

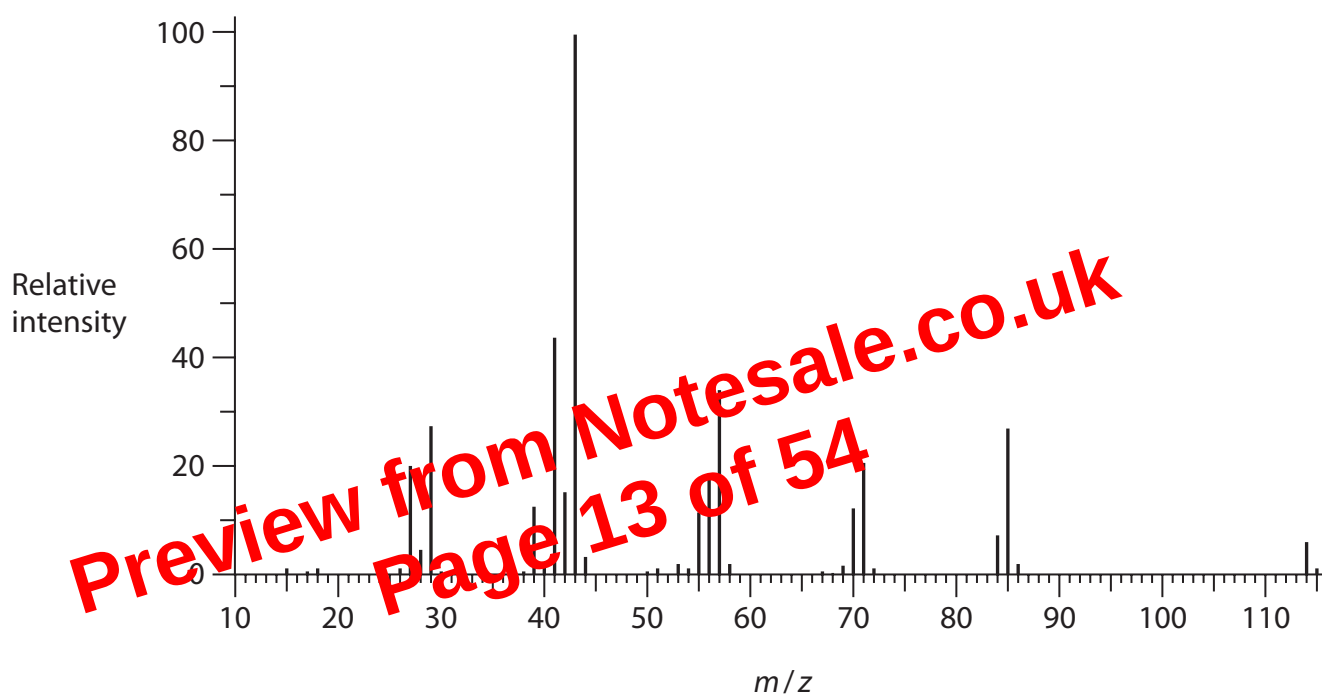
(c) Cations are formed in a mass spectrometer.

Which species is a cation?

(1)

	Number of protons	Number of neutrons	Number of electrons
☐ A	3	4	3
☐ B	6	6	6
☐ C	12	12	10
☐ D	35	44	36

(d) The mass spectrum of another compound, **D**, is shown.



Use the spectrum to determine the relative molecular mass of compound **D**.

(1)

(Total for Question 6 = 8 marks)

7 This question is about comparing the chemical and physical properties of Group 1 and Group 2 compounds.

- *(a) Potassium chloride and potassium bromide are white crystalline solids which react with concentrated sulfuric acid.

Give the observations in these reactions and an explanation, using oxidation numbers, of which is the stronger reducing agent.
Include equations for any reactions that occur.

(6)

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Page 15 of 54



- (b) A student was asked to confirm the cation present in a sample of white powder that was known to be a Group 1 compound. The student carried out a flame test using the procedure shown.

Procedure

Step 1 A platinum wire was first cleaned by dipping it into concentrated hydrochloric acid and then heating in a colourless Bunsen flame.

Step 2 After cleaning, the cleaned wire was dipped into a fresh, clean sample of concentrated hydrochloric acid and then into the white powder to pick up a sample for testing.

Step 3 The sample was tested by placing the wire in the colourless Bunsen flame.

Result

The flame was coloured lilac.

- (i) State a reason why, in Step 2, the acid used was hydrochloric acid.

(1)

- (ii) Identify the cation present in this sample of white powder.

(1)

- (c) The thermal stability of compounds in Group 2 is investigated.

