$.

This formula shows that lansfordite contains water of crystallisation. When a sample of lansfordite is heated gently, the water of crystallisation is given off and eventually anhydrous magnesium carbonate is left.

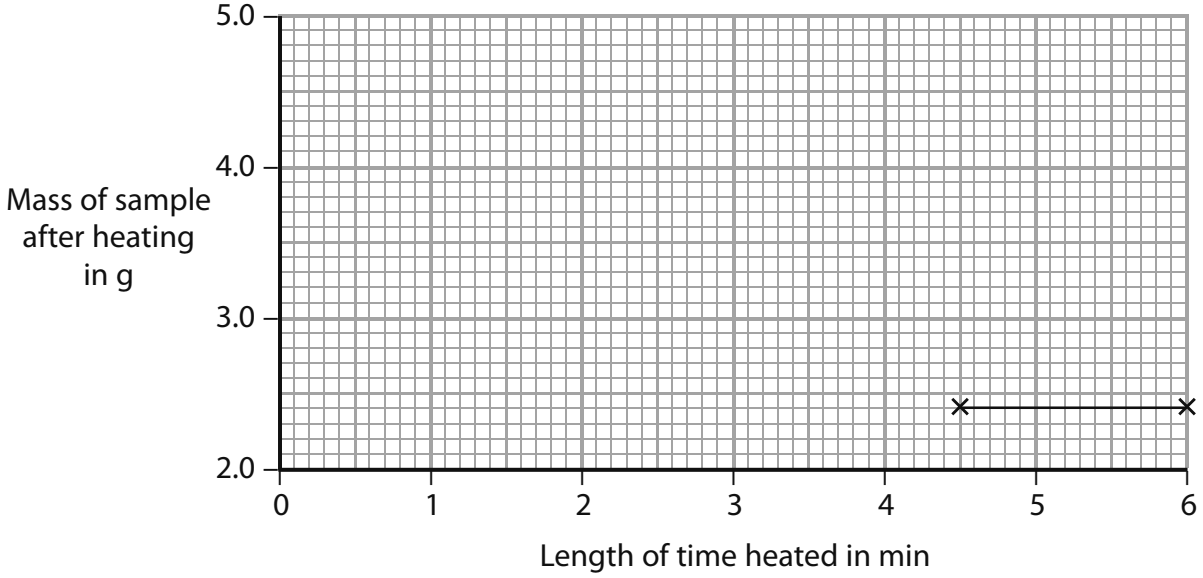
A teacher gave 5.0 g samples of powdered lansfordite to some students and told each student to heat the sample, then to let it cool and reweigh it.

The students heated the samples for different times. The teacher recorded their results in a table.

Length of time heated in min	0.0	1.0	3.0	3.5	4.0	4.5	6.0
Mass of sample after heating in g	5.0	4.4	3.3	3.0	2.7	2.4	2.4

(a) Plot a graph of these results on the grid. The last two results have been plotted for you.

Draw a straight line of best fit through the points you have plotted.



(3)

(b) Use your graph to predict the mass of a sample after heating for 2.0 minutes.

(1)

(c) Suggest why the masses of the samples after heating for 4.5 minutes and after heating for 6.0 minutes were the same.

(1)

.....

.....

(d) The teacher told one of the students that the amount of hydrated salt in a sample of lansfordite was 0.030 mol, and that the amount of water lost on heating was 0.15 mol.

Calculate the value of x in the formula $MgCO_3.xH_2O$

(1)

(e) When anhydrous magnesium carbonate is heated strongly it decomposes. The equation for the reaction is:

$$MgCO_3(s) \rightarrow MgO(s) + CO_2(g)$$

Calculate the volume, in dm^3, of carbon dioxide formed when 0.030 mol of anhydrous magnesium carbonate is completely decomposed.

(You may assume that the molar volume of a gas is 24 dm^3)

(2)

(Total for Question 7 = 8 marks)

TOTAL FOR PAPER = 60 MARKS

Sample Mark Scheme

Paper 2C

Question number	Answer	Notes	Marks
1 (a)	red	IGNORE qualifiers such as pale / dark NOT 'brick red'	1
(b) (i)	barium chloride / barium nitrate (solution) (dilute) hydrochloric acid / nitric acid white precipitate	ACCEPT correct formulae ACCEPT solid / suspension / ppt(e)	3
(ii)	$BaCl_2 + Li_2SO_4 \rightarrow BaSO_4 + 2LiCl$	ACCEPT correct ionic equation 1 mark for formula of $BaSO_4$ 1 mark for rest of equation	2
			Total: 6

