Please check the examination details below before entering your candidate information

Candidate surname	Other names

Pearson Edexcel International GCSE

Centre Number | | | | | |

Candidate Number | | | | |

Wednesday 9 January 2019

Morning (Time: 2 hours)

Paper Reference **4CH0/1C** **4SC0/1C**

Chemistry

Unit: 4CH0
Science (Double Award) 4SC0
Paper: 1C

You must have:
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 ▶

R55714A

1/1/1/1/1/1/

Pearson

THE PERIODIC TABLE

Period	Group 1	2											3	4	5	6	7	0
1							1 **H** Hydrogen 1											4 **He** Helium 2
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
3	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
4	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
5	86 **Rb** Rubidium 37	88 **Sr** Strontium 38	89 **Y** Yttrium 39	91 **Zr** Zirconium 40	93 **Nb** Niobium 41	96 **Mo** Molybdenum 42	99 **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
6	133 **Cs** Caesium 55	137 **Ba** Barium 56	139 **La** Lanthanum 57	179 **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	210 **Po** Polonium 84	210 **At** Astatine 85	222 **Rn** Radon 86
7	223 **Fr** Francium 87	226 **Ra** Radium 88	227 **Ac** Actinium 89															

Key

Relative atomic mass
Symbol
Name
Atomic number

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.

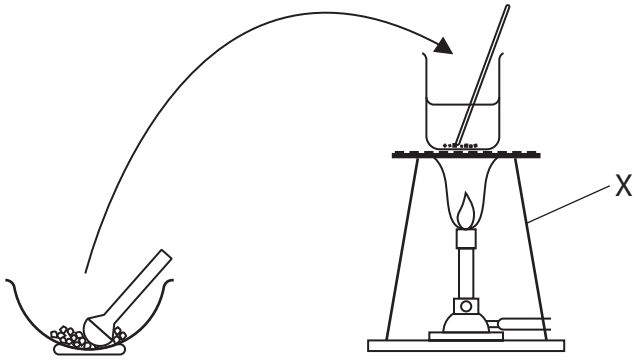
Describe the arrangement and movement of the particles in a gas.

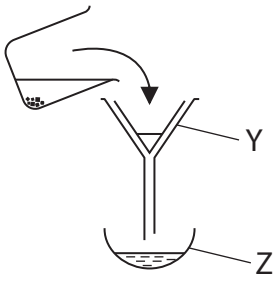
(3)

(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.





Stage 1
rock salt crushed

Stage 2
crushed rock salt added to water

Stage 3

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

(3)

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

(2)

(ii) What is water in stage 2?

(1)

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

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

(2)

(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)

DO NOT WRITE IN THIS AREA

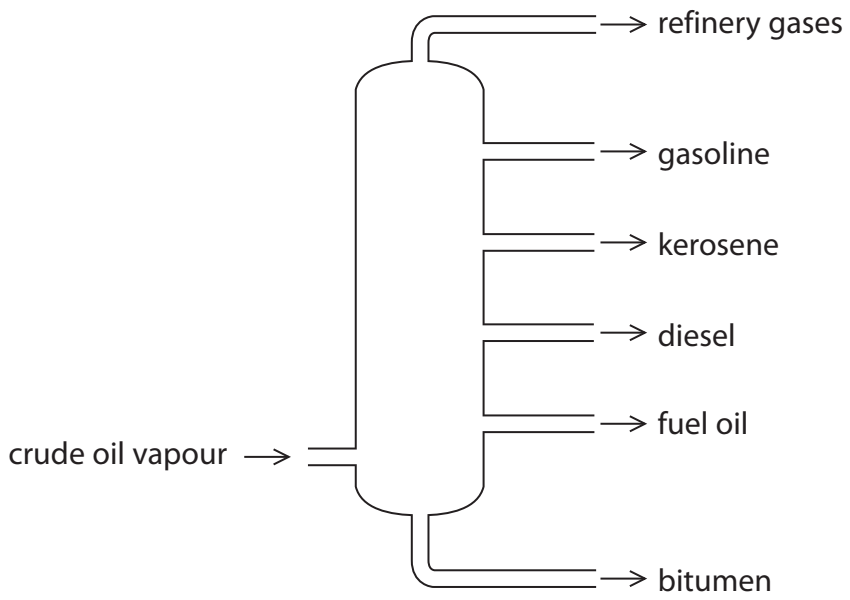
DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

BLANK PAGE

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)

(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)

$$C_{20}H_{42} \rightarrow 3C_4H_8 + \text{.....}$$

(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.