- (i) Draw a labelled diagram of apparatus that would enable you to compare the thermal stability of Group 2 carbonates.

(2)

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Page 17 of 54



8 This question is about the physical properties of some substances.

(a) Water is able to dissolve many compounds.

- (i) Explain, using suitable labelled diagrams, why water is a good solvent for calcium chloride.

(4)

- (ii) Explain why methanol dissolves in water.
Include a suitable labelled diagram.

(3)

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Page 20 of 54



P 7 6 8 9 3 A 0 1 9 2 4

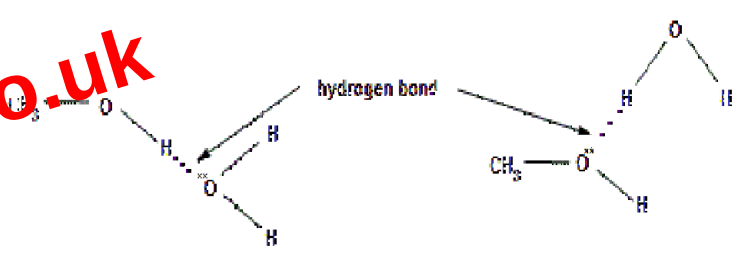
Question Number	Answer	Mark
3	The only correct answer is D (decreasing, increasing) <i>A is incorrect because atomic radii decrease across Period 2</i> <i>B is incorrect because atomic radii decrease across Period 2 and increase down Group 2</i> <i>C is incorrect because atomic radii increase down Group 2</i>	(1)

(Total for Question 3 = 1 mark)

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Page 31 of 54

Question Number	Acceptable Answer	Additional Guidance	Mark
5(a)	An answer that makes reference to the following points: • use a fume cupboard (1) • gloves (1)	Allow an answer that recognises the problem of a toxic gas Allow fume hood/box Ignore use of mask, respirator, breathing equipment (or anything that uses all/part of the available air). Allow an answer that recognises the problem of skin absorption Ignore type of glove (nitrile, plastic, gauntlet etc.)	(2)

Question Number	Acceptable Answer	Additional Guidance	Mark
5(b)	• molar mass of chlorine dioxide (1) • moles of chlorine dioxide (1) • moles of NaClO₂ required (1) • molar mass of NaClO₂ and calculation of mass of NaClO₂ (1)	<u>Example of calculation</u> 67.5 (g mol⁻¹) 5.40 ÷ 67.5 = 0.08 / 0.080 (mol) 5 ÷ 4 × 0.08(0) = 0.1 / 0.10 (mol) 90.5 and 90.5 × 0.1 = 9.05 / 9.1 (g) Ignore SF except 1 SF in final answer only TE at each stage	(4)

Question Number	Acceptable Answer	Additional Guidance	Mark
8(a)(ii)	An explanation that makes reference to the following points: - hydrogen bonding occurs between methanol and water molecules. - labelled diagram of hydrogen bonding including a least one lone pair in the relevant oxygen (max 2 lone pairs on any O atom) - labelled diagram of hydrogen bonding including bond angle $\text{O}-\text{H}-\text{O} = \text{approximately } 180^\circ$ (visual assessment is adequate)	 Allow either or both diagrams. minimum = 3 dashes/dots Hydrogen bond must be identified for M2 and M3. Penalise once only Penalise incorrect structure of methanol / water once only for M2/M3 If two or more hydrogen bonds are shown then both or all must be correct to score M2 and M3.	(3)

Question Number	Acceptable Answer	Additional Guidance	Mark
8(b)(i)	An explanation that makes reference to the following points: 2,2-dimethylpropane has two branches (1) - Contact/surface area for 2,2-dimethylpropane is much smaller than for pentane (1) - London/van der Waals/ instantaneous dipole/temporary dipole/fluctuating dipole forces/ dispersion forces etc are smaller/weaker in 2,2-dimethylpropane (and therefore a lower boiling temperature) (1)	Allow reverse argument throughout e.g. pentane has no branches for M1 Allow is branched Allow pentane has a longer chain length Do not award if reference to different number of electrons Do not award if reference to covalent bonds breaking	(3)

Question Number	Answer	Mark
9(b)(iii)	The only correct answer is C ($\text{ClO}^- + 2\text{H}^+ + \text{e}^- \rightarrow \frac{1}{2}\text{Cl}_2 + \text{H}_2\text{O}$) <i>A is not correct because this equation shows both oxidant and reductant</i> <i>B is not correct because this equation produces hydronium ions which would not be possible in acid conditions</i> <i>D is not correct because oxygen is not a product of the overall reaction</i>	(1)

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Page 53 of 54