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SPECA

GCSE Combined Science (AQA Trilogy) · Chemistry

Quantitative Chemistry · Tiered Worksheet

Section A: Foundation

Conservation of mass and relative formula mass

1) State the law of conservation of mass. [1]

2) In the balanced equation $2H_2 + O_2 \rightarrow 2H_2O$, explain what the large "2" written before H_2 means, compared with the small "2" written after H in H_2O. [2]

3) Define relative formula mass (Mr). [1]

4) Calculate the relative formula mass of magnesium oxide, MgO. (Ar: Mg = 24, O = 16) [2]

5) Calculate the percentage by mass of magnesium in magnesium oxide, MgO. [2]

6) State the relationship between the total relative formula mass of the reactants and the total relative formula mass of the products in a balanced equation. [1]

7) When a piece of magnesium ribbon is burned in air, its mass appears to increase. Explain why, referring to the equation $2Mg + O_2 \rightarrow 2MgO$. [2]

8) When calcium carbonate is heated strongly, its mass appears to decrease. Explain why, referring to the equation $CaCO_3 \rightarrow CaO + CO_2$. [2]

Uncertainty and concentration

9) A student measures the mass of a solid five times and records: 12.1 g, 12.3 g, 11.9 g, 12.2 g, 12.0 g. State the range of these measurements, and explain what the range tells you about the uncertainty in the measurements. [2]

10) Calculate the mean of the five measurements in Q9. [1]

11) A solution has a concentration of 40 g/dm³. Calculate the mass of solute dissolved in 0.5 dm³ of this solution. [2]

12) A solution has a concentration of 25 g/dm³. Calculate the mass of solute dissolved in 2 dm³ of this solution. [2]

Balancing equations and further Mr calculations

13) Balance the following equation: __Na + __Cl_2 → __NaCl [2]

14) Balance the following equation: __Fe_2O_3 + __CO → __Fe + __CO_2 [2]

15) Calculate the relative formula mass of calcium carbonate, $CaCO_3$. (Ar: Ca = 40, C = 12, O = 16) [2]

16) Calculate the percentage by mass of calcium in calcium carbonate. [2]

Section B: Higher (in addition to Section A)

Moles, reacting masses and limiting reactants

17) Define the mole (mol), and state the numerical value of the Avogadro constant. [2]

18) Explain why one mole of carbon atoms contains the same number of particles as one mole of carbon dioxide molecules, even though a mole of CO_2 has a much greater mass. [2]

19) Calculate the number of moles in 8 g of sodium hydroxide, NaOH. (Ar: Na = 23, O = 16, H = 1) [2]

20) Calculate the mass of 0.5 mol of calcium carbonate, $CaCO_3$. (Mr = 100) [2]

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21) Magnesium burns in oxygen to form magnesium oxide. In an experiment, 4.8 g of magnesium reacts completely with 3.2 g of oxygen to form 8.0 g of magnesium oxide. Use moles to determine the simplest whole-number ratio of magnesium atoms to oxygen molecules in this reaction, and hence write the balanced symbol equation. (Ar: Mg = 24, O = 16) **[4]**

22) Ammonia is made from nitrogen and hydrogen: $N_2 + 3H_2 \rightarrow 2NH_3$. Calculate the maximum mass of ammonia that could be produced from 28 g of nitrogen, assuming an excess of hydrogen and that the reaction goes to completion. (Ar: N = 14, H = 1) **[3]**

23) Iron reacts with sulfur to form iron sulfide: Fe + S → FeS. 56 g of iron is reacted with 16 g of sulfur. Determine which reactant is the limiting reactant, and calculate the maximum mass of iron sulfide that can be produced. (Ar: Fe = 56, S = 32) **[4]**

24) A solution contains 5 g of solute dissolved to make 0.25 dm^3 of solution. Calculate the concentration of the solution, in g/dm^3, by rearranging the concentration equation. **[2]**

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