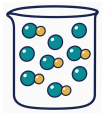
Buffers Map

OCR A Level Chemistry A · 5.1.3 Buffer solutions

1 What a buffer is

5.1.3(i), (j)

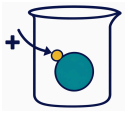
- **Resists pH change**
- Small amounts of acid or alkali
- Weak acid + its salt
- e.g. CH_3COOH + CH_3COONa
- Or excess weak acid + NaOH



2 How it works

5.1.3(k)

- Large reservoirs of HA and A^-
- Add H^+: **A^- + H^+ → HA**
- Add OH^-: **HA + OH^- → A^- + H_2O**
- Ratio barely changes
- Dilution: ratio unchanged

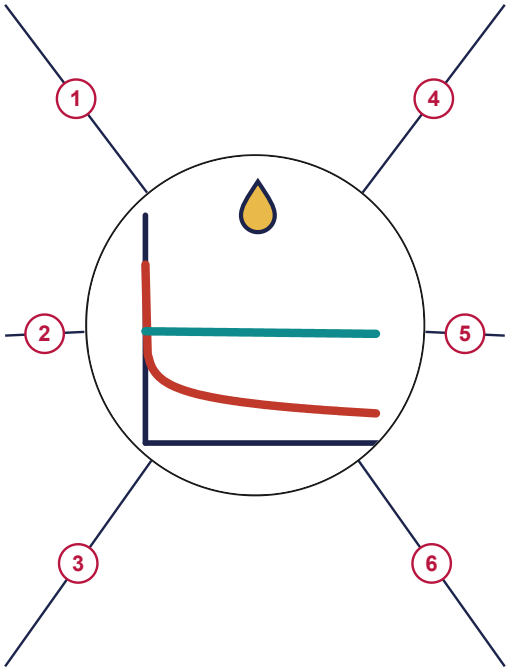


3 Buffer pH

5.1.3(l)

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





4 Making a buffer

5.1.3(l)

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



5 The blood buffer

5.1.3(m)

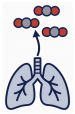
- Blood pH **7.35–7.45**
- **$H_2CO_3 \rightleftharpoons H^+ + HCO_3^-$**
- Add H^+: $HCO_3^- + H^+ \rightarrow H_2CO_3$
- Add OH^-: $H_2CO_3 + OH^- \rightarrow HCO_3^- + H_2O$
- pK_a 6.10; ratio about **20 : 1**



6 Breathing and blood pH

5.1.3(m)

- $H_2CO_3 \rightleftharpoons$ **CO_2** + H_2O
- Lungs breathe out CO_2
- Fast breathing: **pH rises**
- CO_2 build-up: **pH falls**
- Kidneys adjust HCO_3^-



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
$HCOOH$ / $HCOO^-$	3.75	2.00	4.05
CH_3COOH / CH_3COO^-	4.76	1.00	4.76
H_2CO_3 / HCO_3^- (blood, 7.40)	6.10	20.0	7.40
H_2CO_3 / HCO_3^- (blood, acidosis)	6.10	12.6	7.20
CH_3CH_2COOH / $CH_3CH_2COO^-$	4.87	0.500	4.57

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**

5.1.3 is complete: acids and pH, weak acids, titration curves and buffer solutions.

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