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pH CURVES & INDICATORS

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INDICATORS

Indicators are weak acids which have a different colour to their conjugate base

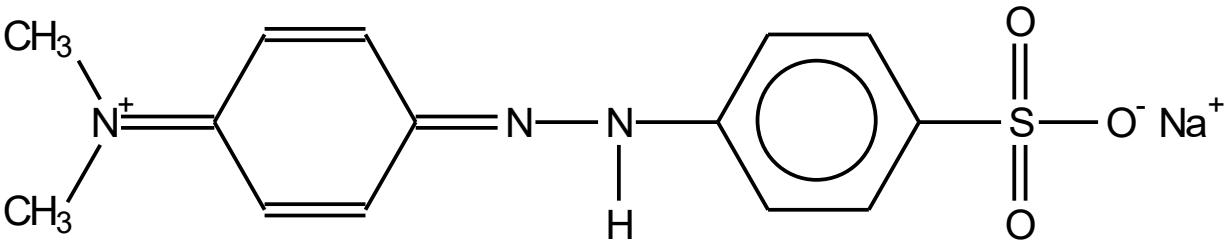
$$\underset{\text{colour 1}}{HIn} \rightleftharpoons H^+ + \underset{\text{colour 2}}{In^-}$$

low pH: equilibrium pushed left = colour 1

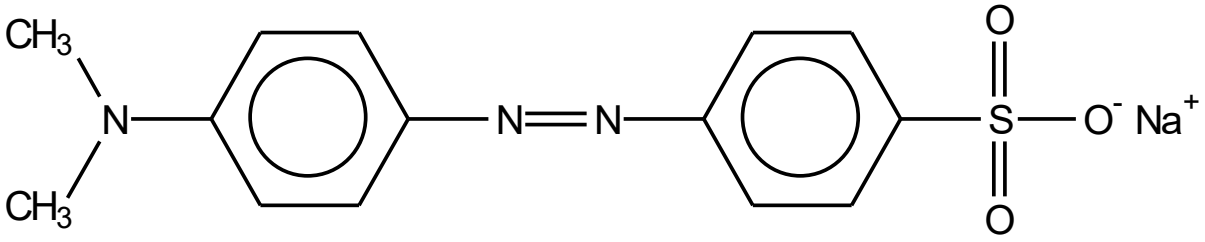
high pH: equilibrium pushed right = colour 2