Question number	Answer	Notes	Marks
2 (a) (i)	ethene / C_2H_4 water / steam / H_2O	ACCEPT in either order	2
(ii)	Any **two** from: 300 °C (+/- 50 °C) 60 – 70 atm phosphoric acid (catalyst)		max 2
(b) (i)	glucose	NOT sugar	1
(ii)	water / H_2O		1
(c) (i)	aluminium oxide	ACCEPT porous pot / conc. sulfuric acid / conc. phosphoric acid	1
(ii)	dehydration		1
(iii)	$C_2H_5OH \rightarrow C_2H_4 + H_2O$		1
(d)	$3\ O_2$ **AND** $2\ CO_2$ **AND** $3H_2O$	ACCEPT multiples	1
			Total: 10

Question number	Answer	Notes	Marks
3 (a)	A description linking **five** of the following points: • set up tubes containing iron (nail) in rainwater and iron (nail) in seawater • control tube / tube with iron (nail) and no water • same mass of iron (nail) / same volume of water • leave tubes for same length of time / stated time interval • method to measure rusting e.g. colour change / mass change • repeat experiment / more than one set of tubes set up		max 5
(b)	involves gain / addition of oxygen	ACCEPT involves loss of electrons / increase in oxidation number	1
			Total: 6

Question number	Answer	Notes	Marks
4 (a) (i)	H^+ / H_3O^+ Cl^-	ACCEPT in either order	2
(ii)	hydrochloric acid		1
(b)	<u>hydrogen chloride in methylbenzene:</u> no reaction / no bubbles / magnesium does nothing <u>hydrogen chloride in water:</u> any **two** from: bubbles / fizzing / gas produced magnesium ribbon gets smaller / reacts away / disappears test tube becomes warm	NOTE candidates can only score full marks by giving observations for BOTH tubes NOT 'hydrogen produced' NOT 'magnesium dissolves'	max 3
			Total: 6

Question number	Answer	Notes	Marks
5 (a) (i)	monomer = propene / propylene **AND** polymer = poly(propene) / polypropylene	Both must be correct for 1 mark	1
(ii)	An explanation linking any **two** from: • not biodegradable • (because) they are inert • (because) they have strong C-C / C-H bonds		max 2
(b)	H CN | | C=C | | H $COOCH_3$	IGNORE the geometry of the molecule	1
(c)	Any valid comparison e.g. Addition: only one type of monomer reacts with itself Condensation: two different monomers **OR** Addition: only one product formed Condensation: forms another product / water / hydrogen chloride	ACCEPT: differences in properties e.g. Addition: inert Condensation: may be hydrolysed / broken down REJECT: comparison of uses	2
			Total: 6

Question number	Answer	Notes	Marks
6 (a) (i)	neutralisation	ACCEPT exothermic	1
(ii)	$KOH + HCl \rightarrow KCl + H_2O$		1
(iii)	orange	ACCEPT red	1
(iv)	28.75 2.20 26.55	NOT 2.2 3rd mark consequential on other two	3
(b) (i)	ticks under 26.70 and 26.50		1
(ii)	$\frac{26.70 + 26.50}{2}$ = 26.6(0)	consequential on ticked results 2nd mark consequential on 1st	2

(c)	Any **two** from the following: P: initial solution contaminated with indicator I: repeat titration / mix same volumes with no indicator / add charcoal and filter (to remove indicator) P: solution heated for too little / too long a time I: evaporate until crystallisation point / check solution with glass rod P: liquid poured off when crystals start to form I: leave to cool until crystallisation complete P: crystals lost when solution poured off I: filter / centrifuge / decant carefully to obtain crystals P: blotting paper may not dry crystals completely I: place crystals in (warm) oven to dry	In each case, 1 mark for identifying the problem; and 1 mark for a correct suggestion for that problem	max 4
(d) (i)	$\frac{0.200 \times 25.0}{1000}$ = 0.005(00)	2nd mark consequential on 1st IGNORE units	2
(ii)	0.0025	ACCEPT answer from (d)(i) ÷ 2	1
(iii)	$\frac{0.0025 \times 1000}{28.4}$ = 0.088(0)	2nd mark consequential on 1st IGNORE units and sig figs ACCEPT correct answer from incorrect (d)(ii)	2
			Total: 18

Question number	Answer	Notes	Marks
7 (a)	all points plotted correctly to nearest gridline straight line through first 5 points	Deduct 1 mark for each error	2 1
(b)	Answer in range 3.8 - 3.9 (g)	Consequential on candidate's line Units not needed, but do not award mark if incorrect units given	1
(c)	all water lost / same amount of water lost	ACCEPT reactions/decompositions complete	1
(d)	5		1
(e)	24 × 0.03(0) = 0.72 (dm^3)	Units not needed, but award max 1 if incorrect units	2
			Total: 8