Please check the examination details below before entering your candidate information

Candidate surname	Other names

Centre Number | Candidate Number

Pearson Edexcel International GCSE (9–1)

Tuesday 11 November 2025

Morning (Time: 1 hour 40 minutes)

Paper reference **4WCH1/1C**

Chemistry (Modular)

UNIT 1: 4WCH1
PAPER: 1C

You must have:
Calculator, ruler

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- If pencil is used for diagrams/sketches/graphs it must be dark (HB or B).
- **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 the calculations and state the units where required.

Information

- The total mark for this paper is 90.
- 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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P 8 1 5 5 8 R A 0 1 2 8

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

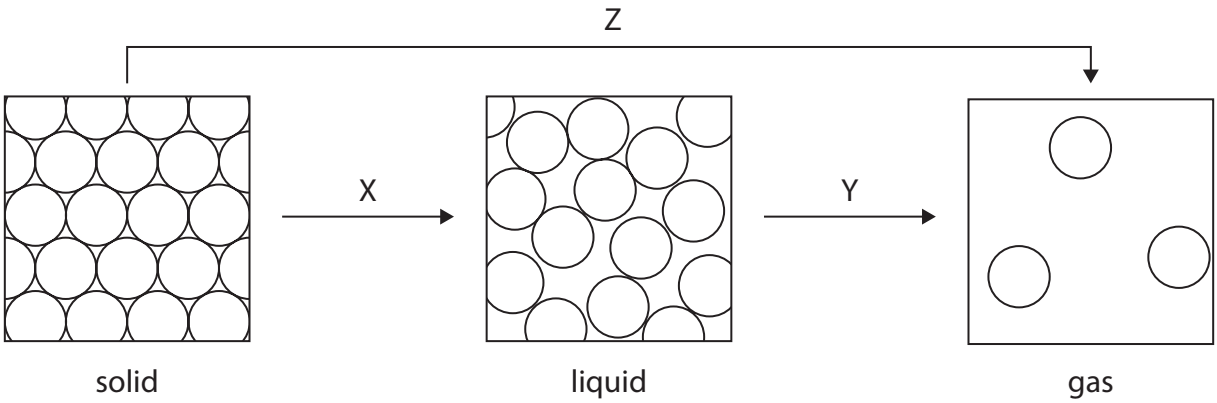
**** The lanthanoids (atomic numbers 58–71) and the actinoids (atomic numbers 90–103) have been omitted.***

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

Answer ALL questions.

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

1 (a) The diagram shows how particles are arranged in the three states of matter.



Give the names of the changes of state labelled X, Y and Z.

(3)

X .....

Y .....

Z .....

(b) Water vapour condenses to form water.

Give the equation for this change of state.

Include the state symbols.

(2)

.....

(c) Describe how particles are arranged differently in solids and gases.

(2)

.....

.....

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.....

(Total for Question 1 = 7 marks)

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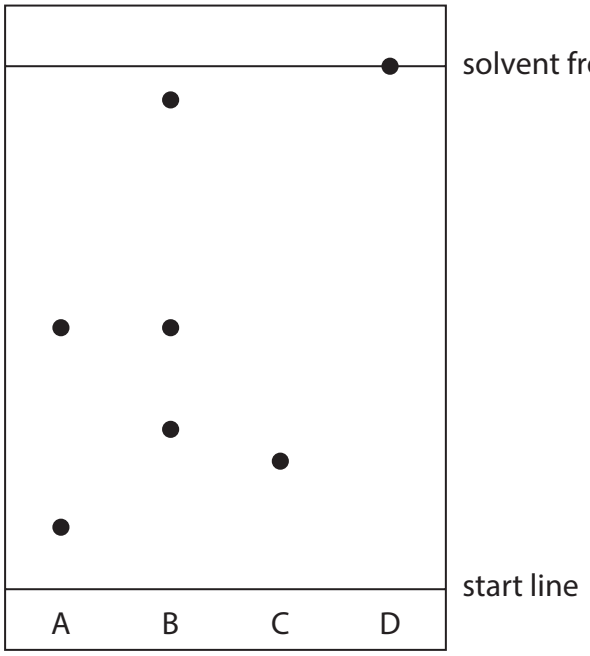
2 Samples of inks A, B, C and D containing dyes are analysed using chromatography.