METHYL ORANGE

pH < 3.2



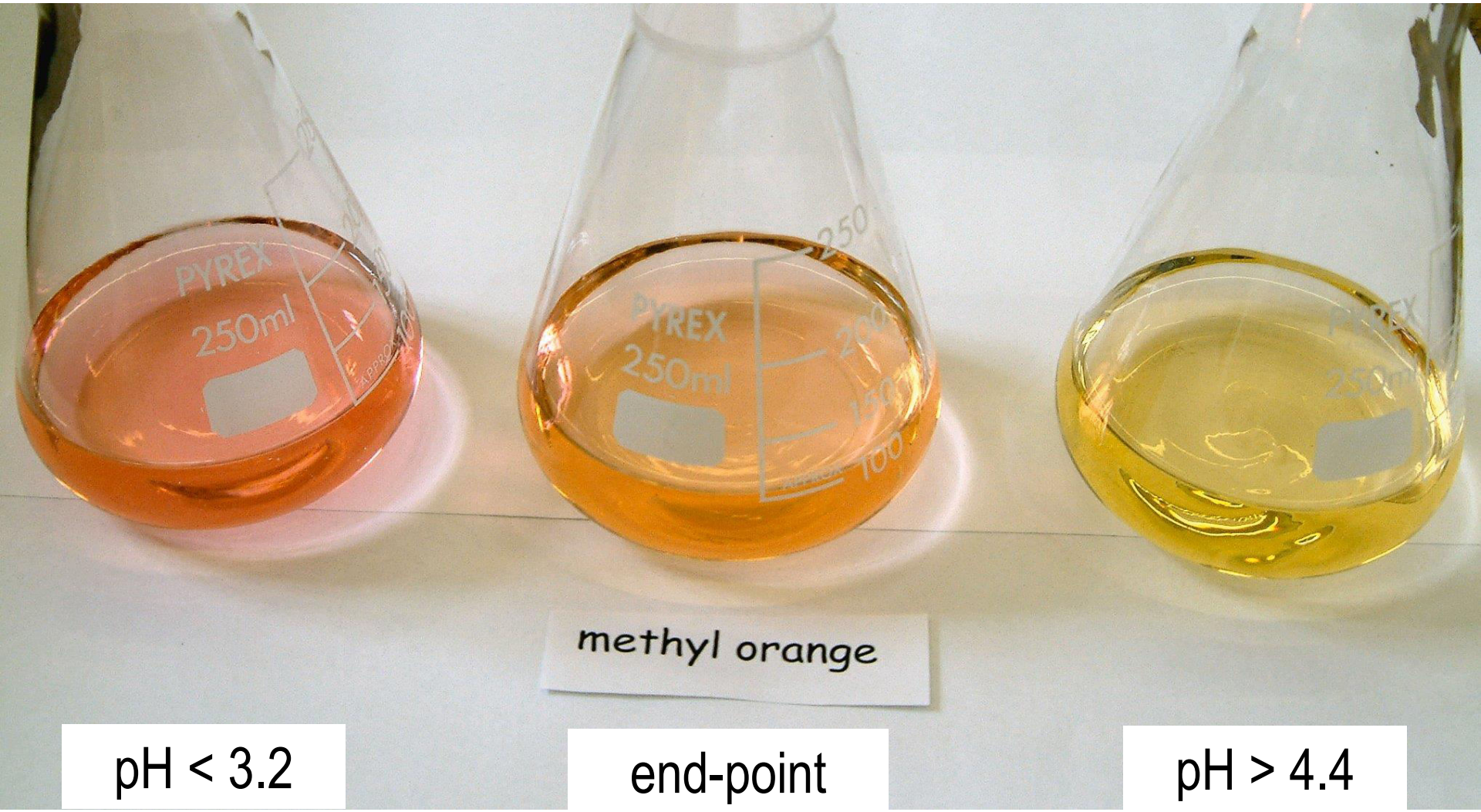
⇌



+ H^+

pH > 4.4

METHYL ORANGE

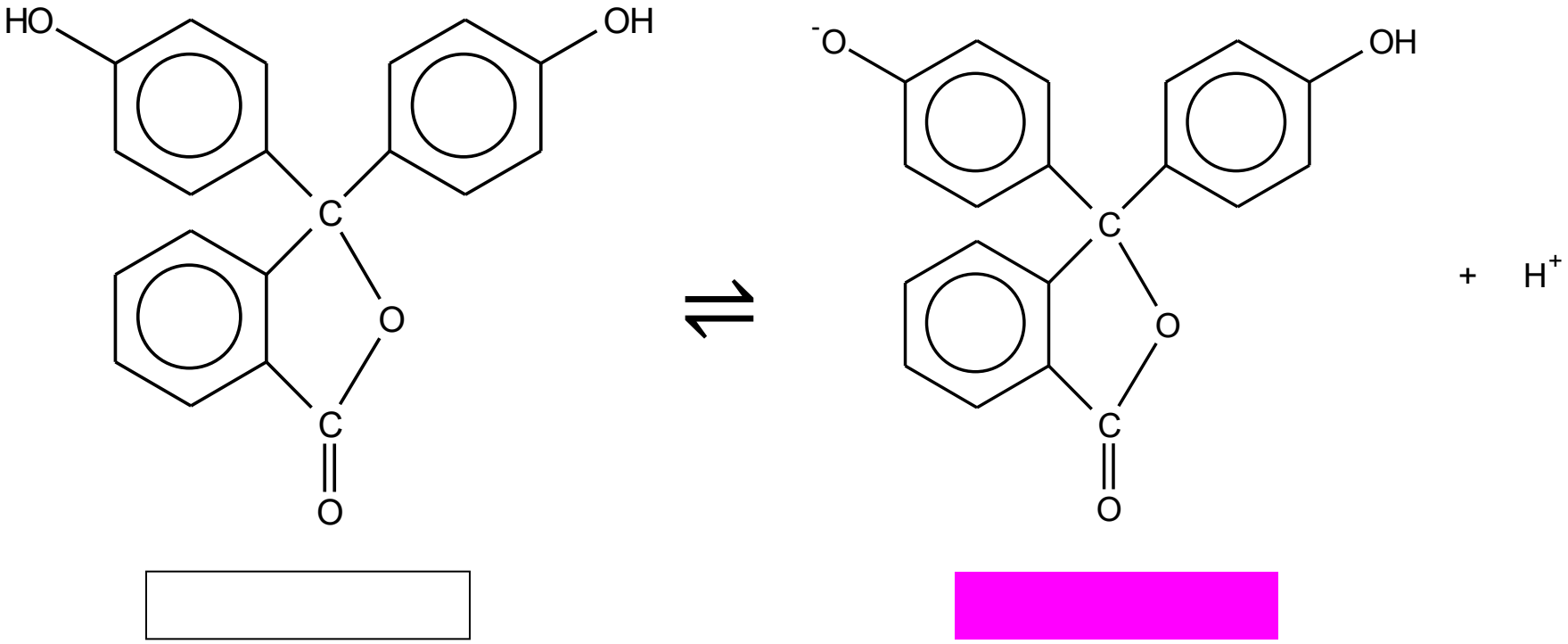


pH < 3.2

end-point

pH > 4.4

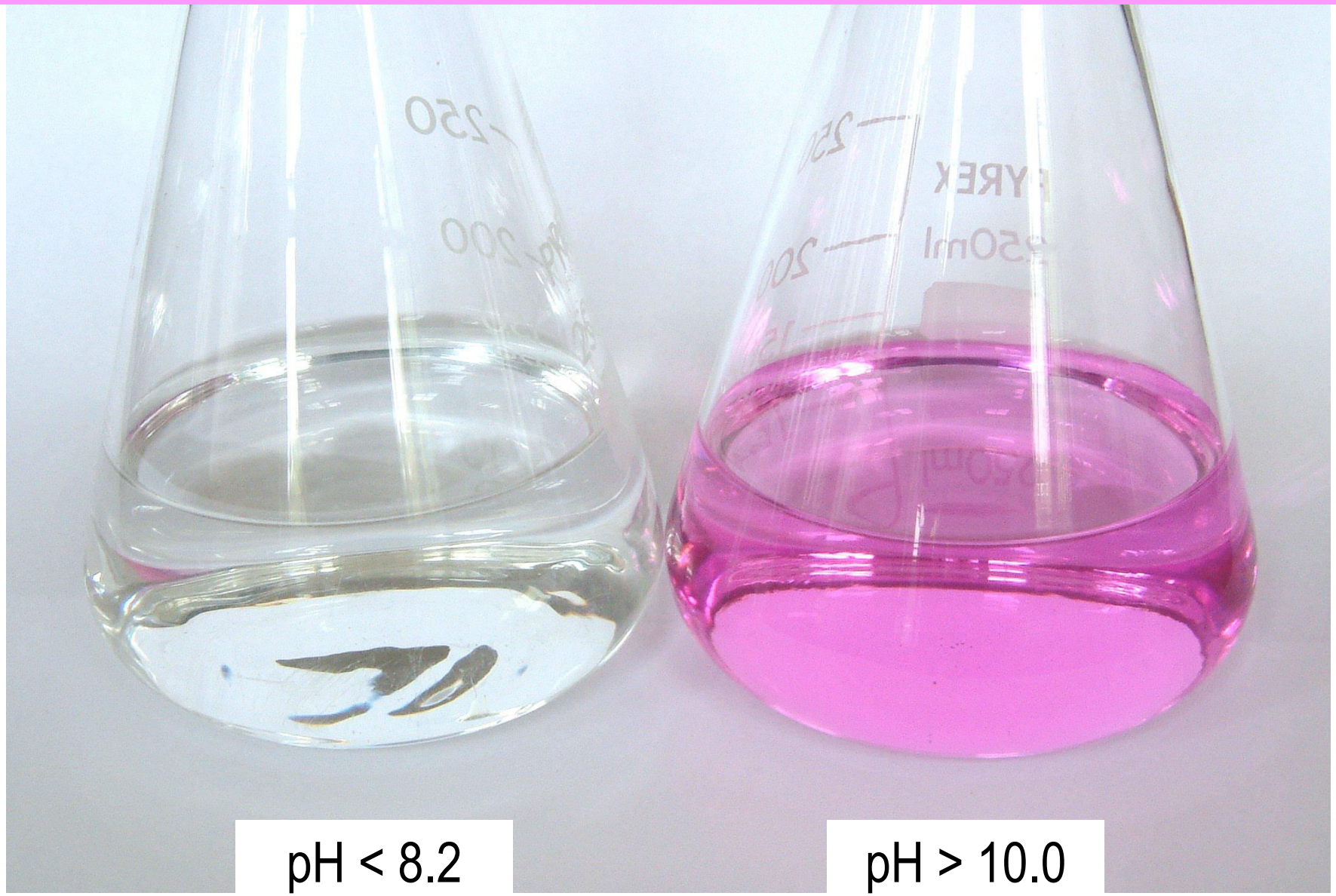
PHENOLPHTHALEIN



pH < 8.2

pH > 10.0

