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SPECA

GCSE Combined Science (AQA Trilogy) · Chemistry

Atomic Structure and the Periodic Table · Mark Scheme

For use with the Tiered Worksheet. Marking points are indicative, not exhaustive: award equivalent correct answers.

Section A: Foundation (Q1 to 21)

1) A substance made of only one type of atom, which cannot be broken down into anything simpler by chemical means (1) [1]

2) In a compound the substances are chemically combined in fixed proportions (1); in a mixture they are not chemically combined and each substance keeps its own properties (1). Accept: a compound can only be separated by a chemical reaction, a mixture can be separated by physical means. [2]

3) Crystallisation (1); the water is evaporated (e.g. by gentle heating) until crystals of the salt form, leaving the solid salt behind (1) [2]

4) Simple distillation (1) [1]

5) Fractional distillation (1) [1]

6) Chromatography (1); the distance travelled by each dye relative to the solvent front (Rf value) can be compared with known reference dyes (1) [2]

7) A ball/sphere of positive charge (1), with negative electrons embedded/spread throughout it (1) [2]

8) Any one of: most alpha particles passed straight through the gold foil, showing that most of the atom is empty space; a small number of alpha particles were deflected/bounced back, showing that the atom's mass and positive charge are concentrated in a small, dense central nucleus. (1 for observation, 1 for correct explanation) [2]

9) solid sphere → plum pudding → nuclear → Bohr (2 for fully correct order; 1 if only partly correct) [2]

10) The proton (the neutron was proposed roughly 20 years after the nuclear model became accepted) (1) [1]

11) Proton: relative charge +1, relative mass 1 (1); neutron: relative charge 0, relative mass 1 (1); electron: relative charge −1, relative mass very small/negligible (1) [3]

12) Protons = 13 (1); neutrons = 27 − 13 = 14 (1); electrons = 13 (1) [3]

13) Atoms of the same element (same number of protons/same atomic number) (1) but with a different number of neutrons, and so a different mass number (1) [2]

14) (63 × 69) + (65 × 31) = 4347 + 2015 = 6362 (1 method); 6362 ÷ 100 (1 method); = 63.6 (1 accuracy) [3]

15) 2,8,5 (2 marks for fully correct; 1 mark if only one shell is correct) [2]

16) Elements in the same group have the same number of electrons in their outer shell (1), and it is the outer-shell electrons that determine an element's chemical properties/reactivity (1) [2]

17) He left gaps for elements not yet discovered (1); he sometimes swapped the order of two elements from strict atomic-weight order, based on predicted properties (1) [2]

18) Group 0 (the noble gases) (1) [1]

19) Group 1: the outer electron is further from the nucleus (more shielded) going down the group, so it is lost more easily, increasing reactivity (up to 2); Group 7: the outer shell needs to gain an electron, which becomes harder going down the group as the outer shell is further

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from the nucleus and more shielded, decreasing reactivity (up to 2). Mark holistically, maximum 3. [3]

20) Boiling point increases going down the group (1) because relative atomic mass increases going down the group (1) [2]

21) The solution changes colour as iodine forms (1); bromine is more reactive than iodine, so it displaces iodine from the potassium iodide solution (1) [2]

Section B: Higher (Q22 to 26)

22) $Cl_2 + 2KBr \rightarrow 2KCl + Br_2$ (1 for correct formulae, 1 for balancing) [2]

23) $Cl_2 + 2Br^- \rightarrow 2Cl^- + Br_2$ (1 for correct ions/formulae, 1 for balancing) [2]

24) $2Br^- \rightarrow Br_2 + 2e^-$ (1); $Cl_2 + 2e^- \rightarrow 2Cl^-$ (1) [2]

25) Bromide ions (Br^-) lose electrons (1); chlorine molecules (Cl_2) gain electrons (1) [2]

26) $Br_2 + 2KI \rightarrow 2KBr + I_2$ (1 symbol equation); $Br_2 + 2I^- \rightarrow 2Br^- + I_2$ (2, ionic equation with correct formulae and balancing) [3]

Total: 41 marks (Section A) + 11 marks (Section B) = 52 marks

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