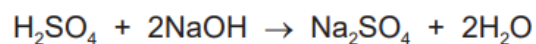


Q1

20.0 cm<sup>3</sup> of H<sub>2</sub>SO<sub>4</sub> reacts with 25.0 cm<sup>3</sup> of 0.200 mol/dm<sup>3</sup> NaOH.

The equation for the reaction is shown.



Calculate the concentration of H<sub>2</sub>SO<sub>4</sub> using the following steps.

- Calculate the number of moles in 25.0 cm<sup>3</sup> of 0.200 mol/dm<sup>3</sup> NaOH.

..... mol

- Determine the number of moles of H<sub>2</sub>SO<sub>4</sub> that react with the NaOH.

..... mol

- Calculate the concentration of H<sub>2</sub>SO<sub>4</sub>.

..... mol/dm<sup>3</sup>  
[3]

Q2

Ester **Y** has the following composition by mass:

C, 48.65%; H, 8.11%; O, 43.24%.

Calculate the empirical formula of ester **Y**.

empirical formula = ..... [3]

Ester **Z** has the empirical formula  $\text{C}_2\text{H}_4\text{O}$  and a relative molecular mass of 88.

Determine the molecular formula of ester **Z**.

molecular formula = ..... [1]

Q3

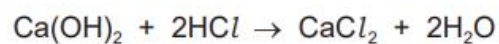
Fluorine reacts with sulfur to form a compound which has 25.2% sulfur by mass and a relative molecular mass of 254.

Determine the molecular formula of this compound.

molecular formula = ..... [3]

Q4

The equation for the reaction is shown.



20.0 cm<sup>3</sup> of 0.0500 mol/dm<sup>3</sup> HCl reacts with the 25.0 cm<sup>3</sup> of Ca(OH)<sub>2</sub>.

Determine the concentration of Ca(OH)<sub>2</sub> in g/dm<sup>3</sup>. Use the following steps.

- Calculate the number of moles in 20.0 cm<sup>3</sup> of 0.0500 mol/dm<sup>3</sup> HCl.

..... mol

- Determine the number of moles of Ca(OH)<sub>2</sub> in 25.0 cm<sup>3</sup> of the limewater.

..... mol

- Calculate the concentration of Ca(OH)<sub>2</sub> in mol/dm<sup>3</sup>.

..... mol/dm<sup>3</sup>

- Determine the concentration of Ca(OH)<sub>2</sub> in g/dm<sup>3</sup>.

..... g/dm<sup>3</sup>  
[5]

Q5

When hydrated sodium sulfate crystals,  $\text{Na}_2\text{SO}_4 \cdot x\text{H}_2\text{O}$ , are heated, they give off water.



In an experiment, 1.61 g of  $\text{Na}_2\text{SO}_4 \cdot x\text{H}_2\text{O}$  is heated until all the water is given off. The mass of  $\text{Na}_2\text{SO}_4$  remaining is 0.71 g.

[ $M_r$ :  $\text{Na}_2\text{SO}_4$ , 142;  $\text{H}_2\text{O}$ , 18]

Determine the value of  $x$  using the following steps.

- Calculate the number of moles of  $\text{Na}_2\text{SO}_4$  remaining.

..... mol

- Calculate the mass of  $\text{H}_2\text{O}$  given off.

..... g

- Calculate the number of moles of  $\text{H}_2\text{O}$  given off.

..... mol

- Determine the value of  $x$ .

$x =$  .....

[4]

6

Many organic compounds contain carbon, hydrogen and oxygen only.

(a) An organic compound **V** has the following composition by mass.

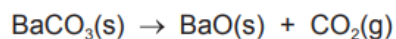
C, 48.65%; H, 8.11%; O, 43.24%

Calculate the empirical formula of compound **V**.

empirical formula = ..... [3]

7

Barium carbonate decomposes when heated.



(a) A student heated a 10.0g sample of barium carbonate until it was fully decomposed.

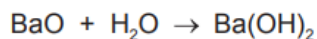
(i) Calculate the number of moles of barium carbonate the student used.

moles of barium carbonate = ..... mol [2]

(ii) Calculate the volume of carbon dioxide gas produced at room temperature and pressure.  
Give your answer in  $\text{dm}^3$ .

volume of carbon dioxide = .....  $\text{dm}^3$  [1]

(b) The student added 2.00g of the barium oxide produced to water.



Calculate the mass of barium hydroxide that can be made from 2.00g of barium oxide. The  $M_r$  of  $\text{Ba}(\text{OH})_2$  is 171.

mass of barium hydroxide = ..... g [1]

(ii) Calculate the concentration of the hydrochloric acid used.

concentration of hydrochloric acid = ..... mol/dm<sup>3</sup> [2]

[Total: 7]

8

Hydrolysis of a polymer gave a compound with the following composition by mass: C, 34.61%; H, 3.85%; O, 61.54%.

(i) Calculate the empirical formula of the compound.

empirical formula = ..... [3]