The diagram shows the results.



(a) State how many dyes are in ink A.

(1)

.....

(b) Calculate the R_f value of the least soluble dye in ink A.

(2)

R_f value = ...

(c) Explain why a solvent other than water is sometimes used to produce a chromatogram.

(2)

.....

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.....

(Total for Question 2 = 5 marks)

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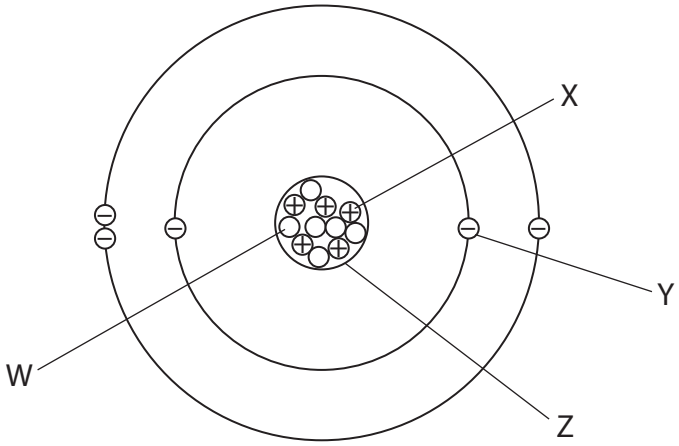
3 This question is about atomic structure and the Periodic Table.

(a) The diagram shows an atom of an element.



Use the diagram to answer these questions.

(i) Which particle is a proton?

(1)

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

(ii) Which particle has a relative charge of 0?

(1)

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

(iii) Name the part of the atom labelled Z.

(1)

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(iv) What is the group number of this element?

(1)

- ☒ **A** 2
- ☒ **B** 3
- ☒ **C** 5
- ☒ **D** 11

(v) What is the period number of this element?

(1)

- ☒ **A** 2
- ☒ **B** 3
- ☒ **C** 5
- ☒ **D** 11

(vi) Give the chemical symbol of this element.

(1)

.....

(b) State what type of particle is formed when an atom loses its outer shell electrons.

(1)

.....

(c) The table shows the atomic number and the relative atomic mass (to 1 decimal place) of the elements in a period of the Periodic Table.

