Solutions

Marking: **M1** a correct method, **A1** the correct answer, **B1** an independent mark.

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

2.1

- acid: proton donor
- base: proton acceptor

2.2

- a strong acid is fully dissociated in water
- a weak acid is only partly dissociated

2.3

- acid: $\mathbf{H_2O}$
- base: $\mathbf{NH_3}$

2.4

- $\mathbf{SO_4^{2-}}$

3.1

- $CH_3COOH + H_2O \rightleftharpoons CH_3COO^- + H_3O^+$
- CH_3COOH/CH_3COO^-
- H_3O^+/H_2O

3.2

- HCl is fully dissociated; ethanoic acid only partly
- so HCl has a higher concentration of ions to carry charge

3.3

- use equal volumes and equal concentrations of each acid
- hydrochloric acid has the lower pH
- hydrochloric acid fizzes faster with magnesium

3.4

- hydrochloric acid reacts faster: higher $[H^+]$
- the total volumes are the same
- as H^+ is used, more ethanoic acid dissociates until all has reacted

3.5

(a) the starting pH is about 3, higher than for a strong acid; the vertical section is at about pH 7–11, equivalence above 7

(b) **phenolphthalein**: its range lies within the vertical section

(c) $CH_3COOH + NaOH \rightarrow CH_3COONa + H_2O$; $n(NaOH) = 0.100 \times 0.0250 = 2.50 \times 10^{-3}$ mol; $[CH_3COOH] = \mathbf{0.100\ mol\,dm^{-3}}$

(d) starts lower, at about pH 1; vertical section longer, about pH 3–11, equivalence at pH 7

(e) the solution contains sodium ethanoate, the salt of a weak acid; ethanoate ions accept protons from water, forming OH^-