

Please check the examination details below before entering your candidate information

Candidate surname					Other names			
<b>Pearson Edexcel</b>		Centre Number			Candidate Number			
<b>International GCSE</b>		<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>			<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>			
<b>Wednesday 9 January 2019</b>								
Morning (Time: 2 hours)					Paper Reference <b>4CH0/1C</b> <b>4SC0/1C</b>			
<b>Chemistry</b> <b>Unit: 4CH0</b> <b>Science (Double Award) 4SC0</b> <b>Paper: 1C</b>								
<b>You must have:</b> Calculator, ruler							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.
- 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 .

### 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.
- 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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THE PERIODIC TABLE

Period 1 2 3 4 5 6 7 0 Group

Period

1	1	2	3	4	5	6	7	0																								
1	1	2	3	4	5	6	7	0																								
2	7 Li Lithium 3	9 Be Beryllium 4	11 Na Sodium 11	12 Mg Magnesium 12	13 Al Aluminium 13	14 Si Silicon 14	15 P Phosphorus 15	16 S Sulfur 16	17 Cl Chlorine 17	18 Ar Argon 18																						
3	19 K Potassium 19	20 Ca Calcium 20	23 Sc Scandium 21	24 Ti Titanium 22	25 V Vanadium 23	26 Cr Chromium 24	27 Mn Manganese 25	28 Fe Iron 26	29 Co Cobalt 27	30 Ni Nickel 28	31 Cu Copper 29	32 Zn Zinc 30	33 Ga Gallium 31	34 Ge Germanium 32	35 As Arsenic 33	36 Se Selenium 34	37 Br Bromine 35	38 Kr Krypton 36														
4	37 Rb Rubidium 37	38 Sr Strontium 38	39 Y Yttrium 39	40 Zr Zirconium 40	41 Nb Niobium 41	42 Mo Molybdenum 42	43 Tc Technetium 43	44 Ru Ruthenium 44	45 Rh Rhodium 45	46 Pd Palladium 46	47 Ag Silver 47	48 Cd Cadmium 48	49 In Indium 49	50 Sn Tin 50	51 Sb Antimony 51	52 Te Tellurium 52	53 I Iodine 53	54 Xe Xenon 54														
5	55 Cs Caesium 55	56 Ba Barium 56	57 La Lanthanum 57	58 Ce Cerium 58	59 Pr Praseodymium 59	60 Nd Neodymium 60	61 Pm Promethium 61	62 Sm Samarium 62	63 Eu Europium 63	64 Gd Gadolinium 64	65 Tb Terbium 65	66 Dy Dysprosium 66	67 Ho Holmium 67	68 Er Erbium 68	69 Tm Thulium 69	70 Yb Ytterbium 70	71 Lu Lutetium 71	72 Hf Hafnium 72	73 Ta Tantalum 73	74 W Tungsten 74	75 Re Rhenium 75	76 Os Osmium 76	77 Ir Iridium 77	78 Pt Platinum 78	79 Au Gold 79	80 Hg Mercury 80	81 Tl Thallium 81	82 Pb Lead 82	83 Bi Bismuth 83	84 Po Polonium 84	85 At Astatine 85	86 Rn Radon 86
6	87 Fr Francium 87	88 Ra Radium 88	89 Ac Actinium 89	90 Th Thorium 90	91 Pa Protactinium 91	92 U Uranium 92	93 Np Neptunium 93	94 Pu Plutonium 94	95 Am Americium 95	96 Cm Curium 96	97 Bk Berkelium 97	98 Cf Californium 98	99 Es Einsteinium 99	100 Fm Fermium 100	101 Md Mendelevium 101	102 No Nobelium 102	103 Lr Lawrencium 103	104 Rf Rutherfordium 104	105 Db Dubnium 105	106 Sg Seaborgium 106	107 Bh Bohrium 107	108 Hs Hassium 108	109 Mt Meitnerium 109	110 Ds Darmstadtium 110	111 Rg Roentgenium 111	112 Cn Copernicium 112	113 Nh Nihonium 113	114 Fl Flerovium 114	115 Mc Moscovium 115	116 Lv Livermorium 116	117 Ts Tennessine 117	118 Og Oganesson 118

1	H Hydrogen 1
---	--------------------

4	He Helium 2
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Key

Relative atomic mass
Symbol
Name
Atomic number

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**Answer ALL questions.**

- 1** The three states of matter are solid, liquid and gas.  
 (a) Substances can be changed from one state to another.