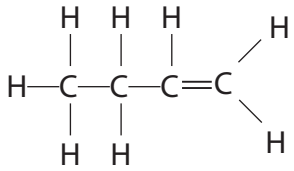
(3)

test

results

(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)

(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)

(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 °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)

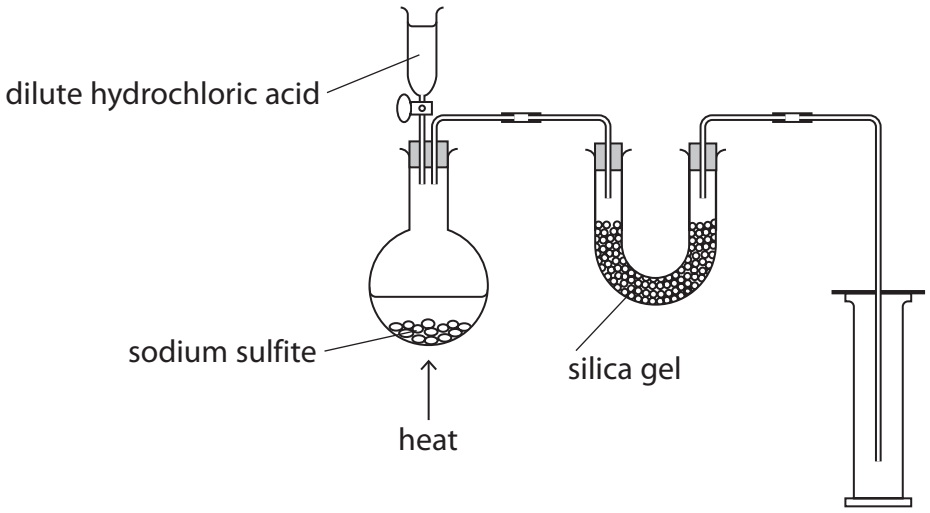
(b) Sulfur dioxide gas is formed during the reaction between dilute hydrochloric acid and sodium sulfite, Na_2SO_3

A salt and water are also formed.

Write a chemical equation for this reaction.

(2)

(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)

(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)

