

## **A. Chemical Measurements part 1 – Balanced Chemical Equations and Conservation of Mass**

1. What is the law of conservation of mass?
2. Why might some reactions appear to show a change in mass?
3. Give two examples of a reaction where a change in mass may appear to take place.
4. Balance the following equations:
  - a.  $\text{H}_2 + \text{O}_2 \rightarrow \text{H}_2\text{O}$
  - b.  $\text{Ca} + \text{HCl} \rightarrow \text{CaCl}_2 + \text{H}_2$
  - c.  $\text{Li} + \text{H}_2\text{O} \rightarrow \text{LiOH} + \text{H}_2$
  - d.  $\text{NH}_3 + \text{O}_2 \rightarrow \text{NO} + \text{H}_2\text{O}$
  - e.  $\text{K} + \text{O}_2 \rightarrow \text{K}_2\text{O}$
5. How many atoms and elements are in the compound sodium aluminate,  $\text{NaAl}(\text{OH})_4$ ?
6. What do the following formulae tell you?
  - a)  $2\text{HCl}$
  - b)  $\text{Cl}_2$
7. An aqueous solution of hydrogen peroxide ( $\text{H}_2\text{O}_2$ ) decomposes to form water and oxygen.
  - a) Write a balanced symbol equation for this reaction. Include the state symbols.
  - b) Why does the water, produce during the reaction, have a lower mass than the original hydrogen peroxide?

## **B. Chemical Measurements part 2 – Relative Formula Mass**

1. What is the relative formula mass of a compound?
2. What is the relative formula mass of:
  - a)  $\text{MgCl}_2$
  - b)  $\text{C}_6\text{H}_{12}\text{O}_6$
3. What can be said about the sum of the relative formula masses of the reactants and products of a reaction?
4. Why can you have relative atomic masses which are not whole numbers e.g. chlorine is 35.5?

## C. Use of amount of substance part 1 – Amount of Substance, Equation Quantities, Moles and Equation Balancing and limiting factors (HIGHER Tier ONLY)

1. What is meant by the term 'mole'?
2. What is the symbol for the unit mole?
3. What does 'Avogadro's constant' tell us?
4. What is the value for Avogadro's constant?
5. How many atoms in 1 mole of carbon?
6. How many atoms in 1 mole of chlorine gas, Cl<sub>2</sub>?
7. What can the following equation tell us about the number of moles of each substance?

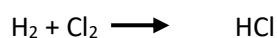


8. What is meant by the term 'limiting reactant'?
9. How many moles of helium are there in 0.04g of Helium?
10. What is the mass of 20 moles of calcium carbonate, CaCO<sub>3</sub>? Answer in Kg.
11. Calcium carbonate decomposes to calcium oxide in a kiln in the following reaction

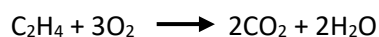


Calculate the mass of calcium oxide that can be produced when 300 tonnes of calcium carbonate is heated.

12. 0.10g of hydrogen reacts with 3.55g of chlorine to produce 3.65g of hydrogen chloride. Use this information to work out the balancing numbers for hydrogen chloride.



13. If 4.95g of ethane (C<sub>2</sub>H<sub>4</sub>) are combusted with 3.25g of oxygen, what is the limiting reagent?



## **D. Use of amount of substance - part 2 – Concentration of solutions**

1. What units can be used for the concentration of a solution?
2. What does  $\text{dm}^3$  mean?
3. Give the equation for calculating concentration from the mass of substance and volume of solution.
4. HT Only: How can you increase the concentration of an aqueous solution?
5. Calculate the concentration in  $\text{g/dm}^3$ , for 50g of sodium chloride in  $2.5\text{dm}^3$  of water.
6. Calculate the concentration, in  $\text{g/dm}^3$ , of 1.4g of potassium carbonate in  $855\text{cm}^3$  of water.
7. A teacher has a solution of lithium fluoride with a concentration of  $72.6\text{g/dm}^3$ . Calculate the mass of lithium fluoride dissolved in  $25.0\text{cm}^3$  of solution.

## **E. Percentage yield, atom economy (CHEMISTRY ONLY)**

1. What is meant by the term 'yield'?
2. What is the equation for calculating percentage yield?
3. Give 2 reasons why it is not always possible to obtain the expected amount of product from a reaction.
4. What is meant by the term 'atom economy'?
5. Why is it important to use reactions with high atom economy?
6. What is the equation for calculating the percentage atom economy from a balanced chemical equation?
7. Magnesium is heated in air to make magnesium oxide. Suggest why the actual yield might be less than the maximum theoretical yield.
8. In the neutralization of sulfuric acid with sodium hydroxide, the theoretical yield from 13.8g of sulfuric acid is 20g. In a synthesis, the actual yield is 17.4g. What is the percentage yield for this synthesis?
9. Calculate the atom economy for making hydrogen from methane and steam.



## **F. Quantities part 2 – Moles of solution and gases (CHEMISTRY HIGHER Tier ONLY)**

1. What are the units for concentration?
2. What is the equation for the calculation of concentration from the moles and volume of solution?
3. What can be said about equal amounts of moles of gases and the volume they occupy?
4. What is meant by RTP?
5. What are the values for RTP?
6. What is the concentration (in g/dm<sup>3</sup>) of a solution that has 40g of solute in 2dm<sup>3</sup> of solution?
7. Calculate the concentration, in mol/dm<sup>3</sup>, of a solution that has 0.75 mol of an acid in 3dm<sup>3</sup> of solution.
8. It takes 28.0 cm<sup>3</sup> of potassium hydroxide to neutralize 25.00cm<sup>3</sup> of nitric acid at a concentration of 0.50mol/dm<sup>3</sup>



Calculate the concentration of the potassium hydroxide.

9. What is the volume of 4.5g of oxygen?
10. Calculate the number of moles of hydrogen that occupy 6dm<sup>3</sup> at RTP.