The box lists some words relating to changes of state.

condensing	cooling	evaporation
heating	melting	sublimation

Complete the table by giving the correct word from the box for each change of state.

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

(3)

Change of state	Name of change
from solid to liquid	
from liquid to gas	
from solid to gas	

- (b) The particles in a solid are closely packed, arranged in a regular pattern and vibrate about a fixed position.

Describe the arrangement and movement of the particles in a gas.

(3)

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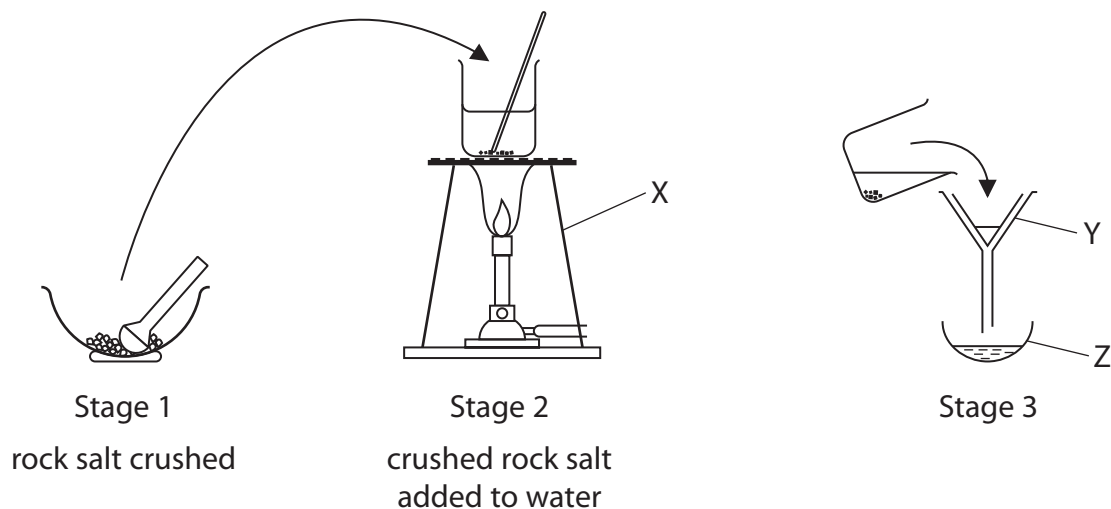
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**(Total for Question 1 = 6 marks)**



2 Rock salt is a mixture of the soluble salt, sodium chloride, and some insoluble impurities.

The diagram shows the first three stages of a method used to obtain pure sodium chloride from rock salt.



(a) Name the pieces of apparatus labelled X, Y and Z

(3)

X .....

Y .....

Z .....

(b) (i) State why the mixture of rock salt and water is warmed and stirred in stage 2.

(2)

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.....

.....

(ii) What is water in stage 2?

(1)

- A a residue
- B a solute
- C a solution
- D a solvent

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(c) (i) Explain what happens to the impurities in stage 3.

(2)

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(ii) What is the liquid collected at the end of stage 3?

