

Solutions

Each answer shows the steps, then the **result**.

2.1

- an insoluble solid from a liquid: **filtration**

2.2

- impurities **lower** the melting point

2.3

- **simple distillation**
- water boils, is condensed and collected; dissolved salts **stay behind**

2.4

- **pencil**, because ink would dissolve and separate
- **above the solvent**, so the spots are not washed off

2.5

$$R_f = \frac{2.7 \text{ cm}}{9.0 \text{ cm}} = \mathbf{0.30}$$

3.1 C

- two liquids with different boiling points: **fractional distillation**
- A is solid/liquid; B is a solid from solution; D is dyes

3.2

(a)

- **simple distillation**

(b)

- water **boils off** and is cooled in the condenser
- the **salt is left** in the flask

3.3

- measure its **melting (or boiling) point**
- a pure substance melts at a **sharp, fixed** temperature; impurities **lower** it

3.4

(a)

- **filtration**
- sand is the **residue** in the filter paper

(b)

- evaporate to crystallisation, cool, filter and dry
- crystallisation is preferred because boiling dry can **decompose** the solid or leave impurities

(c)

- **fractional distillation**
- ethanol has the **lower boiling point**, so it vaporises first
- water vapour condenses in the column and runs back
- ethanol vapour is cooled in the condenser and collected

(d)

- **ethanol** is collected first
- 78 °C is lower than water's 100 °C

(e)

$$R_f = \frac{4.4 \text{ cm}}{8.0 \text{ cm}} = \mathbf{0.55}$$

- the same R_f as a known dye means the unknown is **likely that dye**