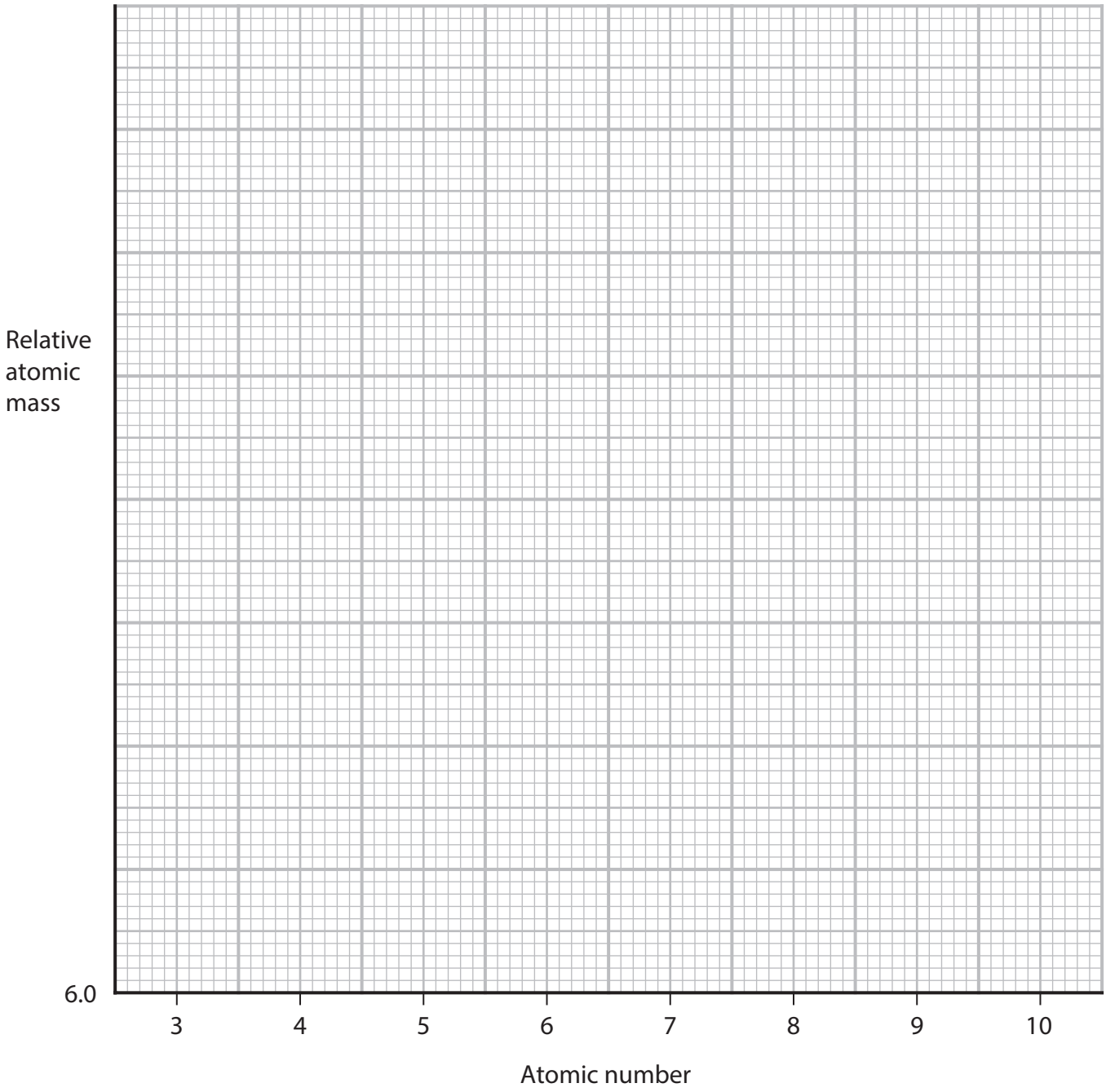
Element	Li	Be	B	C	N	O	F	Ne
Atomic number	3	4	5	6	7	8	9	10
Relative atomic mass	6.9	9.0	10.8	12.0	14.0	16.0	19.0	20.2

(i) On the grid, add an appropriate scale to the *y*-axis, starting at 6.0

(1)

(ii) Plot the data on the grid. Do not join the points.

(2)



(iii) Identify the relationship between relative atomic mass and atomic number for the elements in this period.

(1)

.....

.....

(Total for Question 3 = 11 marks)

4 This question is about the reactivity of metals.

(a) Give the order of reactivity of these metals.

aluminium copper iron potassium

(2)

most reactive .....

.....

.....

least reactive .....

(b) Explain how barrier methods are used to prevent iron from rusting.

(2)

.....

.....

.....

.....

(c) Zinc is used in sacrificial protection to prevent iron from rusting.

Explain, in terms of electrons, why this is an example of a redox reaction.

(2)

.....

.....

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.....

(d) Iron is added to a solution of copper(II) sulfate.

Give the chemical equation for this reaction.

(2)

.....

(Total for Question 4 = 8 marks)

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5 Crude oil is an important raw material for the chemical industry.

(a) Describe how fractional distillation separates the fractions in crude oil.

(5)

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(b) Some fractions can be cracked to make more useful products.

One possible product of cracking is the alkane, propane.

Draw the displayed formula for propane.

(1)

(c) What is the general formula of an alkane?

