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SPECA

GCSE Combined Science (AQA Trilogy) · Chemistry

Quantitative Chemistry · Mark Scheme

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

Section A: Foundation (Q1 to 16)

1) No atoms are lost or made (gained) in a chemical reaction, so the mass of the products equals the mass of the reactants (1) [1]

2) The large "2" is a multiplier applying to the whole formula H_2: meaning two molecules/moles of hydrogen (1); the small "2" is a subscript that is part of the formula itself, showing two hydrogen atoms are bonded in each water molecule (1) [2]

3) The sum of the relative atomic masses of all the atoms shown in a compound's formula (1) [1]

4) 24 + 16 = 40 (2, 1 for method, 1 for answer) [2]

5) 24 ÷ 40 × 100 = 60% (1 method, 1 answer) [2]

6) They are equal (1) [1]

7) The magnesium combines with oxygen from the air (1) which becomes part of the solid magnesium oxide, adding to the mass (1) [2]

8) Carbon dioxide gas is produced and escapes into the air (1), so its mass is no longer included in the mass of the solid remaining (1) [2]

9) Range = 12.3 − 11.9 = 0.4 g (1); a larger range means greater uncertainty/spread in the measurements (1) [2]

10) (12.1 + 12.3 + 11.9 + 12.2 + 12.0) ÷ 5 = 60.5 ÷ 5 = 12.1 g (1) [1]

11) 40 × 0.5 = 20 g (1 method, 1 answer) [2]

12) 25 × 2 = 50 g (1 method, 1 answer) [2]

13) $2Na + Cl_2 \rightarrow 2NaCl$ (2, 1 for correct formulae, 1 for balancing) [2]

14) $Fe_2O_3 + 3CO \rightarrow 2Fe + 3CO_2$ (2, 1 for correct formulae, 1 for balancing) [2]

15) 40 + 12 + (16 × 3) = 40 + 12 + 48 = 100 (2, 1 method, 1 answer) [2]

16) 40 ÷ 100 × 100 = 40% (1 method, 1 answer) [2]

Section B: Higher (Q17 to 24)

17) The mole is the unit for measuring the amount of a substance (1); the Avogadro constant is 6.02×10^{23} per mole (1) [2]

18) One mole of any substance always contains the same fixed number of particles (the Avogadro constant), regardless of what that substance is (1); mass differs between them only because different particles have different relative formula masses, not because the number of particles differs (1) [2]

19) Mr of NaOH = 23 + 16 + 1 = 40 (method); moles = 8 ÷ 40 = 0.2 mol (1 method, 1 answer) [2]

20) Mass = moles × Mr = 0.5 × 100 = 50 g (1 method, 1 answer) [2]

21) Moles Mg = 4.8 ÷ 24 = 0.2 mol (1); moles O_2 = 3.2 ÷ 32 = 0.1 mol (1); ratio Mg : O_2 = 0.2 : 0.1 = 2 : 1 (1); balanced equation: $2Mg + O_2 \rightarrow 2MgO$ (1) [4]

22) Moles N_2 = 28 ÷ 28 = 1 mol (1); mole ratio N_2 : NH_3 = 1 : 2, so moles NH_3 = 2 mol (1); mass NH_3 = 2 × (14 + 3) = 2 × 17 = 34 g (1) [3]

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23) Moles Fe = 56 ÷ 56 = 1 mol; moles S = 16 ÷ 32 = 0.5 mol (1); the equation needs a 1:1 mole ratio, and only 0.5 mol S is available compared with 1 mol Fe, so sulfur is the limiting reactant (1); maximum moles of FeS = 0.5 mol (1); mass FeS = 0.5 × (56 + 32) = 0.5 × 88 = 44 g (1) [4]

24) Concentration = mass ÷ volume = 5 ÷ 0.25 = 20 g/dm³ (1 method, 1 answer) [2]

Total: 28 marks (Section A) + 21 marks (Section B) = 49 marks

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