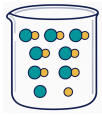
Weak Acids Map

AQA A-level Chemistry · 3.1.12.4 Weak acids

1 Weak acids

3.1.12.4

- **Partially dissociated**
- $HA \rightleftharpoons H^+ + A^-$
- Equilibrium well to the left
- % dissociated = $[H^+] \div c \times 100$
- Weak ≠ dilute



2 K_a

3.1.12.4

- $K_a = [H^+][A^-] \div [HA]$
- Equilibrium concentrations
- Units: **mol dm^{-3}**
- No $[H_2O]$ term
- Larger K_a: **stronger**

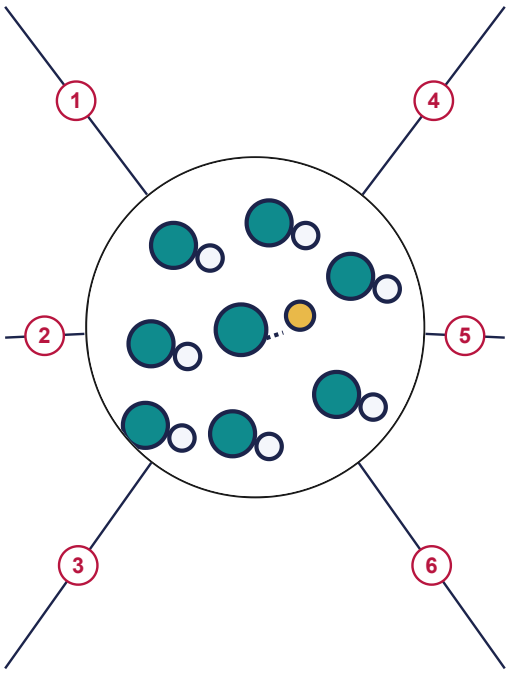


3 pK_a

3.1.12.4

- $pK_a = -\log_{10}K_a$
- $K_a = 10^{-pK_a}$
- Ethanoic acid: 4.76
- Smaller pK_a: **stronger**
- 1 unit = ×10 in K_a





4 pH of a weak acid

3.1.12.4

- $[H^+] = [A^-]$ (water ignored)
- $[HA] \approx c$ (little dissociates)
- $[H^+] = \sqrt{(K_a \times c)}$
- Backwards: $c = [H^+]^2 \div K_a$
- Check: under about 5 %



5 Measuring pH

RP 9

- pH meter: **calibrate** first
- Buffers of known pH
- **Rinse** the probe each time
- Wait for a **steady** reading
- Same temperature throughout



6 Finding K_a

3.1.12.4, RP 9

- Known mass: $K_a = [H^+]^2 \div c$
- Half-neutralised: $[HA] = [A^-]$
- So $pH = pK_a$
- RP 9: titrate, neutralise,
- add equal acid, read pH



Some weak acids at 298 K

pH of 0.100 mol dm^{-3} solutions from $[H^+] = \sqrt{(K_a c)}$

Acid	pK_a	K_a / mol dm^{-3}	pH (0.100 mol dm^{-3})
chloroethanoic acid, $CH_2ClCOOH$	2.86	1.38×10^{-3}	1.93 (estimate fails: 12 %)
methanoic acid, $HCOOH$	3.75	1.78×10^{-4}	2.38
benzoic acid, C_6H_5COOH	4.20	6.31×10^{-5}	2.60
ethanoic acid, CH_3COOH	4.76	1.74×10^{-5}	2.88
propanoic acid, CH_3CH_2COOH	4.87	1.35×10^{-5}	2.94

Worked examples

pH from pK_a

- 0.0500 mol dm^{-3} benzoic
- $[H^+] = \sqrt{(6.31 \times 10^{-5} \times 0.0500)}$
- **pH 2.75**

K_a from a mass

- 1.50 g CH_3COOH in 250 cm^3
- c = 0.100; pH 2.88
- **$K_a = 1.74 \times 10^{-5}$**

Half-way

- equivalence 22.40 cm^3
- pH at 11.20 cm^3: 4.87
- **$pK_a = 4.87$**

pH curves follow in 3.1.12.5; buffers, $pH = pK_a + \log([A^-]/[HA])$, in 3.1.12.6.

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