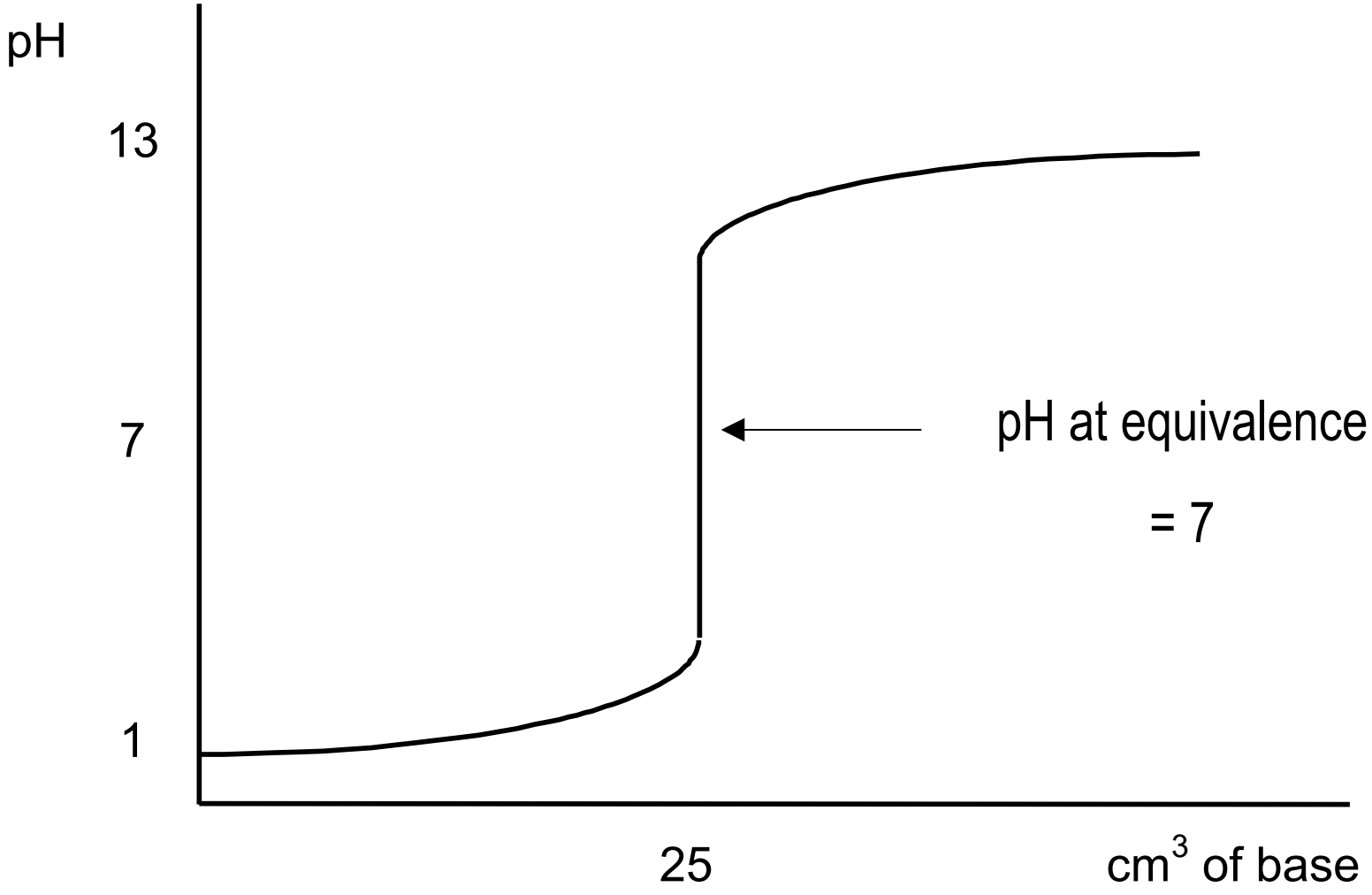
PHENOLPHTHALEIN



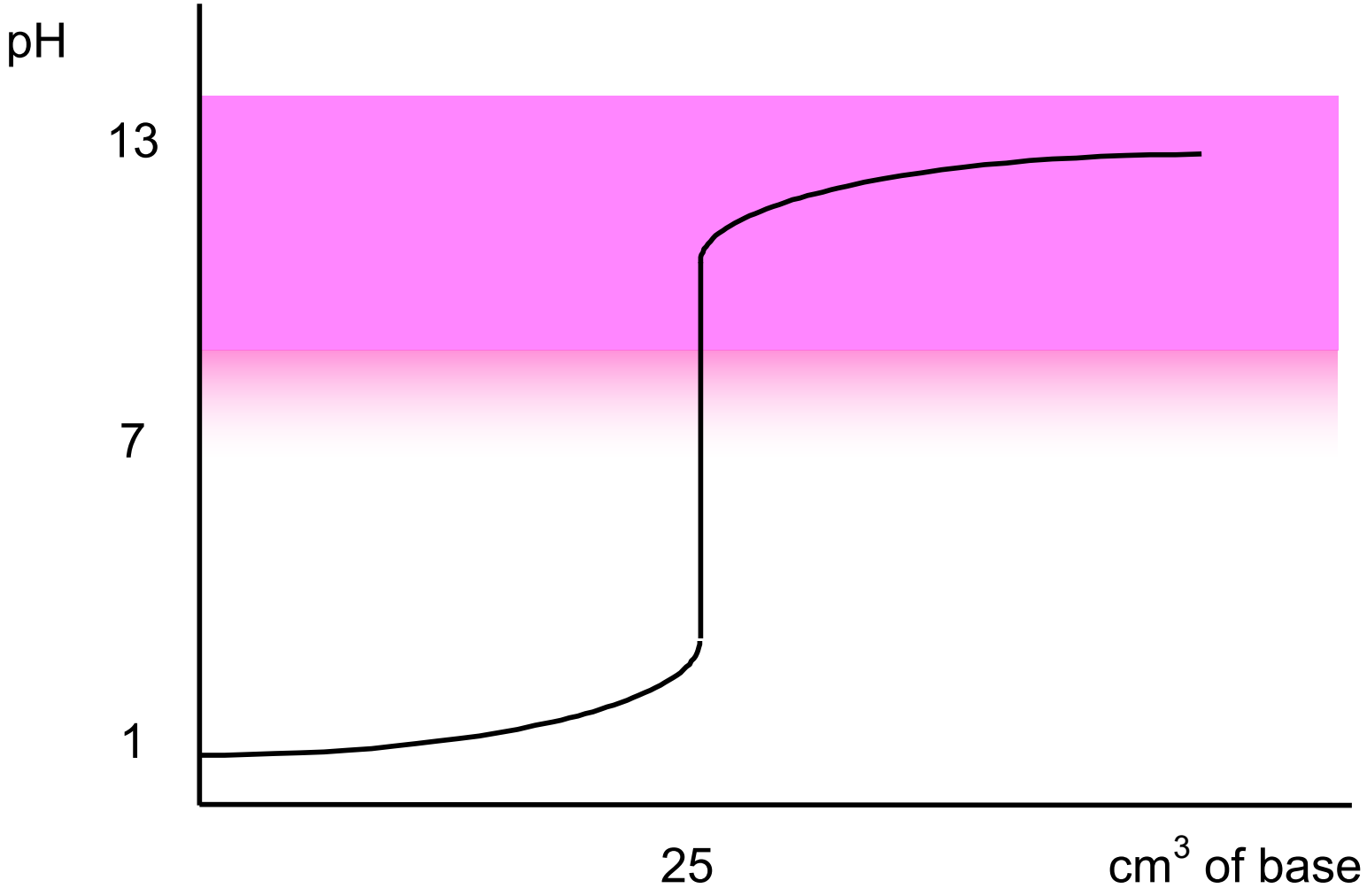
INDICATORS

Indicator	colour at low pH	pH range of colour change	colour at high pH
methyl orange	red	3.2 – 4.4	orange
phenolphthalein	colourless	8.2 – 10.0	purple