(1)

- A a residue
- B a solute
- C a solution
- D a solvent

**(Total for Question 2 = 9 marks)**

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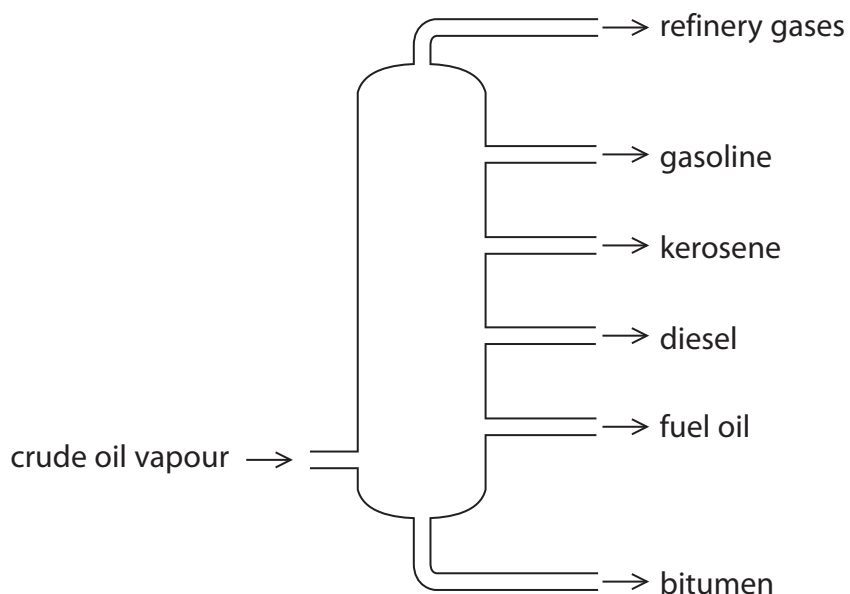
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3 Crude oil is a mixture of hydrocarbons.

(a) The diagram shows a column used in the industrial process to separate crude oil.



(i) Name the industrial process used to separate crude oil.

(1)

(ii) State a use for kerosene and a use for bitumen.

(2)

kerosene .....

bitumen .....



(b) A molecule of the hydrocarbon eicosane has the formula  $C_{20}H_{42}$

(i) Explain which homologous series eicosane belongs to.

(2)

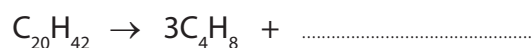
(ii) Name a catalyst used in the industrial cracking of eicosane.

(1)

(iii) In a possible reaction for the cracking of eicosane, the products are three molecules of  $C_4H_8$  and one molecule of another hydrocarbon.

Complete the equation for this reaction.

(1)



(c) Hydrocarbons can be saturated or unsaturated.

(i) Explain what is meant by the term **hydrocarbon**.

(2)

(ii) State what is meant by a hydrocarbon being saturated.

(1)



(iii) Describe a chemical test used to distinguish between unsaturated and saturated hydrocarbons.

(3)

test .....

results .....

.....

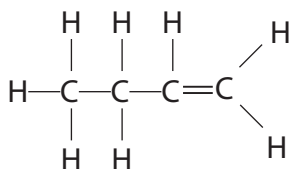
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(d) The unsaturated hydrocarbon  $C_4H_8$  has several isomers.

The displayed formula for one of these isomers is



(i) Name this isomer.

(1)

(ii) Draw the displayed formula of another isomer of  $C_4H_8$

(1)

**(Total for Question 3 = 15 marks)**



4 (a) (i) Explain what is meant by the term **covalent bonding**.

(2)

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(ii) Draw a dot and cross diagram to show the bonding in a molecule of ethene,  $C_2H_4$   
Show only the outer electrons.

(2)

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(b) Substances A and B are covalently bonded and have simple molecular structures.

The table gives the boiling points for substances A and B.

Substance	Boiling point in °C
A	-42
B	-0.5



- (i) Explain why substances with simple molecular structures have low boiling points. (2)

- (ii) Suggest why the boiling point of B is higher than the boiling point of A. (1)

- (iii) Substance B has the empirical formula  $C_2H_5$  and an  $M_r$  value of 58.  
Determine the molecular formula of substance B. (2)

- (c) Substance X is also covalently bonded, but its structure is different from that of A and B.  
It has a boiling point of  $2230^\circ C$ .

