Topic 8: Quantitative aspects of chemical change - Questions

MULTIPLE CHOICE QUESTIONS

1 The molar mass of sodium sulphate is ….

A 70 $g.mol^{-1}$

B 98 $g.mol^{-1}$

C 119 $g.mol^{-1}$

D 142 $g.mol^{-1}$ [CL2] (2)

2 During a reaction 0,02 moles of magnesium were ignited in excess oxygen at standard temperature and pressure. The reaction that occurred is shown below:

$2Mg(s) + O_2(g) \longrightarrow 2MgO(s)$

The volume of O_2 that reacted with the magnesium was ….

A 0,320 dm^3

B 0,160 dm^3

C 0,224 dm^3

D 0,224 cm^3 [CL2] (2)

3 Consider the reaction:

$C_3H_8(g) + 5O_2(g) \rightarrow 3CO_2(g) + 4H_2O(g)$

If the rate of appearance of CO_2 is 0,8 $mol \cdot s^{-1}$, the rate of disappearance of O_2 is:

A 0,8 $mol \cdot s^{-1}$

B 0,48 $mol \cdot s^{-1}$

C 0,27 $mol \cdot s^{-1}$

D 1,33 $mol \cdot s^{-1}$ [CL2] (2)

4 Which of the following solutions contains the greatest number of dissolved ions?

A 50 cm^3 of 0,1 $mol.dm^{-3}$ LiF

B 100 cm^3 of 0,2 $mol.dm^{-3}$ KCl

C 100 cm^3 of 0,1 $mol.dm^{-3}$ $MgCl_2$

D 50 cm^3 of 0,2 $mol.dm^{-3}$ Na_2O [CL3] (2)

5. Water is formed when oxygen reacts with hydrogen according to the following **un**balanced reaction: $H_2 + O_2 \rightarrow H_2O$

What mass of oxygen is required to react completely with 2 g of hydrogen?

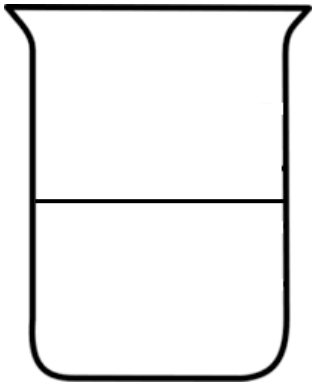
A 12 g

B 16 g

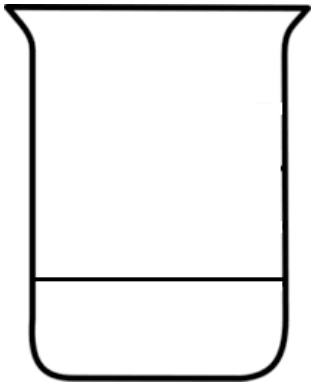
C 96 g

D 144 g [CL3] (2)

6. Consider beakers A and B below:



Beaker A
200cm^3
0,25 mol.dm^{-3}
$NaOH_{(aq)}$



Beaker B
150cm^3
0,1 mol.dm^{-3}
$NaC\ell_{(aq)}$

20cm^3 of the $NaOH_{(aq)}$ solution in beaker A is added to the $NaC\ell_{(aq)}$ solution in beaker B. Which one of the following represents the correct calculation for the **new concentration** of $Na^+_{(aq)}$ ions in beaker B?

A $\frac{0,015+0,005}{0,17}$

B $\frac{0,015+0.05}{0,17}$

C $\frac{0,015\times0,05}{0,15}$

D $\frac{0,015+0,005}{0,15}$ [CL4] (2)

LONG QUESTIONS

1 Iron (Fe) reacts with sulphur (S) to form iron sulphide (FeS) according to the following balanced equation:
Fe(s) + S(s) → FeS

1.1. Define the term limiting reactant. [CL1] (2)

1.2. Calculate which of the two substances will be used up completely if 20 g of Fe and 10 g of S are mixed and heated. [CL3] (5)

1.3. How many grams of the other substance are in excess? [CL2] (2)

1.4. Magnesium burns in air to form magnesium oxide according to the following balanced equation:

$$2Mg(s) + O_2(g) \rightarrow 2MgO(s)$$

1.5. If the percentage yield of this reaction is only 80%, calculate the mass of magnesium that needs to be burned to produce 30 g of magnesium oxide. [CL4] (6)

[15]

1. A standard solution of CH_3CH_2OH is made up so that it will have a volume of 0,25 dm^3 and a concentration of 0,5 $mol.dm^{-3}$.