(1)

- ☒ **A** $C_{2n}H_n$
- ☒ **B** C_nH_{2n+2}
- ☒ **C** C_nH_{2n+4}
- ☒ **D** C_nH_{2n}

(d) Give two products of the incomplete combustion of propane.

(2)

1 .....

2 .....

(Total for Question 5 = 9 marks)

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6 Hydrated zinc chloride crystals can be prepared by reacting zinc oxide with dilute hydrochloric acid.

(a) Describe a method to prepare a sample of hydrated zinc chloride crystals.

(6)

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(b) The method is expected to give a theoretical yield of 5.5 g of hydrated zinc chloride crystals.

The actual yield was 3.2 g.

Calculate the percentage yield.

(2)

percentage yield = ... %

(Total for Question 6 = 8 marks)

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7 A student uses this method to investigate the reaction between sodium hydroxide solution and dilute nitric acid.

Step **1** pour 20 cm^3 of dilute nitric acid into a 100 cm^3 glass beaker

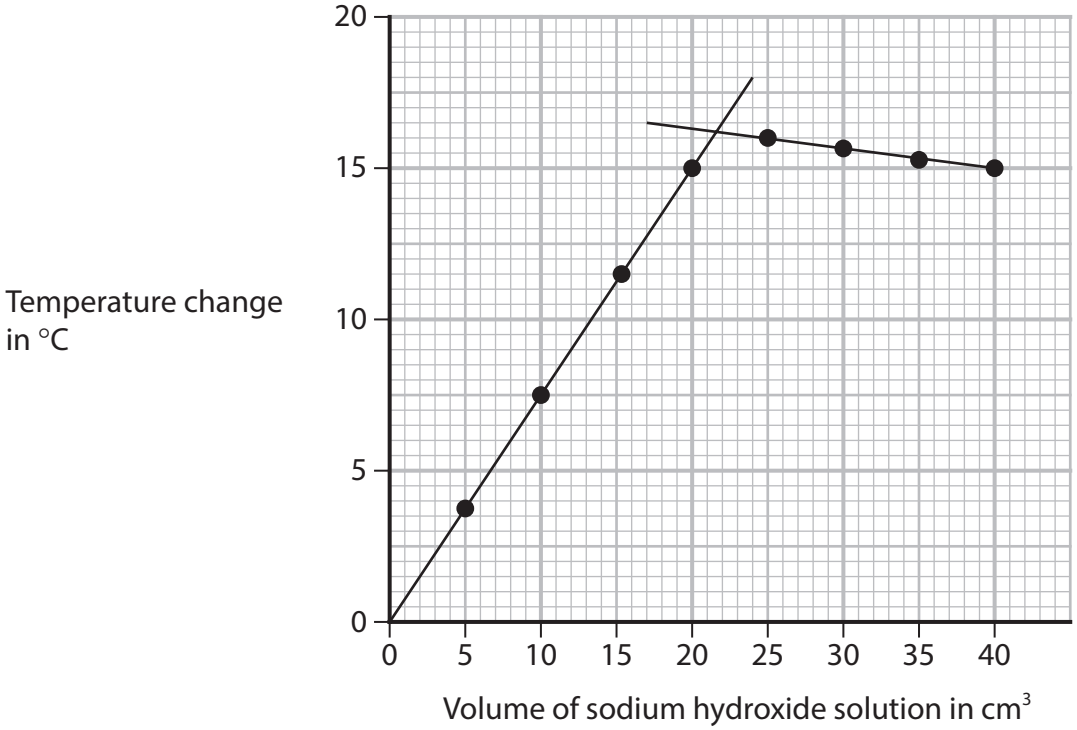
Step **2** measure the temperature of the acid

Step **3** add 5 cm^3 of sodium hydroxide solution and stir the mixture

Step **4** record the highest temperature reached

The student repeats steps **3** and **4** until a total of 40 cm^3 of sodium hydroxide solution has been added.

(a) The graph shows the student's results.



(i) Determine the volume of sodium hydroxide solution at the point where the lines cross.

