

Solubility: teacher guidance

These **In context** worksheets ask learners to use their knowledge of solubility in an applied context, building their confidence and capability to face exam questions. Calculation questions are included to give opportunities to practise mathematical skills within this topic. The worksheets are available at Foundation and Higher level and as fully editable versions, giving you the flexibility to select the questions most relevant to a particular lesson.

Also available to assess this topic:

- **Review my learning worksheets:** available with three levels of scaffolded support to help build confidence in every learner. Use before, during or after teaching the relevant topic to understand progress and identify misconceptions, rsc.li/44igB7V.
- **Knowledge check worksheets:** select from Foundation and Higher level to assess learners' knowledge and understanding of this topic at the end of a period of teaching or as revision, rsc.li/4uSvyue.

Answers

Foundation tier

1 (a) titration

(b) **D** volumetric pipette

(c) $\text{mass} = 4.00 \times \frac{25}{1000}$
 $= 0.10 \text{ g}$

(d) Methyl orange is an indicator.

(e) yellow

2 (a) **B** methyl orange and sodium chloride solution

(b) i. 0.20 cm^3

ii. 21.80 cm^3

iii. 21.60 cm^3

3 (a) The solution is heated to reduce the volume by half, then left to crystallise in a crystallising dish.

(b) **A** Methyl orange would contaminate the sodium chloride.

$$\begin{aligned} \text{(c) percentage yield} &= \frac{0.07}{0.15} \times 100 \\ &= 46.7\% \end{aligned}$$

$$\text{(d) } M_r \text{NaCl} = 23 + 35.5 = 58.5$$

$$\begin{aligned} M_r \text{ reactants} &= (23 + 16 + 1) + (1 + 35.5) \\ &= 76.5 \end{aligned}$$

$$\text{percentage atom economy} = \frac{58.5}{76.5} \times 100$$

$$\text{percentage atom economy} = 76.5\% \text{ (3 sig fig)}$$

Higher tier

1 (a) Methyl orange is an indicator and is used to detect an end point.

(b) Answer to include the following:

- Dilute hydrochloric acid is added from the burette, 1 cm³ at a time.
- The contents are swirled after each addition.
- When the yellow colour starts to change, the acid is added drop by drop until an orange colour just persists.
- Initial and final burette readings are recorded.

(c) A pH meter could be used. The contents of the conical flask will record pH 7 at the end point.

(d) 21.60 cm³

2 (a) The procedure was repeated to produce an uncontaminated solution of sodium chloride.

(b) The solution is evaporated to half volume (Step 2), then left to crystallise in a crystallising dish (Step 3).

3 (a) $\text{NaOH(aq)} + \text{HCl(aq)} \rightarrow \text{NaCl(aq)} + \text{H}_2\text{O(l)}$

(b) number of moles of NaOH in 25 cm³ solution = $0.10 \times \frac{25.00}{1000} = 2.5 \times 10^{-3}$ mol

(c) From the equation 1 mol NaOH produces 1 mol NaCl.
Therefore, 2.5×10^{-3} mol NaOH produces 2.5×10^{-3} mol NaCl.

(d) $M_r \text{ NaCl} = 23 + 35.5 = 58.5$
 $\text{mass (g)} = (2.5 \times 10^{-3}) \times 58.5$
 $= 0.146 \text{ g NaCl (3 sig fig)}$

(e) i. $\text{percentage yield} = \frac{0.070}{0.146} \times 100$
 $= 47.9\% \text{ (3 sig fig)}$

ii. Percentage yield is less than 100% because some product may remain in the apparatus used to prepare it or the reaction might not be complete.

(f) $\text{percentage atom economy} = \frac{58.5}{76.5} \times 100$
 $= 76.5\% \text{ (3 sig fig)}$

4 (a) Titration is used to prepare a soluble salt from an acid and a soluble substance. Fe(OH)_2 is not soluble.

(b) Add Fe(OH)_2 to hot dilute hydrochloric acid until no more dissolves and Fe(OH)_2 is in excess. Then filter the resulting mixture to remove the excess Fe(OH)_2 and either leave the filtrate to crystallise or evaporate to half volume to remove some of the water and until crystals start to form, and then leave to crystallise.