Explain, in terms of its structure, why X has such a high boiling point. (2)

(Total for Question 4 = 11 marks)



5 Hot, molten sulfur reacts with oxygen to form sulfur dioxide gas.

(a) Describe what is seen when a sample of hot, molten sulfur is lowered into a gas jar containing oxygen.

(1)

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(b) Sulfur dioxide gas is formed during the reaction between dilute hydrochloric acid and sodium sulfite,  $\text{Na}_2\text{SO}_3$

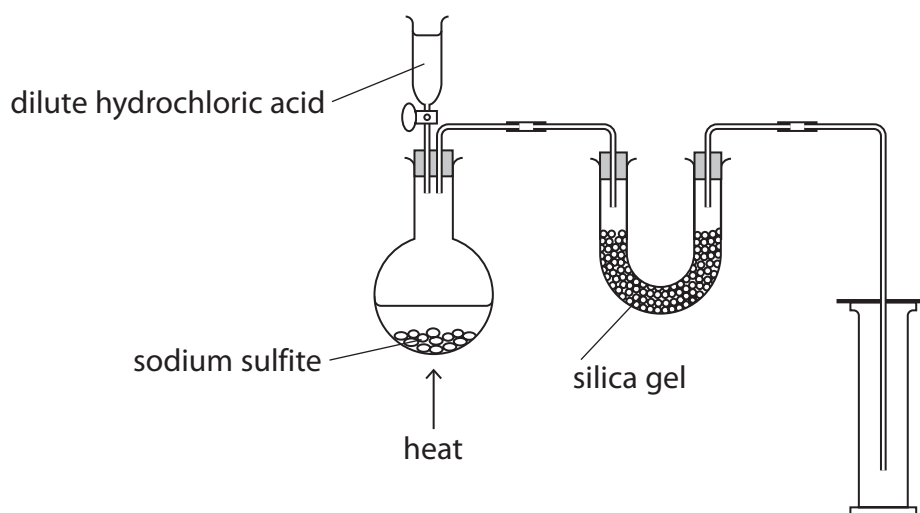
A salt and water are also formed.

Write a chemical equation for this reaction.

(2)

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(c) This apparatus can be used to collect a pure, dry sample of sulfur dioxide gas.



(i) Suggest the purpose of the silica gel.

(1)

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(ii) Name the method used in the diagram to collect the sulfur dioxide gas. (1)

(iii) State the physical property of sulfur dioxide gas that allows it to be collected in this way. (1)

(d) A sample of sulfur dioxide reacts with water to form an acidic solution.

(i) Identify the acid formed. (1)

(ii) A few drops of methyl orange indicator are added to this solution.  
State the colour of the indicator in this solution. (1)

(iii) Give the formula of the ion responsible for this colour. (1)

(iv) An alkali is then added to neutralise the acid.  
State the final colour of the indicator. (1)

**(Total for Question 5 = 10 marks)**

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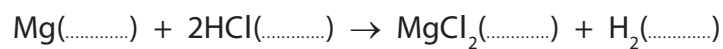
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6 A student investigates the rate of the reaction between magnesium ribbon and dilute hydrochloric acid. The products are magnesium chloride and hydrogen.

