2.1 Atomic Structure and the Periodic Table: 30-minute Pack

Total Marks

AQA 8462 · Calculator allowed · about 30 minutes

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 Elements in the periodic table are arranged in groups (vertical columns) and periods (horizontal rows).

(a) State what the group number tells you about an element in the main group. **(1)**

(b) State what the period number tells you about an element. **(1)**

(Total for Question 1 is 2 marks)

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2 A student is asked to write the electronic configuration for magnesium, which has atomic number 12.

(a) Write the electronic configuration of magnesium using commas to separate shells. **(2)**

(b) State the group number for magnesium using its outer electron count. **(2)**

(Total for Question 2 is 4 marks)

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3 A student is given a sample of an element and measures its reactivity with water. This is a practical test to compare reactivity in Group 1.

(a) Suggest one safety precaution the student should take when testing reactivity with water. **(1)**

(b) Give one variable that should be kept the same for fair comparison between different metals. **(1)**

(Total for Question 3 is 2 marks)

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4 The electronic configuration of neon (Ne) is 2,8.

(a) State whether neon is a metal or a non-metal. **(1)**

(b) Explain why neon is chemically unreactive. **(2)**

(Total for Question 4 is 3 marks)

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5 Two unlabelled samples are magnesium (a metal) and carbon (a non-metal). State one chemical test that distinguishes between these samples, and describe the expected observation for each.

(Total for Question 5 is 2 marks)

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6 This question is about atoms, elements and compounds.

(a) Which of these is the approximate radius of an atom? **(1)**

- ☐ A) 1×10^{-10} m
- ☐ B) 1×10^{-3} m
- ☐ C) 1×10^{-2} m
- ☐ D) 1×10^{-6} m

(b) An element contains only one type of atom. What is a compound? **(1)**

(c) Give one difference between a compound and a mixture. **(1)**

(Total for Question 6 is 3 marks)

7 The Group 0 elements are the noble gases.

(a) Explain, in terms of electronic structure, why the noble gases are very unreactive. **(2)**

(b) State the trend in boiling point of the noble gases going down Group 0. **(1)**

(Total for Question 7 is 3 marks)

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8 Transition metals are found in the central block of the periodic table.

(a) Compared with the Group 1 metals, give two ways in which the typical properties of the transition metals are different. **(2)**

(Total for Question 8 is 2 marks)

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9 Describe a method the student could use to obtain a pure, dry sample of the sand and a pure, dry sample of the salt from the mixture. You should name the apparatus and separation techniques used.

(Total for Question 9 is 6 marks)

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Mark scheme · 2.1 Atomic Structure and the Periodic Table: 30-minute Pack

Question 1

(a) the number of electrons in the outer shell (for main group elements) cao **B1**

(a) Answer: Number of electrons in the outer shell

(b) the number of electron shells (energy levels) that the atoms have cao **B1**

(b) Answer: Number of electron shells

Question 2

(a) first shell 2 electrons **B1**

(a) second shell 8 electrons and third shell 2 electrons so 2,8,2 cao **B1**

(a) Answer: 2,8,2

(b) uses outer electrons = 2, so group 2 **M1**

(b) Group 2 cao **A1**

(b) Answer: Group 2

Question 3

(a) wear safety goggles, or use a small piece of the metal, or keep distance, or perform behind a safety screen, oe **B1**

(a) Answer: Wear safety goggles

(b) volume of water, temperature of water, size of metal piece, or concentration if using solution, oe **B1**

(b) Answer: Same volume of water

Question 4

(a) non-metal cao **B1**

(a) Answer: Non-metal

(b) states that neon has a full outer shell (2,8) so it is stable **M1**

(b) therefore it does not readily gain or lose electrons and is unreactive cao **A1**

(b) Answer: Neon has a full outer shell (2,8) so it is stable and unreactive

Question 5

test: add dilute hydrochloric acid; magnesium produces bubbles of hydrogen **B1**

carbon shows no reaction with the dilute hydrochloric acid (no bubbles) **B1**

Answer: Add dilute hydrochloric acid to each sample. Magnesium produces bubbles of hydrogen; carbon shows no reaction (no bubbles).

Question 6

(a) A (1×10^{-10} m, i.e. 0.1 nm) **B1**

(b) two or more elements chemically combined (in fixed proportions) **B1**

(b) Answer: Two or more elements chemically combined

(c) in a compound the elements are chemically combined / can only be separated by chemical reactions; in a mixture the substances are not chemically combined / can be separated by physical means (oe) **B1**

(c) Answer: A compound is chemically combined; a mixture is not (and can be separated physically)

Question 7

(a) they have a full (complete) outer shell of electrons **B1**

(a) so they have a stable arrangement and do not easily gain or lose electrons **B1**

(a) Answer: Full outer shell (stable arrangement), so they do not readily gain or lose electrons

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

(b) Answer: Boiling point increases down the group

Question 8

(a) any one of: higher melting points / more dense / harder / stronger / less reactive **B1**

(a) a second, different, correct property, e.g. form coloured compounds / useful as catalysts / form ions with different charges **B1**

(a) Answer: Any two of: higher melting points/density, harder/stronger, less reactive, form coloured compounds, catalytic, variable ion charges

Question 9

Level 3 A logically ordered method that would obtain BOTH pure dry sand and pure dry salt. Techniques are correctly named and steps are in a sensible order. **5-6**

Level 2 A method that would obtain at least one of the pure substances, with some correct techniques named. Some steps may be missing or out of order. **3-4**

Level 1 One or more isolated correct steps or techniques with no coherent method. **1-2**

Level 0 No relevant content. **0**

Indicative content:

- Add water to the mixture and stir so that the salt dissolves.
- The sand does not dissolve (it is insoluble).
- Filter the mixture using filter paper and a funnel.
- The sand is trapped as the residue in the filter paper.
- Rinse the sand with distilled water and leave it to dry (or dry in an oven) to obtain pure dry sand.
- The salt solution passes through as the filtrate.
- Heat the filtrate to evaporate most of the water (evaporating basin).
- Leave the remaining solution to crystallise / evaporate slowly to obtain pure dry salt crystals.
- Named apparatus: beaker, glass rod, filter funnel, filter paper, evaporating basin, Bunsen burner/water bath.

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