1. **Chemical measurements part 1 – Chemical changes and conservation of mass**

1. A piece of magnesium was heated in a crucible.



a) Write a balance equation to show how the magnesium reacts with oxygen. (2)

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b) The mass of the crucible at the start of the reaction was 0.34g, but 0.56g at the end. Explain why the

 mass increased. (2)

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c) The student heated the crucible at the end of the reaction. What could the student do to make sure

 the reaction is complete? (2)

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d) Another student heated magnesium carbonate in a similar crucible, with the lid off.

 The reaction is shown below:

MgCO3 (s)  MgO (s) + CO2 (g)

 Use the reaction to explain whether the mass would increase or decrease. Explain your answer. (3)

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1. **Chemical measurements part 2 – Relative formula mass**
2. Calculate the relative formula mass of Na2CO3. (1)

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1. Calculate the relative atomic mass of Iron (with 5.8% 54Fe, 91.8% 56Fe, 2.1% 57Fe and 0.3% 59Fe). (2)

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1. **Calculations part 1 – Moles/Quantities/Balancing and Limiting factors (HT)**

1. How many moles of sulfur atoms are there in:

 a) 9.8 grams of sulfur? (1)

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b) 16 tonnes of sulfur? (where 1 tonne = 1000kg) (1)

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 2. What is the mass of:

a) 0.04 moles of hydrogen H2? (1)

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b) 0.6 moles of sodium nitrate (NaNO3)? (2)

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3. When calcium reacts with water it forms a solution of calcium hydroxide Ca(OH)2 and hydrogen gas.

 a) Write a balanced symbol equation, including the state symbols to show this equation. (3)

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1. Calculate how much calcium must be added to an excess of water to produce 3.7g of calcium hydroxide (2)

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4. What mass of sodium chloride is produced when 5.3g of sodium carbonate reacts with excess dilute

 hydrochloric acid? (3)

Na2CO3 + 2HCl  2NaCl + H20 + CO2

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5. 0.010 moles of C4H10 reacts with oxygen as in the following equation:

C4H10 + O2  \_\_\_CO2 + \_\_\_H20

 1.76g of carbon dioxide and 0.90 of water are produced.

 Use this information to work out the balancing numbers for carbon dioxide and water. (4)

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6. 84 tonnes of nitrogen were mixed with 30 tonnes of hydrogen in the following equation:

N2(g) + 3H2(g)  2NH3(g)

1. Calculate the number of moles of nitrogen and hydrogen and calculate which reactant is the

 limiting factor. (3)

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1. Calculate the maximum mass of ammonia that can be produced from 42 tonnes of nitrogen. (3)

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**D. Calculations part 2 – Concentrations of solutions**

1. A technician made up a solution of sodium hydroxide by placing 5.00g of solid sodium hydroxide in a flask

 and adding 100cm3 of water. She placed in the stopper and shook until the reaction had stopped. What

 was the concentration of the solution in g/dm3? (1)

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2. A solution of copper chloride has a concentration of 300g/dm3. What is the mass of copper chloride in

 500cm3 of the solution? (2)

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3. **Higher:**

 Explain how the mass of a solute and the volume of water effect the concentration of a solution. (2)

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**CHEMISTRY ONLY**

**E. Quantities part 1 – Percentage yield and atom economy**

1. Give two possible reasons for the actual yield in a reaction being less that the maximum theoretical

 yield. (2)

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2. Magnesium is burnt in air. The theoretical yield of magnesium oxide is 5g, but only 4.5g is produced.

 What is the percentage yield?

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3. Lead nitrate and potassium iodide solutions are mixed to make solid lead iodide. The solid is then

 separated using the following equipment:



 Suggest why the actual yield is less than the theoretical yield. (1)

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4. **Higher:**

 100g of magnesium carbonate is heated. It decomposes to make magnesium oxide and carbon dioxide.

 Calculate the theoretical yield of magnesium oxide made. (2)

MgCO3  MgO + CO2

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5. Calculate the atom economy for making hydrogen from the following reaction: (1)

C(s) + 2H2O(g)    →    CO2(g) + 2H2(g)

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6. Suggest why industrial processes need as high an atom economy as possible? (2)

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**F. Quantities part 2 – Moles of solutions and gases (HT)**

1. What is the concentration of a solution that has 0.25 mol of solute in 135cm3 of solution? (1)

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2. How many moles of copper sulfate are there in 40cm3 of a 0.1 mol/dm3 solution? (1)

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3. Calculate the concentration in mol/dm3 of a solution that has 2 mol of an alkali in 250 cm3 of solution.(2)

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4. What mass of sodium fluoride (NaF) is in 250cm3 of a 2 mol/dm3 solution? (2)

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5. It takes 27.00cm3 of hydrochloric acid to neutralise 25.00am3 of sodium hydroxide at a concentration on

 1.0 mol/dm3. Calculate the concentration of hydrochloric acid in g/cm3. (4)

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6. Calculate the volume of 0.7 mol of carbon dioxide gas at RTP. (1)

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7. What is the volume 12.3g of butane gas (C4H10) at RTP? (3)

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