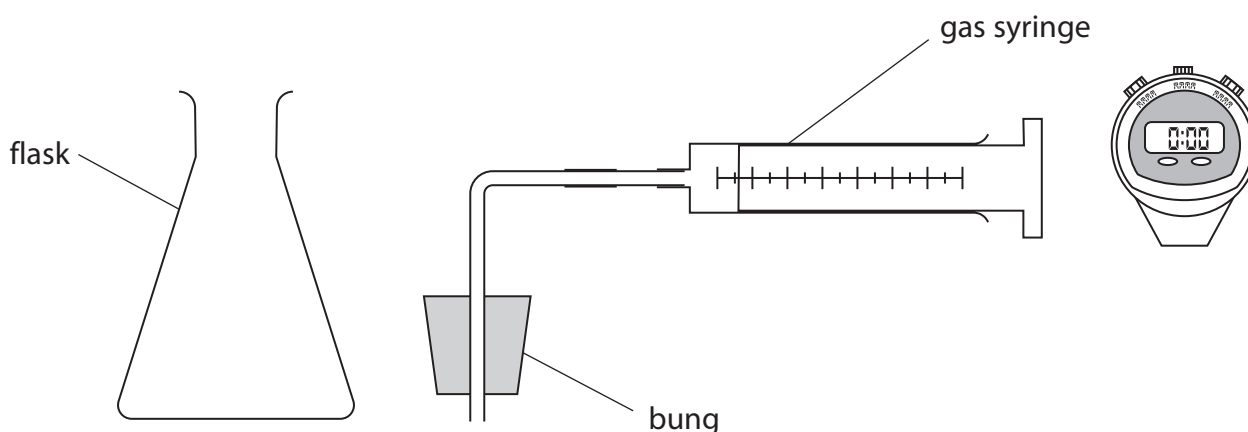
(a) The equation for the reaction is



Complete the equation by adding the state symbols.

(1)

(b) The student uses these pieces of apparatus in his experiment.



This is his method.

- clean a strip of magnesium ribbon to remove the oxide layer
- pour  $50 \text{ cm}^3$  of  $0.5 \text{ mol/dm}^3$  hydrochloric acid into the flask
- put the clean magnesium ribbon into the flask
- quickly put the bung into the flask to connect the gas syringe
- record the volume of gas in the syringe every minute for eight minutes

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(i) Suggest why the student cleans the magnesium ribbon to remove the oxide layer. (1)

(ii) Suggest why the student needs to put the bung into the flask quickly. (1)

(iii) Suggest when the student should start the stop watch. (1)

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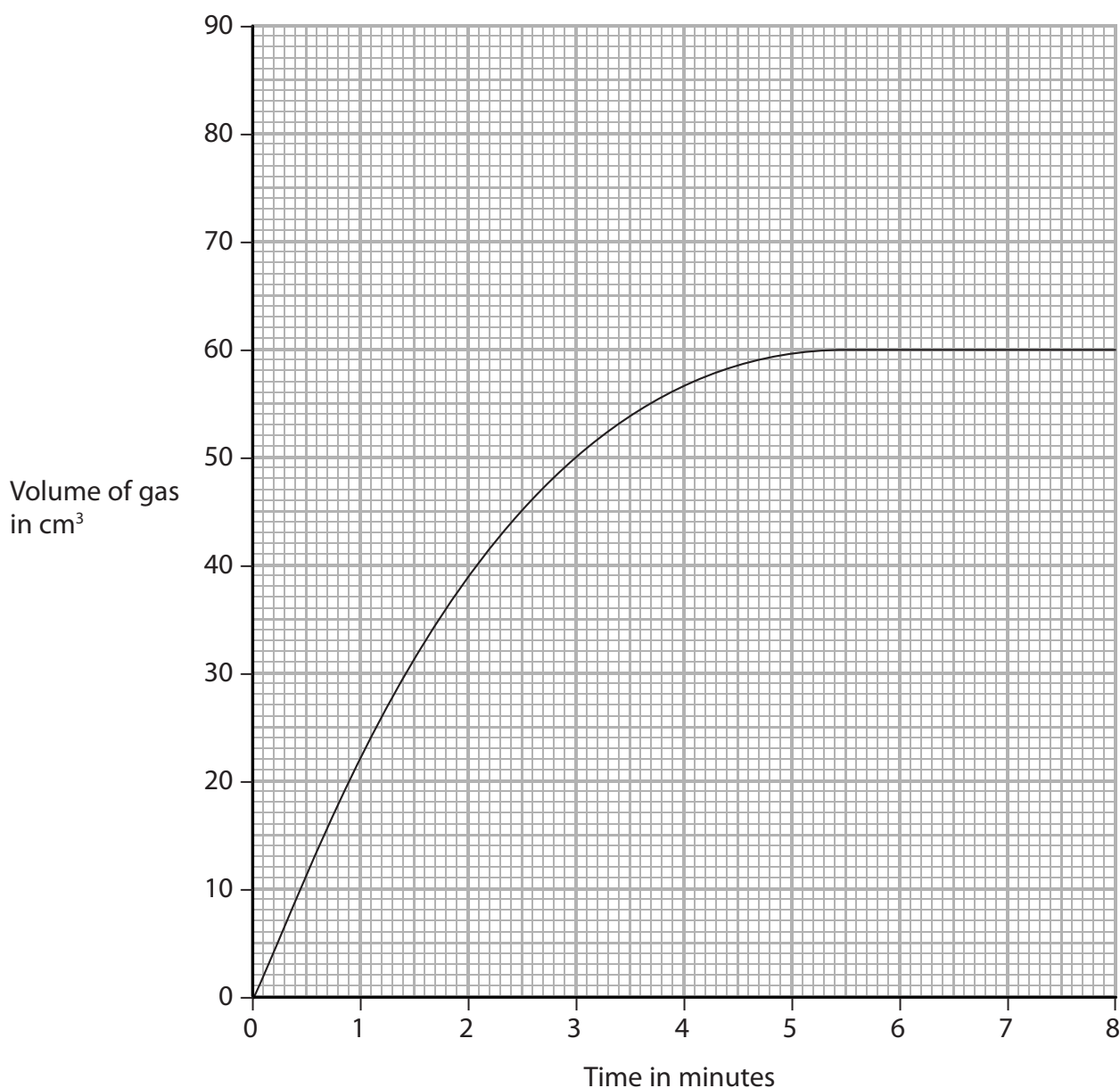