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

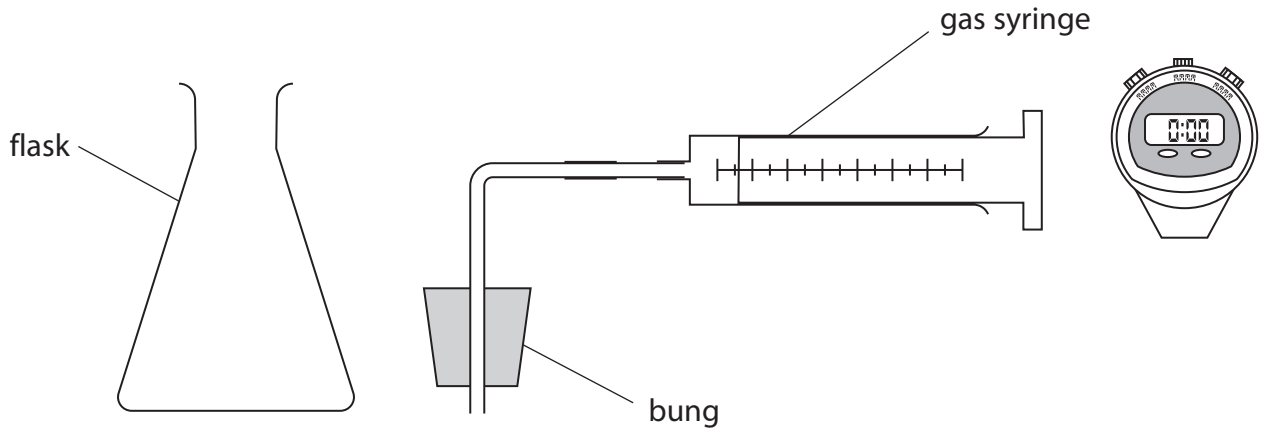
(a) The equation for the reaction is

$$Mg(\ldots\ldots) + 2HCl(\ldots\ldots) \rightarrow MgCl_2(\ldots\ldots) + H_2(\ldots\ldots)$$

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 cm^3 of 0.5 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

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

(1)

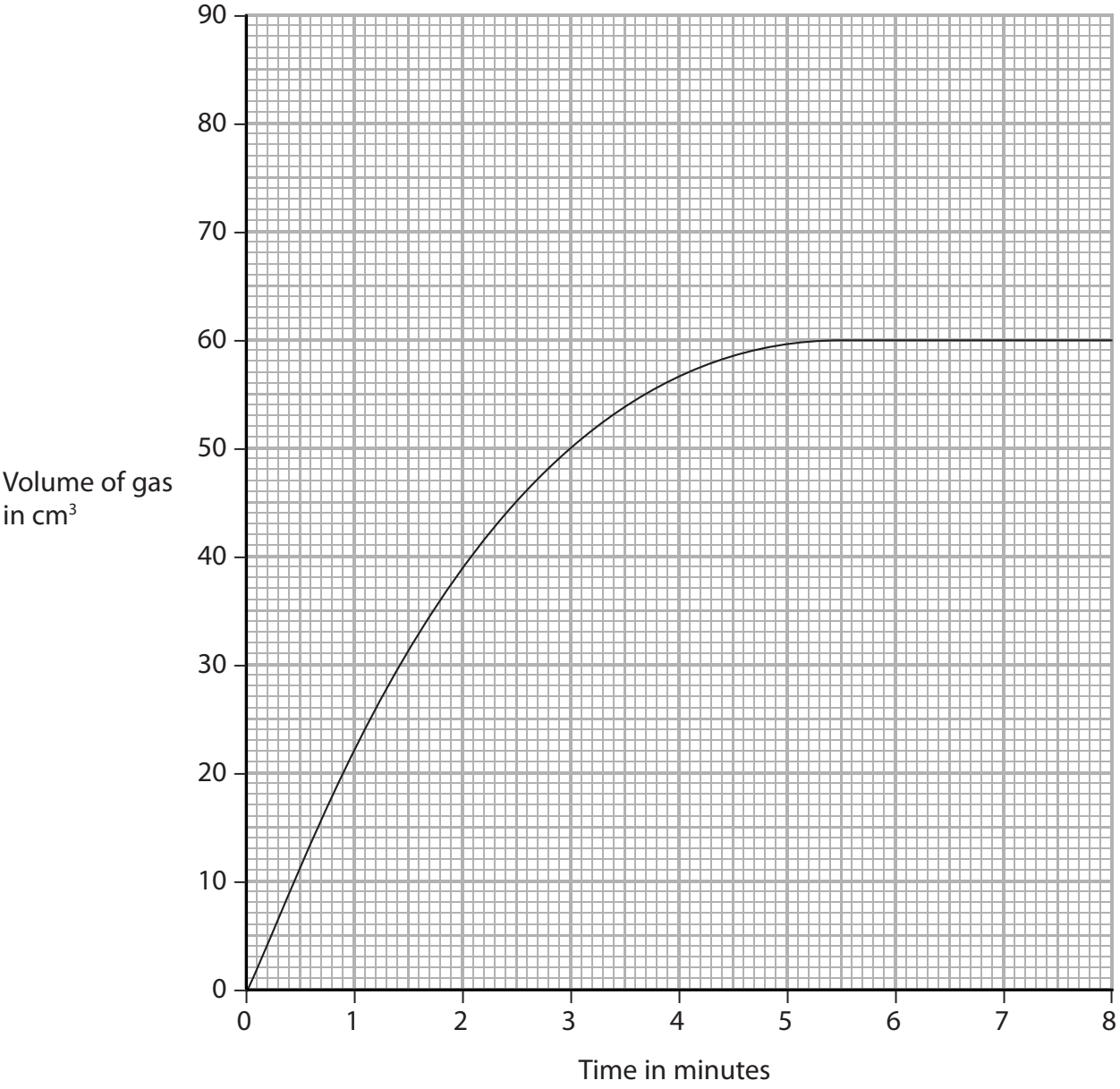
(ii) Suggest why the student needs to put the bung into the flask quickly.