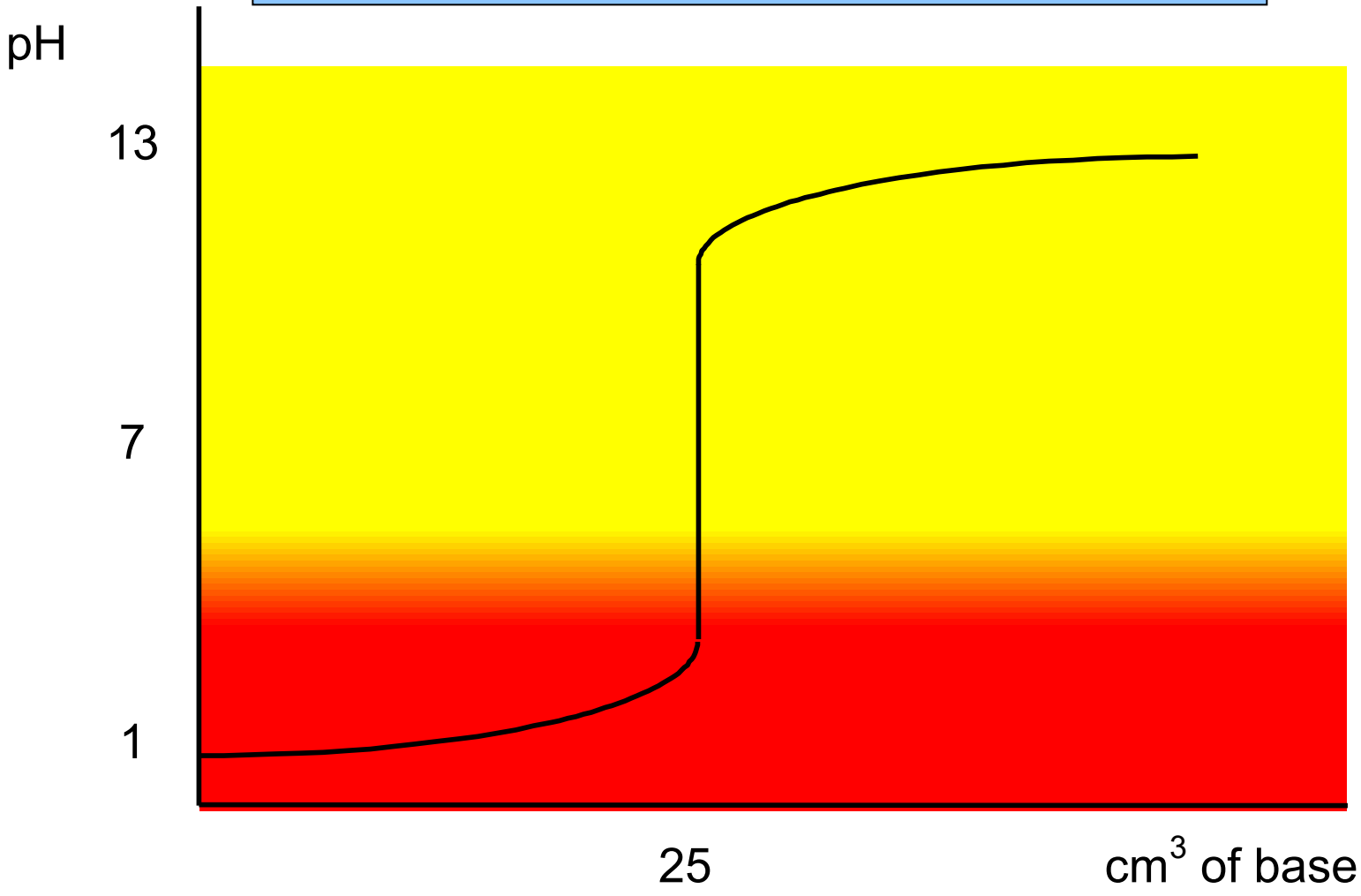
Strong acid – Strong base



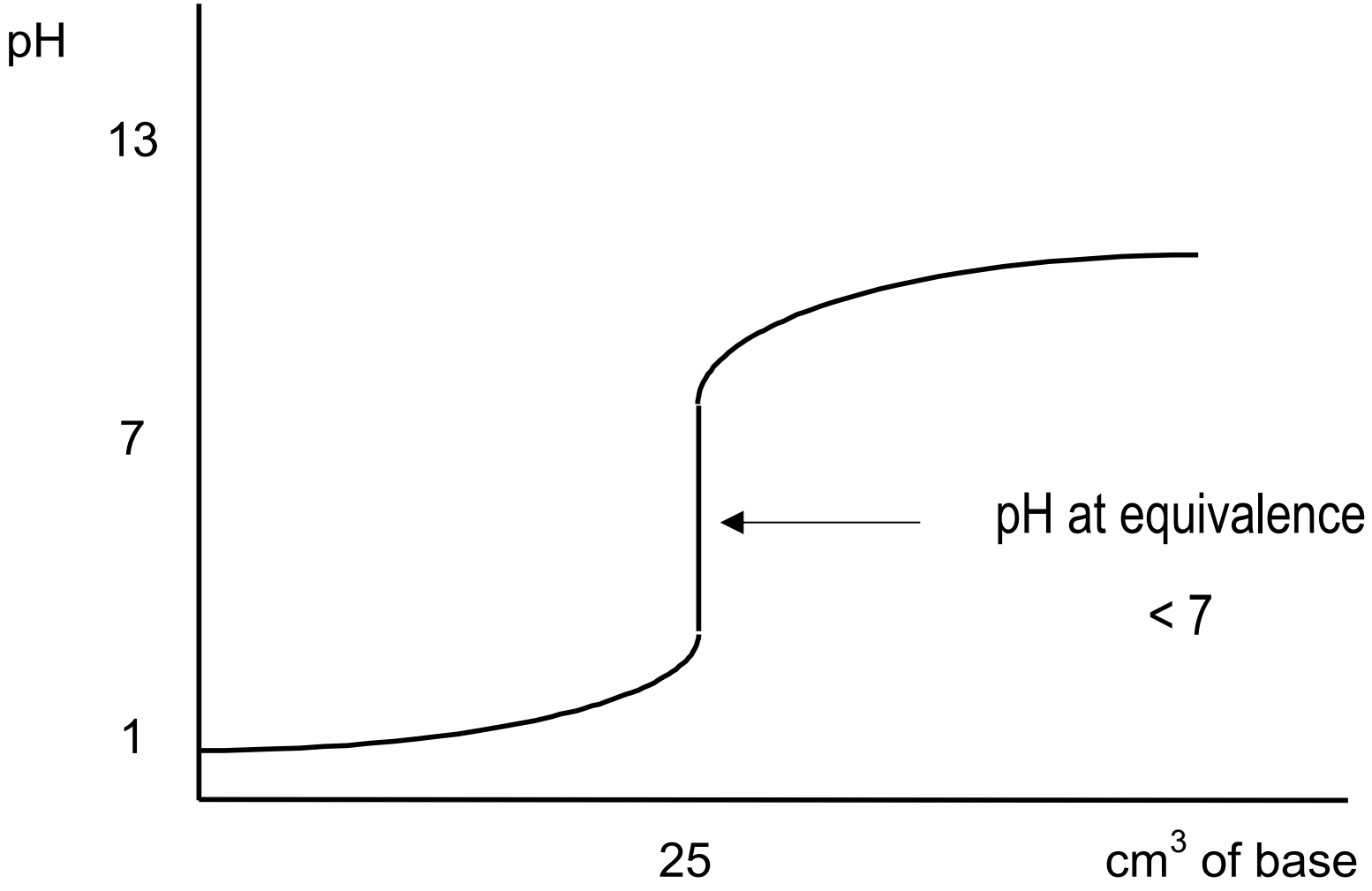
Strong acid – Strong base