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(c) The graph shows the results of the student's experiment.



(i) Use the graph to find the volume of gas in the syringe at one minute.

Show on the graph how you obtained your answer.

(2)

volume = ..... cm<sup>3</sup>

(ii) Use the graph to find the time when the reaction stops.

(1)

time = ..... minutes



(iii) Suggest two possible reasons why the reaction stops.

(2)

1 .....

.....

2 .....

.....

(iv) Explain when the rate of reaction is greatest.

(2)

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(d) Explain how increasing the concentration of the hydrochloric acid affects the rate of the reaction with magnesium.

Refer to the particle collision theory in your answer.

(4)

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**(Total for Question 6 = 15 marks)**

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7 In the Periodic Table, the vertical columns of elements are called groups.

(a) The table gives some information about the first four elements in Group 0.

Element	Relative atomic mass ( $A_r$ )	Boiling point in $^{\circ}\text{C}$
helium	4	-269
neon	20	-246
argon	40	-186
krypton	84	-153

(i) State the relationship between the relative atomic mass and the boiling point of these elements.

(1)

(ii) State why the elements in Group 0 are unreactive.

(1)

(b) The elements in Group 7 of the Periodic Table are called halogens.

State why the halogens have similar chemical properties.

Refer to electronic configurations in your answer.

(1)

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(c) The order of reactivity of the halogens can be shown by using displacement reactions.

(i) When chlorine is added to sodium bromide solution, chlorine displaces bromine.

Write a chemical equation for this reaction.

(1)

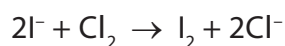
(ii) State the colour of the solution formed in this reaction.

(1)

(iii) Explain whether or not a reaction takes place when bromine water is added to sodium chloride solution.

(2)

(iv) The displacement reaction between potassium iodide and chlorine can be represented by the ionic equation



Explain why this is described as a redox reaction.

(2)



(d) Chlorine reacts with hydrogen to form hydrogen chloride gas.

(i) Write the chemical equation for this reaction.

