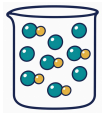
Buffers Map

AQA A-level Chemistry · 3.1.12.6 Buffer action

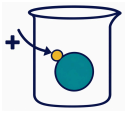
1 What a buffer is 3.1.12.6

- **Resists pH change**
- Small amounts of acid or alkali
- Weak acid + its salt
- Weak base + its salt
- Or partly neutralise a weak acid



2 How it works 3.1.12.6

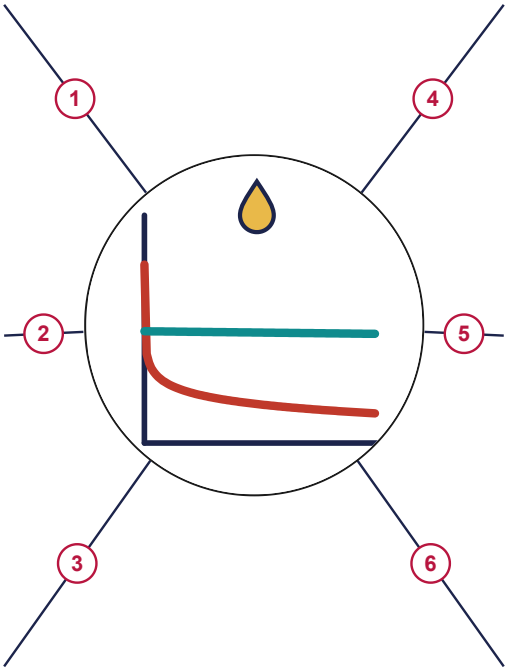
- Large reservoirs of HA and A^-
- Add H^+: $\mathbf{A^- + H^+ \rightarrow HA}$
- Add OH^-: $\mathbf{HA + OH^- \rightarrow A^- + H_2O}$
- Ratio barely changes
- Dilution: ratio unchanged



3 Buffer pH 3.1.12.6

- $\mathbf{[H^+] = K_a[HA] \div [A^-]}$
- $pH = pK_a + \log([A^-] \div [HA])$
- [HA] = acid; $[A^-]$ = salt
- Mixtures: use **moles**
- Equal amounts: $pH = pK_a$





4 Making a buffer 3.1.12.6

- $\mathbf{[A^-] \div [HA] = K_a \div [H^+]}$
- Choose $pK_a \approx$ target pH
- Mass = n × Mr
- Or add NaOH to the acid
- Flat region of the curve



5 Blood and cells 3.1.12.6

- Blood pH **7.35–7.45**
- $\mathbf{H_2CO_3 \rightleftharpoons H^+ + HCO_3^-}$
- Lungs remove CO_2
- Cells: $H_2PO_4^-$ / HPO_4^{2-}
- Enzymes need steady pH



6 Food 3.1.12.6

- **Bacteria and fungi**
- release acids: pH changes
- Spoils taste and texture
- Citric acid + sodium citrate
- Buffer keeps food longer



Some buffers

$pH = pK_a + \log([A^-] \div [HA])$; values at 298 K except blood (310 K)

Buffer pair (acid / base)	pK_a	Example ratio $[A^-] \div [HA]$	pH
citric acid / dihydrogencitrate	3.13	1.48	3.30
CH_3COOH / CH_3COO^-	4.76	1.00	4.76
CH_3CH_2COOH / $CH_3CH_2COO^-$	4.87	0.500	4.57
H_2CO_3 / HCO_3^- (blood)	6.10	20.0	7.40
$H_2PO_4^-$ / HPO_4^{2-} (cells)	7.21	1.55	7.40

Worked examples

Buffer pH

- 0.100 CH_3COOH + 0.150 CH_3COONa
- $[H^+] = 1.16 \times 10^{-5}$
- **pH 4.94**

Partial neutralisation

- 50.0 cm^3 0.100 acid + 20.0 cm^3 NaOH
- HA 3.00, A^- 2.00 × 10^{-3} mol
- **pH 4.58**

Making pH 5.00

- ratio 1.74 with 0.100 CH_3COOH
- 0.0869 mol in 500 cm^3
- **7.12 g CH_3COONa**

3.1.12 is complete: acids and pH (3.1.12.1–3.1.12.3), weak acids (3.1.12.4), pH curves (3.1.12.5), buffers (3.1.12.6).

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