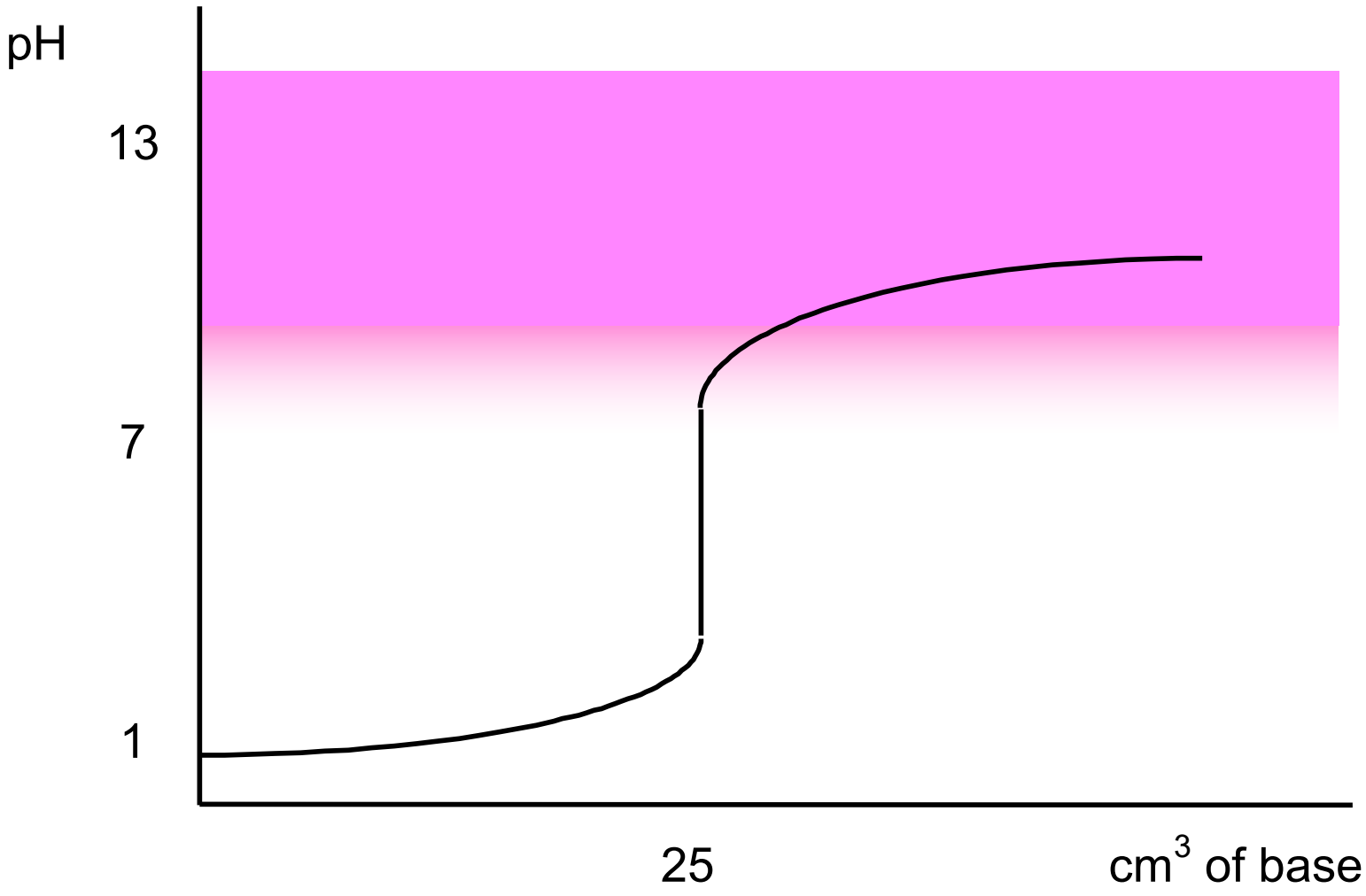
Strong acid – Strong base



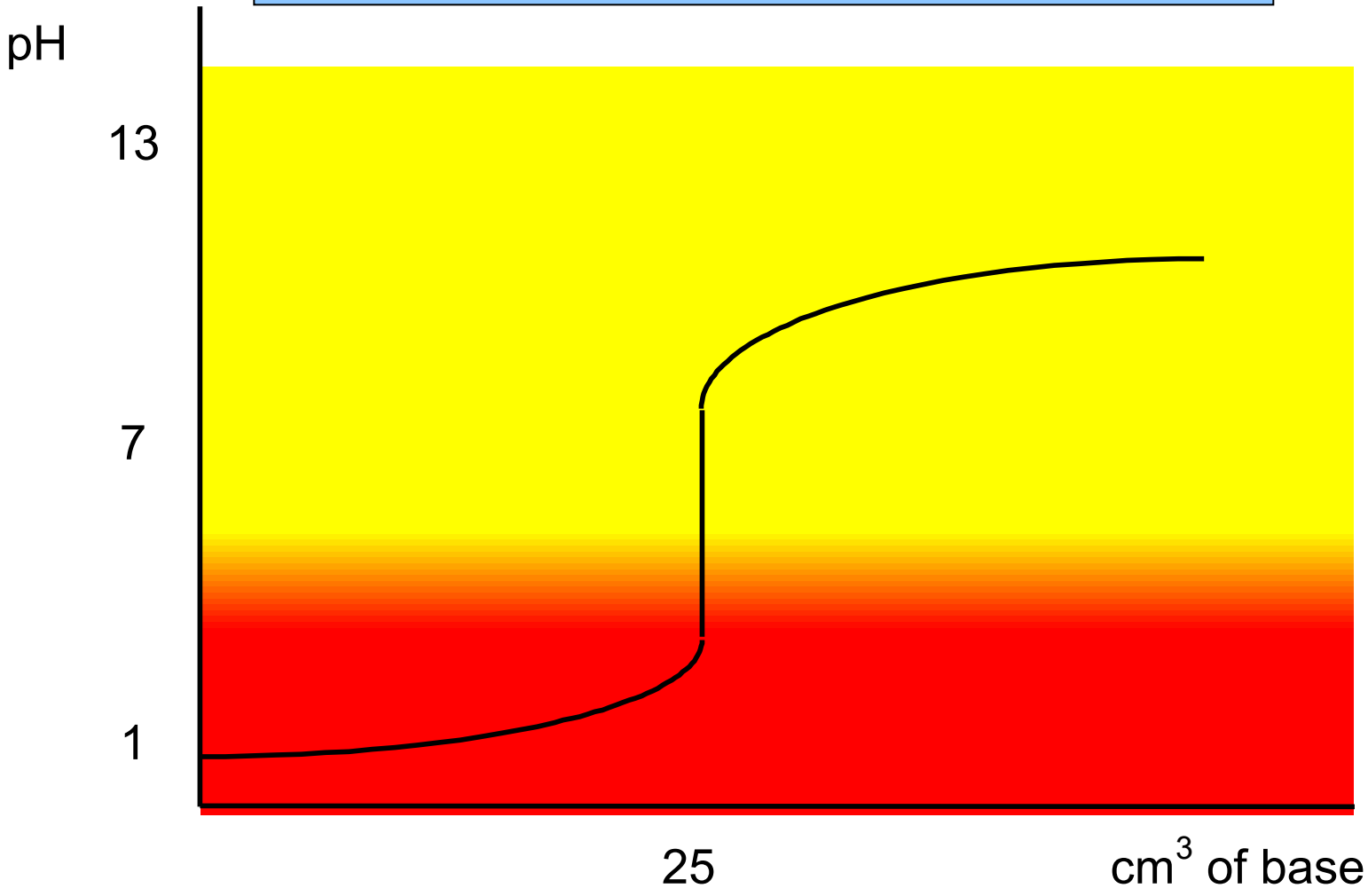
Strong acid – Weak base