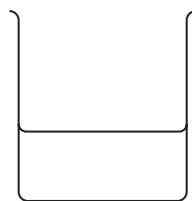
(1)

(ii) Some methylbenzene is poured into beaker A.

Some water is poured into beaker B.

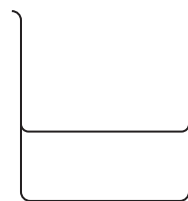
Hydrogen chloride gas is dissolved in each liquid.

A separate piece of dry blue litmus paper is dipped into each solution.



A

hydrogen chloride  
dissolved in methylbenzene



B

hydrogen chloride  
dissolved in water

Explain what happens to

- the piece of litmus paper dipped into beaker A
- the piece of litmus paper dipped into beaker B.

(4)

beaker A

beaker B

(Total for Question 7 = 14 marks)



- 8 The table shows information about the effect of adding sodium hydroxide solution to solutions containing zinc ions, calcium ions or aluminium ions.

Ion in solution	Effect of adding a few drops of sodium hydroxide solution	Effect of adding excess sodium hydroxide solution
zinc, $Zn^{2+}$	white precipitate forms	white precipitate disappears
calcium, $Ca^{2+}$	white precipitate forms	white precipitate remains
aluminium, $Al^{3+}$	white precipitate forms	white precipitate disappears

(a) A student is provided with a sample of a white solid.

- (i) The student dissolves some of the white solid in water and then adds a few drops of sodium hydroxide solution. A white precipitate forms.

She concludes that the sample contains calcium ions.

Explain whether the student's conclusion is valid.

(2)

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- (ii) Give a different test to show that the white solid contains calcium ions.

(2)

test .....

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result .....

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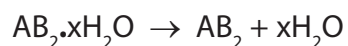
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(b) A hydrated salt has the formula  $AB_2 \cdot xH_2O$

A is a positive ion and B is a negative ion.

When the hydrated salt is heated, this reaction occurs.



A scientist heats a sample of the hydrated salt until all the water has been lost.

She records the mass of the salt before and after heating.

The table shows her results.

Mass of hydrated salt	Mass of salt after heating
6.1 g	5.2 g

(i) Describe how the scientist could make sure that all the water has been lost. (2)

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.....

.....

.....

(ii) Use the scientist's results to find the value of x in  $AB_2 \cdot xH_2O$   
 [ $M_r$  of  $AB_2 = 208$        $M_r$  of  $H_2O = 18$ ] (4)

x = .....



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- (c) Describe how the scientist could use a solution of the salt to find out if the negative ions are chloride ions.

(3)

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- (d) The test shows that the negative ions are chloride ions.

- (i) Calculate the relative atomic mass of metal A using the formula and  $M_r$  value of the anhydrous salt,  $AB_2$

(1)

relative atomic mass of A = .....

- (ii) Identify metal A.

(1)

.....

