

Friday Worksheet

Name:

Gravimetric worksheet 5

- 1) A 12.42 gram sample of ammonium phosphate $(\text{NH}_4)_3\text{PO}_4$ (149.1 g/mol) was placed in a 250 mL volumetric flask and filled to the mark with distilled water. What is the concentration of ammonium ions in the flask?

Step 1 Calculate the mol of $(\text{NH}_4)_3\text{PO}_4$

$$\Rightarrow 12.42 / 149.1 = 0.08330$$

Step 2 Calculate the mol of ammonium ions

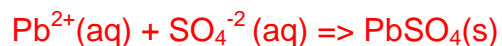
$$\Rightarrow 0.08330 \times 3 = 0.2499$$

Step 3 Calculate the concentration of ammonium ions

$$\Rightarrow 0.2499 / 0.250 = 1.00 \text{ M}$$

- 2) Many garden fertilisers contain sulfate ions as one of their components. A 3.21 g sample of fertiliser was crushed dissolved in distilled water and filtered. Lead nitrate was used to precipitate the sulphate as lead sulphate (303.3 g/mol) from the filtrate. The precipitate was filtered, washed and dried. After weighing, it had a mass of 1.34 g.

- (a) Write the ionic equation for the precipitation reaction.



- (b) Calculate the number of moles of lead sulfate precipitated.

$$1.34 / 303.3 = 4.42 \times 10^{-3}$$

- (c) What is the percentage of sulfate by mass present in the fertiliser?

Step 1 Calculate the mol of sulphate

$$\Rightarrow 4.42 \times 10^{-3}$$

Step 2 Calculate the mass of sulphate

$$\Rightarrow 4.42 \times 10^{-3} \times 96.1 = 0.425\text{g}$$

Step 3 Calculate the percentage of sulphate by mass

$$\Rightarrow (0.425 / 3.21) \times 100 = 13.2\%$$

(d) What is the percentage, by mass, of sulphur present in the fertiliser?

Step 1 Calculate the mol of sulphur

$$\Rightarrow n_{\text{sulfur}} = n_{\text{sulfate}} = 4.42 \times 10^{-3}$$

Step 2 Calculate the mass of sulphur

$$\Rightarrow 4.42 \times 10^{-3} \times 32.1 = 0.142\text{g}$$

Step 3 Calculate the percentage, by mass, of sulphur

$$\Rightarrow (0.142 / 3.21) \times 100 = 4.42\%$$

(e) A 2.52 g sample of a brand of fertiliser was analysed and found to contain 12.7% by mass of sulphate.

i) What should the mass of the precipitate be?

Step 1 Find the mass of sulphate in the fertiliser

$$\Rightarrow (12.7 / 100) \times 2.52 = 0.320\text{g}$$

Step 2 Find the mol of sulphate

$$\Rightarrow 0.320 / 96.1 = 3.33 \times 10^{-3}$$

Step 3 Find the mol PbSO_4

$$\Rightarrow n_{\text{lead sulphate}} = n_{\text{sulphate}} = 3.33 \times 10^{-3}$$

Step 4 Find the mass of lead sulphate

$$\Rightarrow 3.33 \times 10^{-3} \times 303.3 = 1.01\text{g}$$

ii) A student obtained a precipitate of mass 1.55 grams. Which of the following may have caused this result? Explain

a) Failure to wash the precipitate

This will cause an over estimation of amount of precipitate due to spectator ions crystallising on the precipitate.

b) Failure to properly crush the fertiliser before dissolving

Causes a reduction in the sulphate ions present in the filtrate.

c) Not washing the fertiliser residue in the filter paper thoroughly

Causes a reduction in the sulphate ions present in the filtrate.

d) Using too much water to dissolve the fertiliser

No impact on the amount of precipitate.