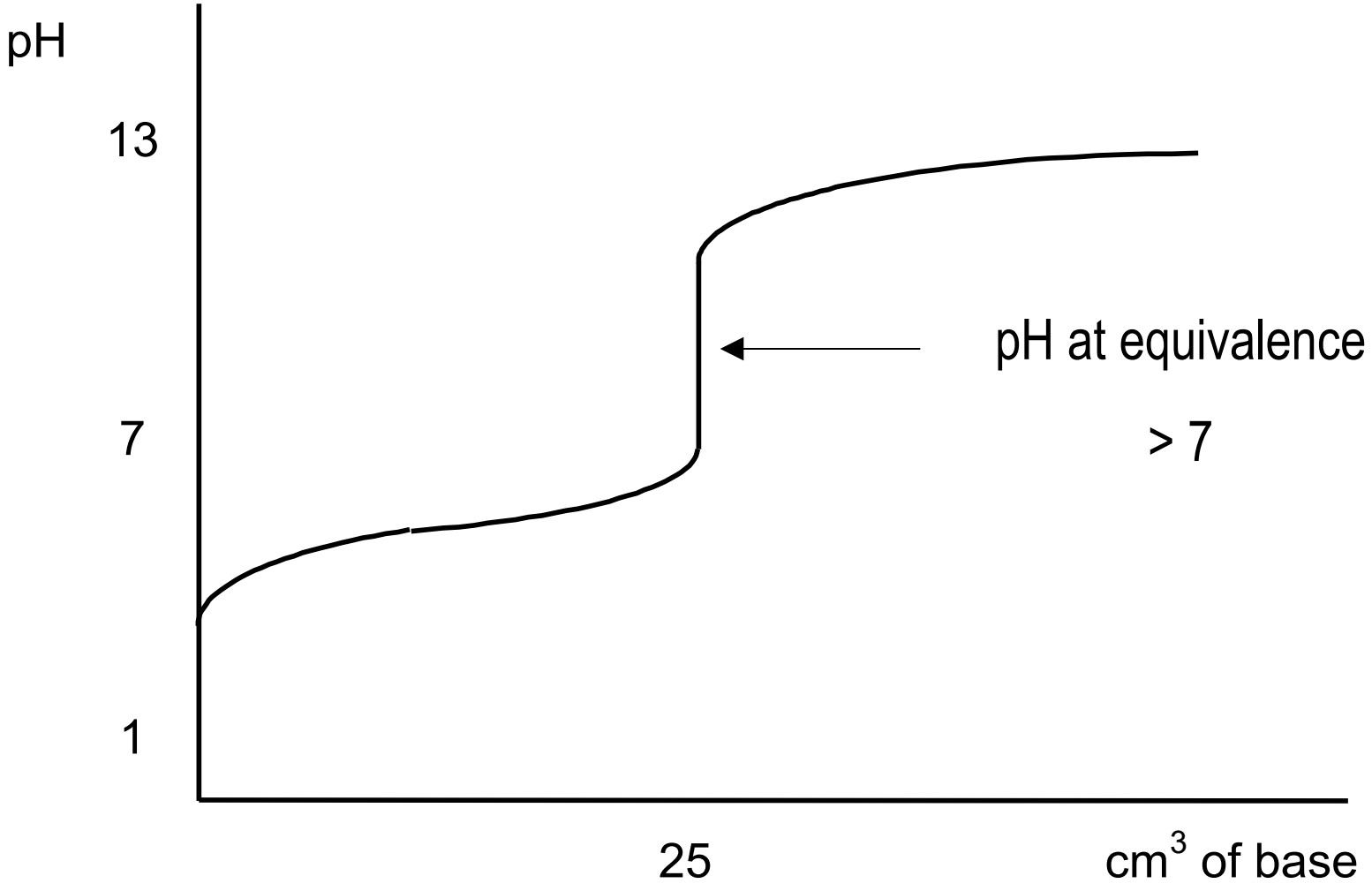
Strong acid – Weak base



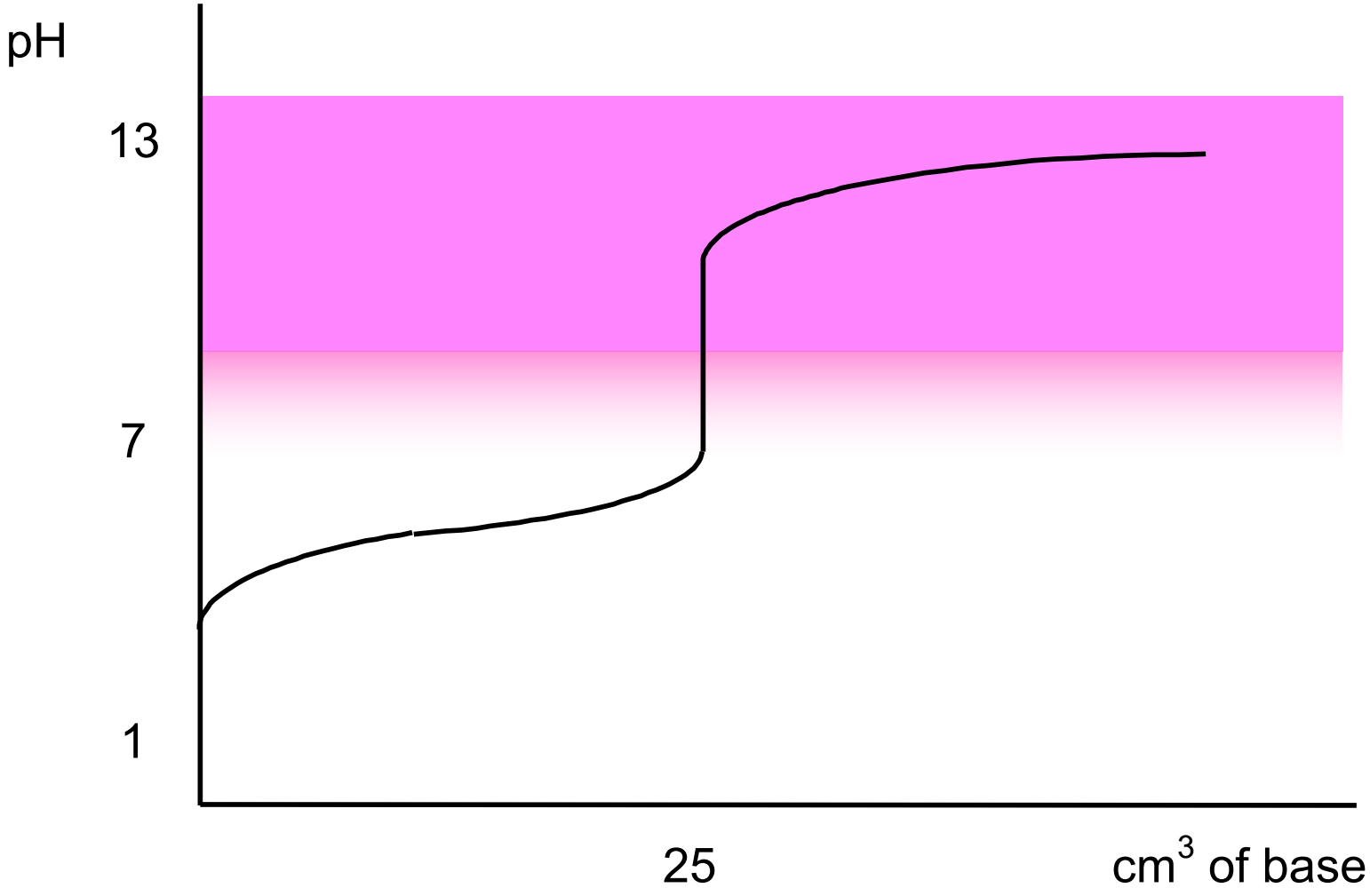
Strong acid – Weak base