(1)

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

(1)

(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)

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

(1)

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

(2)

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

(2)

(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)

(Total for Question 6 = 15 marks)

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 °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)

(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

$$2I^- + Cl_2 \rightarrow I_2 + 2Cl^-$$

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)

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

(2)

test

result

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

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

When the hydrated salt is heated, this reaction occurs.

$$AB_2.xH_2O \rightarrow AB_2 + xH_2O$$

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)

(ii) Use the scientist's results to find the value of x in $AB_2.xH_2O$

[M_r of AB_2 = 208 M_r of H_2O = 18]

(4)

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

(3)

(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)

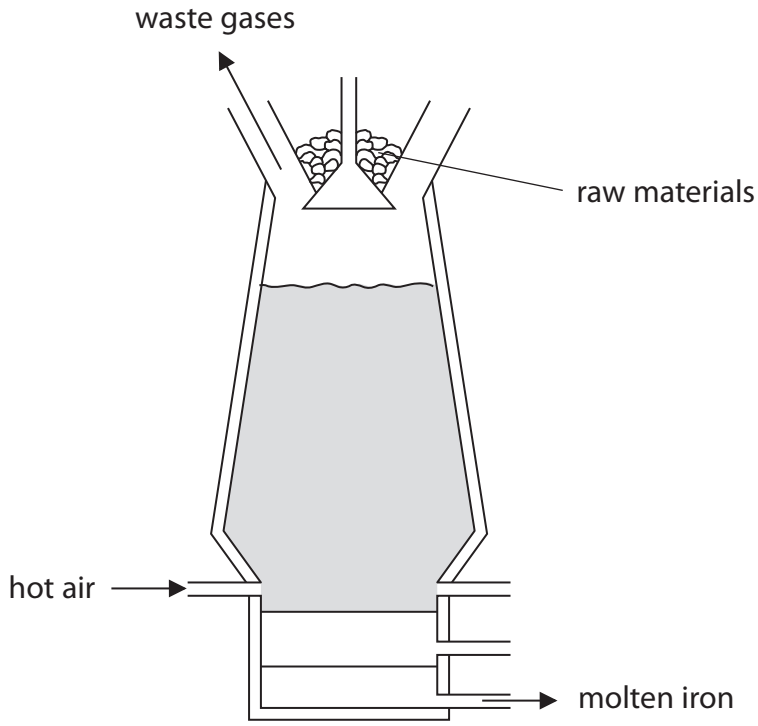
(ii) Identify metal A.

(1)

(Total for Question 8 = 15 marks)

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)

..... Fe_2O_3 + ... C → ..... Fe + ... CO_2

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

Explain how limestone removes the impurity, silica (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^3 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)

The table shows the student's titration results.

Volume of acid added in cm^3	23.40	23.15	22.95	23.10
Concordant results	☐	☐	☐	☐

Concordant results are volumes within 0.20 cm^3 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)

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

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

The equation for the reaction is

$$H_2SO_4 + 2NH_3 \rightarrow (NH_4)_2SO_4$$

(i) Calculate the amount, in moles, of H_2SO_4 in 22.70 cm^3 of the sulfuric acid.

(2)

(ii) Calculate the amount, in moles, of NH_3 in the aqueous ammonia.

(1)

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

(2)

(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)

(Total for Question 10 = 13 marks)

TOTAL FOR PAPER = 120 MARKS