The standard solution is made up using distilled water.

2.1.1 **Name** the solute used to make this solution. [CL1] (2)

2.1.2 Calculate the mass of CH_3CH_2OH required to make up the standard solution. [CL2] (4)

2.2 27 g of propane is burnt in air, according to the equation

$$C_3H_8 + 5O_2 \rightarrow 3CO_2 + 4H_2O$$

2.2.1 27,0 g of propane is burnt. What mass of CO_2 will be produced? [CL2] (5)

2.2.2 What would the volume of this gas be at STP? [CL2] (2)

[13]

3 A learner reacts ethanoic acid and potassium hydroxide. She repeats the experiment, a titration, a number of times until she obtains 3 results that have a high degree of precision. The concentration of the standard KOH solution she uses is 0,1 $mol.dm^{-3}$. She calculates that the average volume of KOH required to neutralise 25,0 cm^3 of vinegar solution is 44,1 cm^3.

$$\mathbf{CH_3COOH_{(aq)} + KOH_{(aq)} \longrightarrow CH_3COOK_{(aq)} + H_2O_{(l)}}$$

3.1.1 Explain how the learner will determine whether her results "have a high degree of precision".

3.1.2 Calculate the number of moles of ethanoic acid in the vinegar solution. [CL2] (4)

3.1.3 Hence, calculate the mass of ethanoic acid in the vinegar solution. [CL2] (3)

3.1.4 If 5g of White Spirit Vinegar was used to make up the 25cm^3 vinegar solution used in the titration, calculate the percentage (by mass) of ethanoic acid in White Spirit Vinegar. [CL3] (2)

3.2 During her titrations the learner used a burette to measure out the volume of KOH required to neutralise the vinegar solution. Describe two precautions that Mary should take when using the burette to ensure that the measurements that she takes with the burette are as accurate as possible. [CL3] (2)

[13]

4 Magnesium burns in air to form magnesium oxide according to the following balanced equation:

$$2Mg(s) + O_2(g) \rightarrow 2MgO(s)$$

If 2,4g of magnesium combines with 0,8g of oxygen, which is at STP:

4.1 What does STP stand for? [CL1] (1)

4.2 Calculate how many moles of magnesium **and** how many moles of oxygen is present. [CL2] (3)

4.3 Which of the two substances will be used up completely? [CL3] (2)

4.4 Determine how many moles of the other substance is in excess. [CL2] (2)

4.5 What mass of product will form? [CL2] (3)

[11]

5 20 g of impure iron reacts with excess sulphuric acid, releasing 5 dm^3 of hydrogen gas. The reaction is presented below:

$$Fe + H_2SO_4 \rightarrow FeSO_4 + H_2$$

5.1.1 Calculate the number of moles of hydrogen gas released. (2)

5.1.2 Write down the number of moles of pure Fe which reacted. (1)

5.1.3 Calculate the percentage purity of the iron. (3)

5.2 Consider the balanced equation shown below. The yield for the production of water is 68,7%.

$$2\ HNO_3 + NO \rightarrow 3\ NO_2 + H_2O$$

5.2.1 If 44,1 g of HNO_3 reacts completely with nitrogen monoxide, calculate the theoretical mass of water which is produced. (4)

5.2.2 Considering the yield for this reaction (68,7%), now calculate the actual mass of water which is produced. (2)

[12]

6 A standard solution of $Mg(OH)_2$ is made up so that it will have a volume of 0,25 dm^3 and a concentration of 0,5 $mol.dm^{-3}$.

The standard solution is made up using distilled water.

6.1 **Name** the solute used to make this solution. [CL1] (2)

6.2 Calculate the mass of solid $Mg(OH)_2$ required to make up the standard solution. [CL2] (6)

6.3 If the solution needed to be diluted to a concentration of 0,2 $mol.dm^{-3}$, how much additional distilled water would need to be added? [CL4](4)

[12]