

AS level Chemistry A
H032/02 Depth in chemistry

Question Set 15

1. Magnesium nitrate is used in fertilisers as a source of nitrogen.

(a)* A student plans to prepare 250.0 cm^3 of a $0.4000 \text{ mol dm}^{-3}$ solution of magnesium nitrate, starting from magnesium nitrate crystals, $\text{Mg}(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$.

Describe how the student would prepare the solution, giving full details of quantities, apparatus and method.

[6]

moles of $\text{Mg}(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$:

$$0.25 \times 0.4 = 0.1$$

$$\begin{aligned} \text{mass} &= n \times M_r \\ &= 0.1 \times 256.3 \\ &= 25.63 \text{ g} \end{aligned}$$

Method:

1. Weigh out 25.63 g of the magnesium nitrate using a scale balance using the weigh by difference method: first weigh an empty crucible, then add the crystals and record mass of crystals + crucible, then transfer the crystals to a 250 cm^3 glass beaker and re-weigh the crucible. Find the difference in mass of the empty and full crucible after transfer.
2. Add 100 cm^3 distilled water to the crystals and stir with a glass stirring rod.
3. Transfer the solution to a 250 cm^3 volumetric flask and wash the beaker, funnel and stirring rod using distilled water. Add all washings to the flask.
4. Make up the solution to the 250 cm^3 mark using distilled water and a pipette and stopper the flask.
5. Invert several times to ensure all contents are well distributed.

- (b) A solution of magnesium nitrate can be prepared by reacting magnesium carbonate, MgCO_3 , with nitric acid, $\text{HNO}_3(\text{aq})$.

The equation is shown below.



Calculate the minimum volume, in cm^3 , of 1.75 mol dm^{-3} HNO_3 that is needed to prepare a solution containing 5.00 g of $\text{Mg}(\text{NO}_3)_2$.

Give your answer to 3 significant figures.

moles ($\text{Mg}(\text{NO}_3)_2$) :

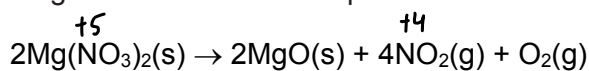
$$\frac{5.00}{148.3} = 0.033715$$

$$\begin{aligned} \text{moles of } \text{HNO}_3 &= 0.0337 \times 2 \\ &= 0.06743 \end{aligned}$$

$$\text{volume} = \frac{n}{c} = \frac{0.06743}{1.75} = 0.038531 \text{ dm}^3$$
$$= \underline{\underline{38.5 \text{ cm}^3}}$$

[3]

- (c) Magnesium nitrate decomposes when heated, as shown in the equation.



Using oxidation numbers, show which element has been oxidised and which has been reduced when magnesium nitrate decomposes.

State the changes in oxidation numbers, including all signs.

Element oxidisedoxygen.....

Oxidation number change: from-2.... to ..0.....

Element reducednitrogen.....

Oxidation number change: from+5.... to+4.....

[2]

Total Marks for Question Set 2: 11

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