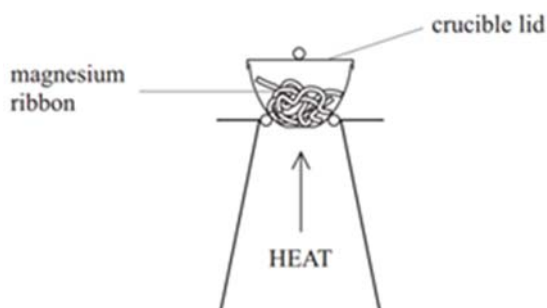


## A. Chemical measurements part 1 – Chemical changes and conservation of mass

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:



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

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**B. Chemical measurements part 2 – Relative formula mass**

1. Calculate the relative formula mass of  $\text{Na}_2\text{CO}_3$ . (1)

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2. Calculate the relative atomic mass of Iron (with 5.8%  $^{54}\text{Fe}$ , 91.8%  $^{56}\text{Fe}$ , 2.1%  $^{57}\text{Fe}$  and 0.3%  $^{59}\text{Fe}$ ). (2)

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**C. 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 H<sub>2</sub>? (1)

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b) 0.6 moles of sodium nitrate (NaNO<sub>3</sub>)? (2)

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

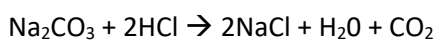
a) Write a balanced symbol equation, including the state symbols to show this equation. (3)

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b) 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)



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5. 0.010 moles of  $C_4H_{10}$  reacts with oxygen as in the following equation:



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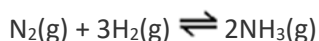
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6. 84 tonnes of nitrogen were mixed with 30 tonnes of hydrogen in the following equation:



a) Calculate the number of moles of nitrogen and hydrogen and calculate which reactant is the limiting factor. (3)

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b) 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 100cm<sup>3</sup> of water. She placed in the stopper and shook until the reaction had stopped. What was the concentration of the solution in g/dm<sup>3</sup>? (1)

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2. A solution of copper chloride has a concentration of 300g/dm<sup>3</sup>. What is the mass of copper chloride in 500cm<sup>3</sup> 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?

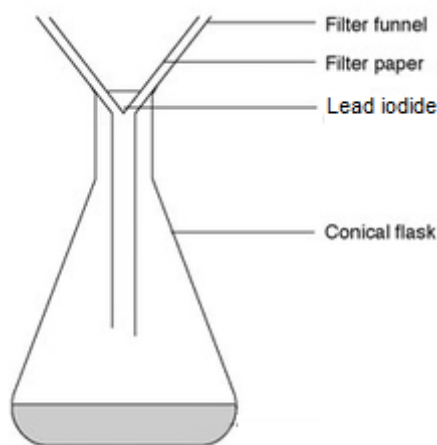
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3. Lead nitrate and potassium iodide solutions are mixed to make solid lead iodide. The solid is then separated using the following equipment:



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)



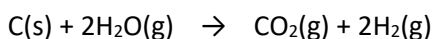
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5. Calculate the atom economy for making hydrogen from the following reaction: (1)



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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 135cm<sup>3</sup> of solution? (1)

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2. How many moles of copper sulfate are there in 40cm<sup>3</sup> of a 0.1 mol/dm<sup>3</sup> solution? (1)

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3. Calculate the concentration in mol/dm<sup>3</sup> of a solution that has 2 mol of an alkali in 250 cm<sup>3</sup> of solution.(2)

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4. What mass of sodium fluoride (NaF) is in  $250\text{cm}^3$  of a  $2\text{ mol/dm}^3$  solution? (2)

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5. It takes  $27.00\text{cm}^3$  of hydrochloric acid to neutralise  $25.00\text{cm}^3$  of sodium hydroxide at a concentration of  $1.0\text{ mol/dm}^3$ . Calculate the concentration of hydrochloric acid in  $\text{g/cm}^3$ . (4)

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6. Calculate the volume of  $0.7\text{ mol}$  of carbon dioxide gas at RTP. (1)

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7. What is the volume  $12.3\text{g}$  of butane gas ( $\text{C}_4\text{H}_{10}$ ) at RTP? (3)

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