2.13 The Periodic Table: Groups and Trends: 30-minute Pack

Total Marks

AQA 8464 · Calculator allowed · about 30 minutes

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 Use these relative atomic masses (Ar): H = 1, Li = 7, O = 16, K = 39.

(a) Calculate the relative formula mass (Mr) of lithium hydroxide, LiOH. **(1)**

.....

(b) Calculate the relative formula mass (Mr) of potassium hydroxide, KOH. **(1)**

.....

(c) Calculate the difference between the two Mr values found in (a) and (b). **(1)**

.....

(Total for Question 1 is 3 marks)

2 The noble gases (Group 0) are found in the final column of the periodic table.

(a) State the type of particle noble gas elements exist as. **(1)**

(b) Describe the trend in boiling point down Group 0. **(1)**

(c) State why the noble gases are described as inert. **(1)**

(d) Give one everyday use of helium and one everyday use of argon, linking each use to a property of the gas. **(2)**

(Total for Question 2 is 5 marks)

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3 This question is about the chemical differences between metals and non-metals.

(a) State the general type of ion formed when a metal atom reacts. **(1)**

(b) State the general type of ion formed when a non-metal atom reacts. **(1)**

(c) State whether metal oxides are generally acidic or basic. **(1)**

(Total for Question 3 is 3 marks)

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4 An unknown element X forms an oxide with formula X2O3. What is the likely group or typical ionic charge of X? Explain your answer in terms of electrons transferred.

(Total for Question 4 is 3 marks)

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5 The alkali metals (Group 1) become more reactive as you go down the group.

(a) State how the reactivity of Group 1 metals changes down the group. **(1)**

(b) Explain this trend in terms of atomic size and the distance of the outer electron from the nucleus. **(2)**

(Total for Question 5 is 3 marks)

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6 Halogens react with metals to form metal halide salts.

(a) Balance the symbol equation for the reaction of sodium with chlorine: ___Na(s) + Cl_2(g) -> ___NaCl(s) **(1)**

(b) Write a fully balanced symbol equation, including state symbols, for the reaction of iron with chlorine to form iron(III) chloride, $FeCl_3$. **(3)**

(Total for Question 6 is 4 marks)

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7 Chlorine water is added to separate test tubes of potassium bromide solution and potassium iodide solution.

(a) Predict what would be observed in each test tube. **(2)**

(b) Write a fully balanced symbol equation, including state symbols, for the reaction between chlorine and potassium bromide solution. **(3)**

(c) Predict whether a reaction would occur if iodine solution were added to potassium chloride solution. Give a reason for your answer. **(1)**

(Total for Question 7 is 6 marks)

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Mark scheme · 2.13 The Periodic Table: Groups and Trends: 30-minute Pack

Question 1

(a) 24 cao **B1**

(a) Answer: 24

(b) 56 cao **B1**

(b) Answer: 56

(c) 32 cao, ft from (a) and (b) **B1**

(c) Answer: 32

Question 2

(a) monatomic (single, separate atoms, not molecules) oe **B1**

(a) Answer: Monatomic (single atoms)

(b) boiling point increases down the group **B1**

(b) Answer: Boiling point increases down Group 0

(c) they have a full outer shell of electrons, so do not readily react or form bonds (oe) **B1**

(c) Answer: They have a full outer shell of electrons, so are very unreactive

(d) helium is used in party/weather balloons because it has a very low density (oe) **B1**

(d) argon is used in filament light bulbs or welding because it is unreactive/inert, so it does not react with the hot filament or molten metal (oe) **B1**

(d) Answer: Helium in balloons (low density); argon in light bulbs/welding (unreactive, protects hot metal from reacting)

Question 3

(a) a positive ion (cation) oe **B1**

(a) Answer: A positive ion (cation)

(b) a negative ion (anion) oe **B1**

(b) Answer: A negative ion (anion)

(c) basic (non-metal oxides are generally acidic) cao **B1**

(c) Answer: Basic

Question 4

X likely forms a +3 ion (for example group 3 or an element that commonly forms +3) **B1**

because 3 oxide ions (each O^{2-}) give total charge -6 and 2 X must give +6 so each X is +3 **B1**

thus each X atom loses three electrons to oxygen, oe **B1**

Answer: X is likely +3 (group 3 or a +3 ion), because 2 X give +6 to balance 3 O^{2-} so each X has charge +3.

Question 5

(a) reactivity increases down the group **B1**

(a) Answer: Reactivity increases down Group 1

(b) atoms get larger down the group (more electron shells), so the single outer electron is further from the nucleus and more shielded (oe) **M1**

(b) this means there is a weaker force of attraction between the nucleus and the outer electron, so it is lost more easily, making the metal more reactive (oe) **A1**

(b) Answer: Atoms get larger down the group, so the outer electron is further from the nucleus and more shielded; the weaker attraction means it is lost more easily, so reactivity increases

Question 6

(a) $2Na(s) + Cl_2(g) \rightarrow 2NaCl(s)$, fully balanced cao **B1**

(a) Answer: $2Na(s) + Cl_2(g) \rightarrow 2NaCl(s)$

(b) correct formulae for reactants and product: Fe, Cl_2, $FeCl_3$ **M1**

(b) correctly balanced: $2Fe + 3Cl_2 \rightarrow 2FeCl_3$ **M1**

(b) correct state symbols: $2Fe(s) + 3Cl_2(g) \rightarrow 2FeCl_3(s)$ cao **A1**

(b) Answer: $2Fe(s) + 3Cl_2(g) \rightarrow 2FeCl_3(s)$

Question 7

(a) potassium bromide solution: colour change to orange/yellow as bromine is formed (oe) **B1**

(a) potassium iodide solution: colour change to brown as iodine is formed (oe) **B1**

(a) Answer: Potassium bromide solution turns orange/yellow (bromine forms); potassium iodide solution turns brown (iodine forms)

(b) correct formulae: Cl_2, KBr, KCl, Br_2 **M1**

(b) correctly balanced: $Cl_2 + 2KBr \rightarrow 2KCl + Br_2$ **M1**

(b) correct state symbols: $Cl_2(aq) + 2KBr(aq) \rightarrow 2KCl(aq) + Br_2(aq)$ cao **A1**

(b) Answer: $Cl_2(aq) + 2KBr(aq) \rightarrow 2KCl(aq) + Br_2(aq)$

(c) no reaction, because iodine is less reactive than chlorine, so it cannot displace chloride ions from solution (oe) **B1**

(c) Answer: No reaction; iodine is less reactive than chlorine so cannot displace the chloride ions

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