

**English Martyrs’**

**Catholic School**

**C3 Quantative Chemistry Test**

**GCSE Foundation Tier**



**40 marks available**

**Answer all questions**

**40 minutes**

|  |  |  |
| --- | --- | --- |
| **Section** | **Score**  | **Areas to improve** |
| **Relative Atomic and Formula Mass** |  **/ 16** |  |
| **Concentration of Solutions** |  **/ 8** |  |
| **Percentage Yield and Atom Economy** |  **/ 16** |  |
| **Total Marks** |  **/ 40** | **Test****Grade:** |  | **Expected Grade:** |  |

**Relative Atomic and Formula Mass**

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

 **NaF** \_\_42\_\_\_\_  **PH3 \_\_\_\_34\_**

**AgNO3** \_\_170\_\_\_  **H2O \_\_\_\_18\_**

**C2O4H2 \_\_**90**\_\_\_ Mg(OH)2 \_\_\_\_58\_**

[6 marks]

1. In this reaction:

**C2H4 + H2 → C2H6**

What is the formula mass of: **C2H4** \_28\_ , **H2**  \_2\_ , **C2H6** \_30\_

What do you notice about the mass of the reactants compared to the products? \_\_\_\_THEY ARE THE SAME\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

 [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 = \_\_\_\_\_\_Sulfate = 32 + (4 x 16) = 96\_\_\_\_ 1 mark \_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_Total = (2 x 56) + (3 x 96) = 400\_1 mark \_\_\_\_\_\_\_

 [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 = \_\_\_\_\_\_(6 x 92.5/100)\_\_\_[1 mark]\_\_\_= 5.55\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_(7 x 7.5/100) \_\_\_\_[1 mark]\_\_\_= 0.525 \_\_\_[1]\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_Total = 6.075\_\_\_[1]\_\_all [4 marks] for correct ans.

**Concentration of Solutions**

1. If 5g of lead nitrate is dissolved in 0.2 dm3 of solution, what is the concentration in g/dm3? **25**
2. If 16g of sodium nitrite is dissolved in 4 dm3 of solution, what is the concentration in g/dm3? **4**

[2 marks]

1. Convert the following volumes to dm3:
2. 2000cm3 = \_\_**2**\_\_\_\_ dm3  b. 500cm3 = \_\_0.5\_\_\_\_ dm3

[2 marks]

1. If 2.5g of potassium chloride is dissolved in 500 cm3 of solution, what is the concentration in g/dm3? 5
2. If 8g of copper bromide is dissolved in 250 cm3 of solution, what is the concentration in g/dm3? 32

[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. \_\_\_\_\_\_\_1989 / 36 = 55.25 [1]\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_55.25 x 100 = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Volume of water = \_\_**5525**\_ dm3 [1] – full marks for correct answer

[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? 25%
2. A reaction could produce a theoretical yield of 200g but only makes 150g. What is the percentage yield? 75%
3. Very few chemical reactions have a yield of 100%.

List three reasons why:

* some of the product may be lost (when it is separated from the reaction mixture)
* some of the reactants may react in ways different to the expected reaction
* the reaction may not go to completion because it is **reversible**

 [5 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 \_\_160\_\_
	2. Calculate the Mr of the **useful** product \_\_160\_\_
	3. Calculate the percentage atom economy \_\_100\_\_%

[3 marks]

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

 **2Na + 2H2O → 2NaOH + H2**

1. Add up the Mr of all the reactants \_\_82\_\_
2. Calculate the Mr of the **useful** product \_\_80\_\_
3. Calculate the percentage atom economy \_\_98\_\_\_%

[3 marks]

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

use less raw materials

 produce fewer waste products

[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.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_123.5 +(2 x 98.0) = 221.5 [1]\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (85 x 2) = 170 [1] \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

 Atom economy = \_\_77\_[1]\_\_\_ %

Full marks for correct answer

[3 marks]

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