

**English Martyrs’**

**Catholic School**

**C3 Quantative Chemistry Test**

**GCSE Higher Tier**



**60 marks available**

**Answer all questions**

**60 minutes**

|  |  |  |
| --- | --- | --- |
| **Section** | **Score**  | **Areas to improve** |
| **Relative Atomic and Formula Mass** |  **/ 14** |  |
| **Moles** |  **/ 15** |  |
| **Concentration and Gases** |  **/ 19** |  |
| **Percentage Yield and Atom Economy** |  **/ 12** |  |
| **Total Marks** |  **/ 60** | **Test****Grade:** |  | **Expected Grade:** |  |

**Relative Atomic and Formula Mass**

1. Calculate the relative **formula masses** of these substances:

 **NaF** \_\_\_\_\_\_\_  **PH3 \_\_\_\_\_\_\_**

**C2O4H2 \_\_\_\_\_\_\_ Mg(OH)2 \_\_\_\_\_\_\_**

[4 marks]

1. In this reaction:

**C2H4 + H2 → C2H6**

What is the formula mass of: **C2H4** \_\_\_ , **H2**  \_\_\_ , **C2H6** \_\_\_

What do you notice about the mass of the reactants compared to the products? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

 [4 marks]

1. Calculate the relative formula mass (Mr) of iron sulfate Fe2(SO4)3

Relative atomic masses (Ar): oxygen = 16; iron = 56; sulfur = 32

Relative formula mass = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

[2 marks]

1. There are two isotopes of element A

Mass number of the isotope **6 7**

Percentage abundance **92.5% 7.5%**

Use the information in the table above to calculate the relative atomic mass of element A. Give your answer to **2 decimal places**.

Relative atomic mass = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

[4 marks]

**Moles**

1. Calculate the mass of the following:

 3 moles of CO2 \_\_\_\_\_\_\_\_\_\_\_

 0.5 moles of MgCO3 \_\_\_\_\_\_\_\_\_\_\_

 1.5 moles of Cu(OH)2 \_\_\_\_\_\_\_\_\_\_\_

 [3 marks]

1. Calculate the number of moles of NH3 in 68g \_\_\_\_\_\_\_
2. Calculate the number of moles of H2SO4 in 19.6g \_\_\_\_\_\_\_

[2 marks]

1. 210g of Nitrogen react to produce what mass of ammonia (NH3)?

N2 + 3H2 → 2NH3

[3 marks]

1. When potassium nitrate (KNO3) is heated, it decomposes into potassium nitrite (KNO2) and oxygen (O2). 20.2g of KNO3 decomposes into 17.0g of KNO2 and 3.2g of O2. Find values for *a,* *b* and *c*:

 *a* **KNO3** **→** *b* **KNO2 +** *c* **O2**

* + 1. How many moles of KNO3 are in 20.2g? \_\_\_\_\_\_\_\_\_
		2. How many moles of KNO2 are in 17.0g? \_\_\_\_\_\_\_\_\_
		3. How many moles of O2 are in 3.2g? \_\_\_\_\_\_\_\_\_

We need to simplify these numbers by dividing both by the smallest value.

*a* = \_\_\_\_ *b* = \_\_\_\_ *c* = \_\_\_\_

 [4 marks]

1. Determine the maximum mass of CaO that can be produced from 120g of calcium and 72g of oxygen.

2Ca + O2 → 2CaO

[3 marks]

**Concentration of Solutions**

1. If 5g of lead nitrate is dissolved in 0.2 dm3 of solution, what is the concentration in g/dm3?

 [1 mark]

1. Convert the following volumes to dm3:
2. 2000cm3 = \_\_\_\_\_\_\_\_ dm3  b. 500cm3 = \_\_\_\_\_\_\_\_ dm3

[2 marks]

1. If 2.5g of potassium chloride is dissolved in 500 cm3 of solution, what is the concentration in g/dm3?
2. If 8g of copper bromide is dissolved in 250 cm3 of solution, what is the concentration in **mol/dm3**?

[2 marks]

1. At 30 °C the solubility of sodium chloride is 36 kg per 100 dm3.

Calculate the minimum volume of water in dm3, at 30 °C, needed to dissolve

1989 kg sodium chloride. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Volume of water = \_\_\_\_\_\_\_\_\_ dm3

[2 marks]

1. If 108g of glucose (Mr = 180) is dissolved to form a solution with a concentration of

0.30 mol/dm3, what is the volume of the solution in cm3?

[2 marks]

1. The volume of one mole of any gas at room temperature and pressure is **24 dm3**.

 **Calculate the volume of these gases at rtp (remember to include the unit of volume):**

1. 1 mol of Ne \_\_\_\_\_\_ b. 2 mol of SO2 \_\_\_\_\_\_ c. 0.2 mol of N2 \_\_\_\_\_\_

[3 marks]

 **Calculate the volume of each gas using its mass, by first converting this to no. of moles:**

1. 64g of O2 \_\_\_\_\_\_ f. 12g of Ar \_\_\_\_\_\_

[2 marks]

 **Calculate the no. of moles of these gases at rtp (remember to check the unit of volume):**

1. 96 dm3 of He \_\_\_\_\_\_ h. 240 dm3 of CH4 \_\_\_\_\_\_ i. 12 dm3 of N2 \_\_\_\_\_\_

[3 marks]

 **You can also calculate mass of a gas, by first calculating the no. of moles:**

1. 1.44 dm3 of C2H6 \_\_\_\_\_\_ k. 12000cm3 of H2 \_\_\_\_\_\_

[2 marks]

**Percentage Yield and Atom Economy**

1. A reaction produces 30g of product, but in theory it could make a maximum of 120g. What is the percentage yield?
2. Very few chemical reactions have a yield of 100%.

List three reasons why:

*
*

[4 marks]

**Atom economy = Relative formula mass of desired product from equation × 100**

**Sum of relative formula masses of all reactants from equation**

1. In a reaction to produce SO3 gas, what is the atom economy of the following reaction?

 **2SO2 + O2 → 2SO3**

* 1. Add up the Mr of all the reactants \_\_\_\_\_\_\_
	2. Calculate the Mr of the **useful** product \_\_\_\_\_\_\_
	3. Calculate the percentage atom economy \_\_\_\_\_\_\_%

[3 marks]

1. Why is it important for sustainable development and for economic reasons to use reactions with high atom economy?

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

[2 marks]

1. The equation for the reaction of sodium carbonate and nitrate acid is:

**Na2CO3 + 2HNO3 → 2NaNO3 + H2O + CO2**

Relative formula masses: **Na2CO3** = 123.5; **HNO3**= 98.0; **NaNO3** = 85

Calculate the percentage atom economy for making sodium nitrate from sodium carbonate.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

 Atom economy = \_\_\_\_\_\_ %

[3 marks]

 C3 Test HT (2017) by Ian Sadler ([English Martyrs’ Catholic School](http://www.englishmartyrs.org/)) shared under a [Creative Commons Attribution 4.0 International License](http://creativecommons.org/licenses/by/4.0/).