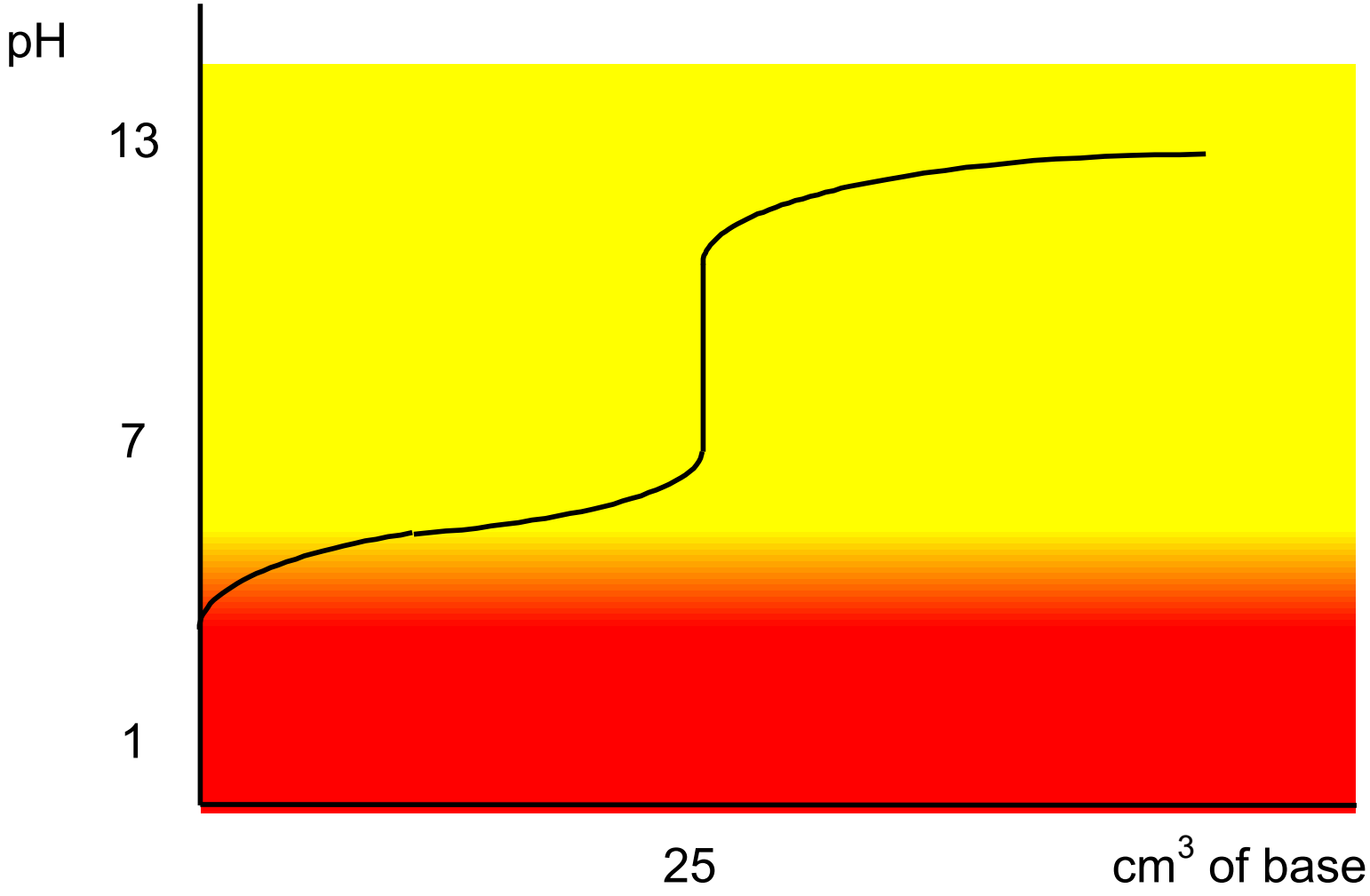
Weak acid – Strong base



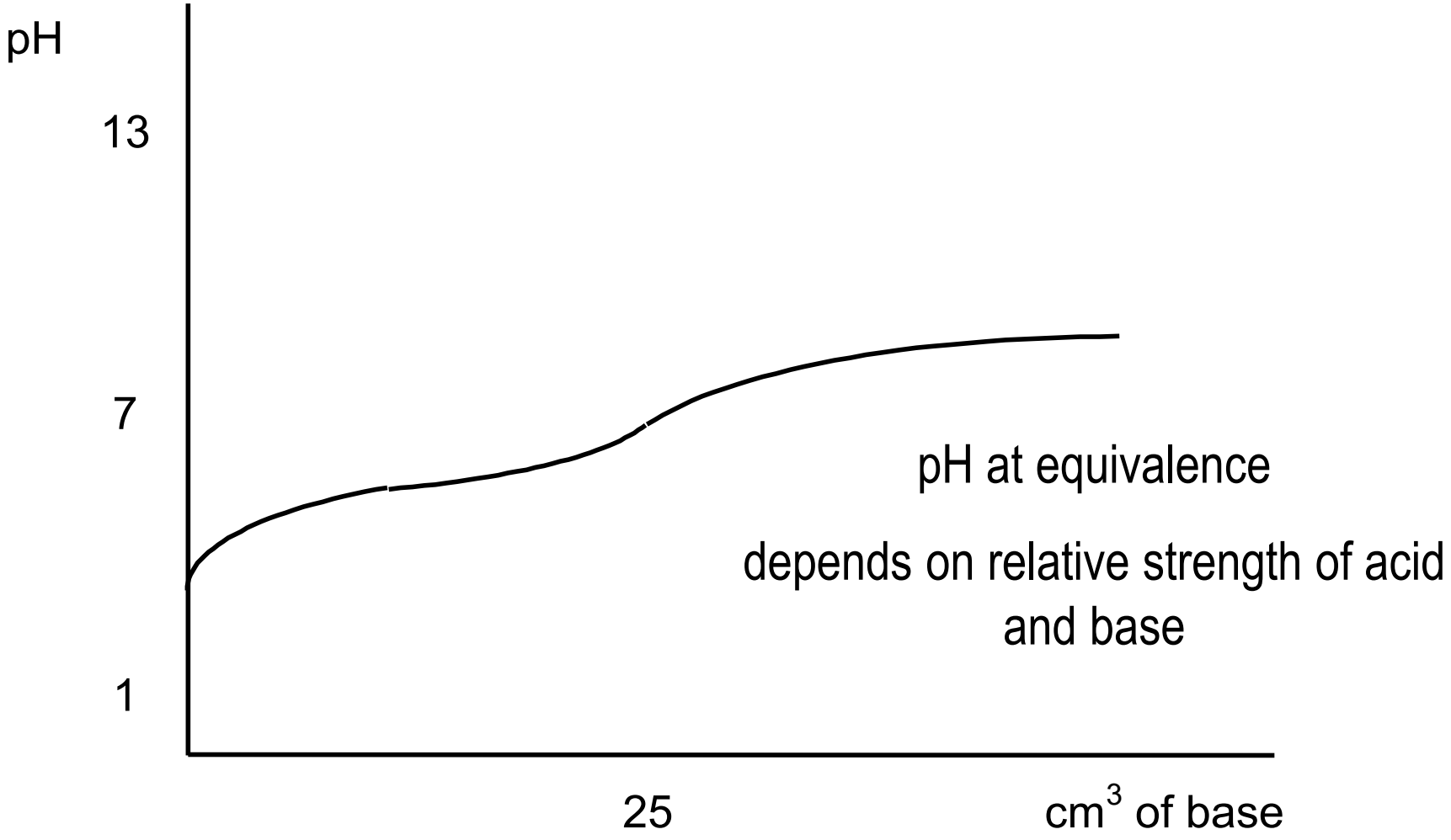
Weak acid – Strong base