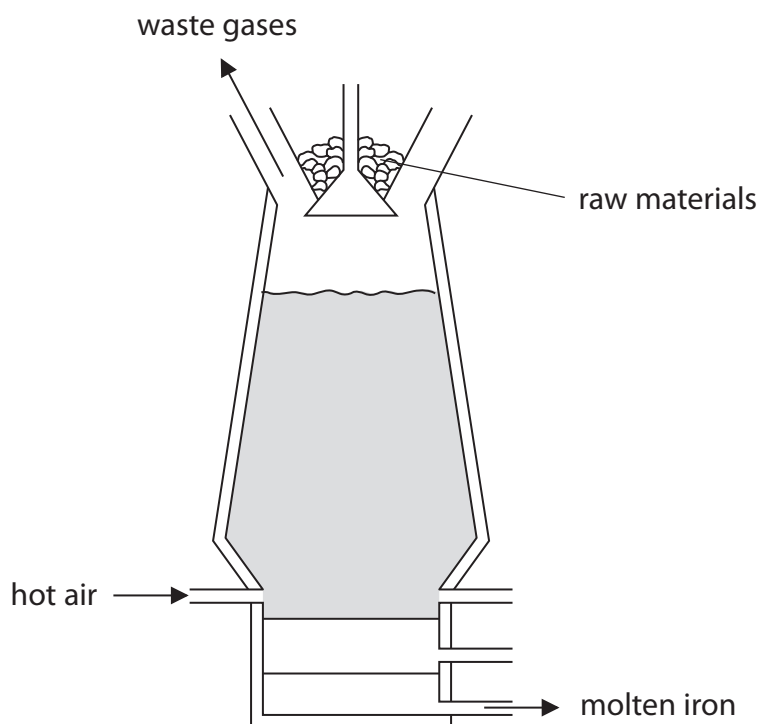
**(Total for Question 8 = 15 marks)**

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9 Some metals can be obtained by heating their oxides with carbon.

(a) The diagram shows a blast furnace used to produce iron from iron ore.



(i) Give the name of an iron ore.

(1)

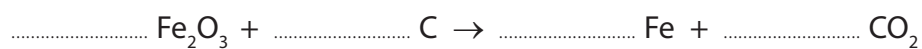
(ii) Explain the role of the hot air in the furnace.

(2)

(iii) Iron(III) oxide can be reduced by carbon.

Balance the equation for this reaction.

(1)



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(iv) Limestone is one of the raw materials added to the blast furnace.

Explain how limestone removes the impurity, silica ( $\text{SiO}_2$ ), from the furnace.

You may use equations to help your answer.

(3)

(b) (i) State why aluminium cannot be produced by heating its oxide with carbon.

(1)

(ii) Describe how aluminium is extracted from purified aluminium oxide.

(4)

(Total for Question 9 = 12 marks)



**10** A student does a titration to find the concentration of a solution of aqueous ammonia.

He uses this method.

- use a pipette to add 25.0 cm<sup>3</sup> samples of the solution into a conical flask
- add a few drops of indicator
- add sulfuric acid from a burette until the indicator changes colour permanently
- repeat the titration three more times

(a) (i) State what the student should do while adding the acid, to make sure that the indicator changes colour permanently.

(1)

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The table shows the student's titration results.

<b>Volume of acid added in cm<sup>3</sup></b>	23.40	23.15	22.95	23.10
<b>Concordant results</b>				

Concordant results are volumes within 0.20 cm<sup>3</sup> of each other.

(ii) Place ticks (✓) in the table to show which results are concordant.

(1)

(iii) Use the concordant results to calculate the average (mean) volume of acid added.

(2)

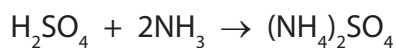
average volume ..... cm<sup>3</sup>



(b) The table shows the titration results of another student.

<b>Volume of aqueous ammonia used in cm<sup>3</sup></b>	25.0
<b>Concentration of sulfuric acid in mol/dm<sup>3</sup></b>	0.0800
<b>Average volume of sulfuric acid added from burette in cm<sup>3</sup></b>	22.70

The equation for the reaction is



(i) Calculate the amount, in moles, of  $\text{H}_2\text{SO}_4$  in 22.70 cm<sup>3</sup> of the sulfuric acid.

(2)

amount of  $\text{H}_2\text{SO}_4$  = ..... mol

(ii) Calculate the amount, in moles, of  $\text{NH}_3$  in the aqueous ammonia.

(1)

amount of  $\text{NH}_3$  = ..... mol

(iii) Calculate the concentration, in mol/dm<sup>3</sup>, of the aqueous ammonia.

(2)

concentration of aqueous ammonia = ..... mol/dm<sup>3</sup>

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(c) Describe how you could use the method of crystallisation to obtain a pure, dry sample of ammonium sulfate from a dilute solution of ammonium sulfate.

(4)

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**(Total for Question 10 = 13 marks)**

**TOTAL FOR PAPER = 120 MARKS**