(1)

volume = ... cm^3

(ii) Determine the maximum temperature change reached during the experiment.

(1)

maximum temperature change = ... °C

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(b) The student makes this statement about the shape of the graph.

The first line on the graph shows that the temperature rises at a steady rate as more nitric acid is added and at 40cm^3, the acid has been neutralised by the sodium hydroxide.

The student's statement includes some mistakes and is incomplete.

(i) Give two mistakes in the student's statement.

(2)

1 .....

.....

.....

.....

2 .....

.....

.....

.....

(ii) Add another sentence to complete the student's statement.

(1)

.....

.....

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.....

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(c) The student repeats the investigation.

The student starts with 25 cm^3 of dilute nitric acid at 19 °C.

The student finds that 25 cm^3 of sodium hydroxide solution is needed for complete neutralisation.

The student calculates that the heat energy (Q) released is 3780 J.

[for the solution, $c = 4.2$ J / g / °C]

[mass of 1.0 cm^3 of the solution = 1.0 g]

(i) Calculate the maximum temperature reached.

(4)

maximum temperature = ... °C

(ii) The amount of dilute nitric acid used in the experiment was 0.079 mol.

Calculate the value of ΔH, in kJ/mol, for the neutralisation reaction.

Include a sign in your answer.

(3)

ΔH = ... kJ/mol

(Total for Question 7 = 12 marks)

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8 This question is about solutions.

(a) Which of these is an ionic compound that is insoluble in water?

(1)

- ☒ **A** ammonium sulfate
- ☒ **B** lithium chloride
- ☒ **C** magnesium hydroxide
- ☒ **D** silver nitrate

(b) Calcium chloride is soluble in water.

Name a compound of calcium that is insoluble in water.

(1)

.....

(c) Magnesium hydroxide is an ionic compound.

(i) Calculate the relative formula mass of magnesium hydroxide, $Mg(OH)_2$

(3)

relative formula mass = ...

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(ii) Some bases dissolve in water to form an alkaline solution.

State which ion is found in all alkaline solutions.

(1)

.....

(iii) Suggest a pH value for a solution formed from a strong base.

(1)

.....

(iv) Magnesium hydroxide reacts with hydrochloric acid.

Give the chemical equation for this reaction.

(2)

.....

(Total for Question 8 = 9 marks)

9 This question is about metals and ores.

(a) Which metal occurs as an uncombined element?

(1)

- ☒ **A** calcium
- ☒ **B** silver
- ☒ **C** sodium
- ☒ **D** zinc

(b) Explain why aluminium and iron are extracted from their ores using different processes.

(3)

(c) Steel is an alloy of iron.

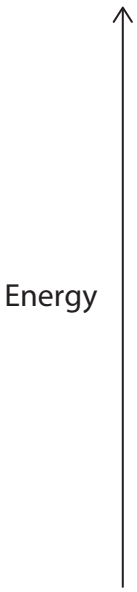
Explain the difference in one property of pure iron and steel.

(3)

(d) The thermal decomposition of calcium carbonate is an endothermic reaction.

Draw an energy level diagram to show this reaction.

(2)



(e) Explain, in terms of bonds broken and bonds made, why a reaction is endothermic.

(2)

.....

.....

.....

.....

.....

.....

(Total for Question 9 = 11 marks)

10 A student does a titration using dilute solutions of sodium hydroxide and sulfuric acid.

The student places the sodium hydroxide solution in a conical flask.

(a) Name the piece of equipment the sulfuric acid will be measured into for the titration.

(1)

(b) Describe a method for the student's titration.

(5)

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(c) This is the equation for the reaction.

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

The student transfers 25.0 cm^3 of 0.125 mol/dm^3 of sodium hydroxide to the conical flask.

The mean volume of sulfuric acid needed in this titration is 22.50 cm^3.

Calculate the concentration of the sulfuric acid.

(4)

concentration = ... mol/dm^3

(Total for Question 10 = 10 marks)

TOTAL FOR PAPER = 90 MARKS

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