Weak acid – Strong base



Weak acid – Weak base



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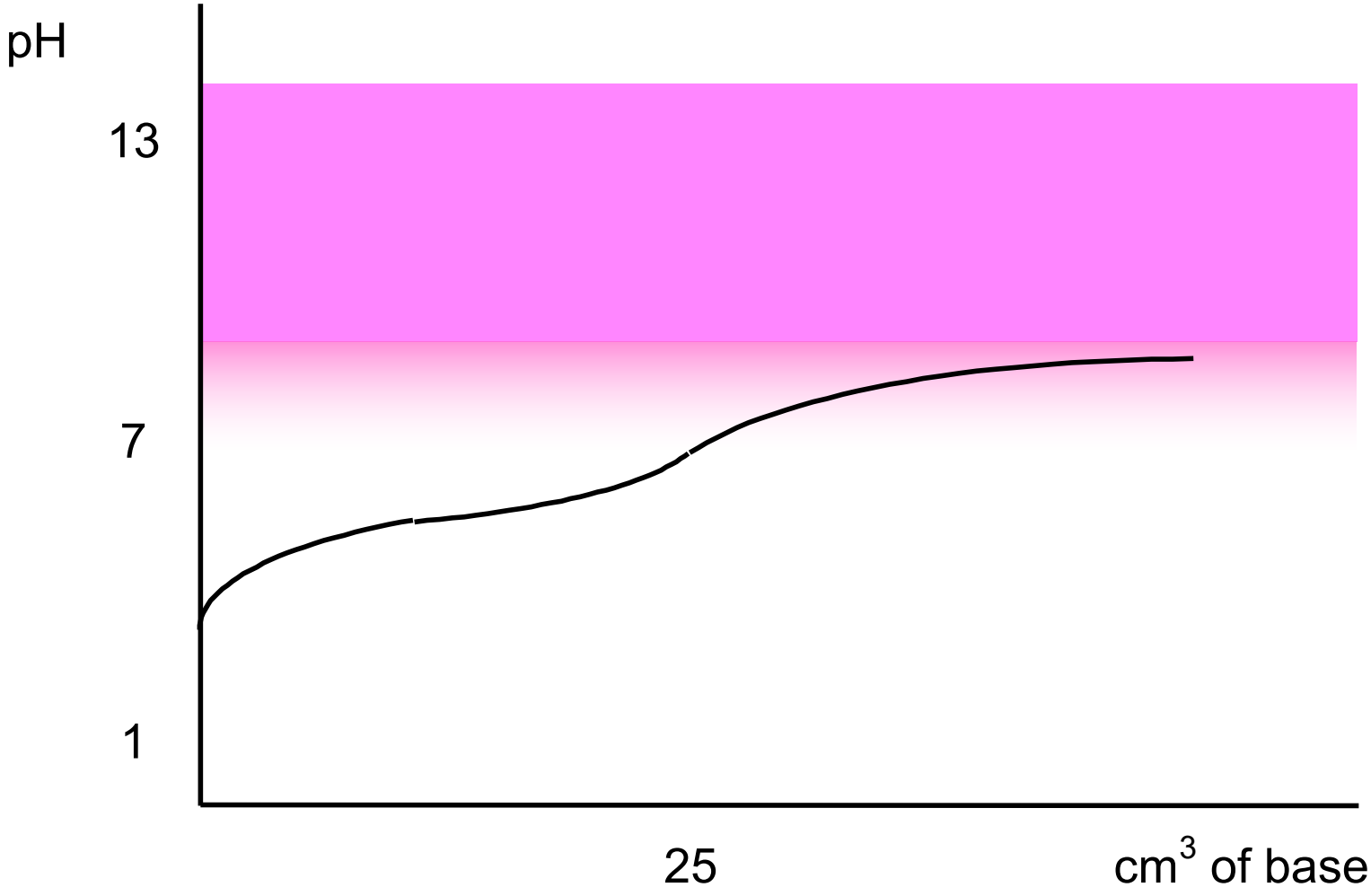
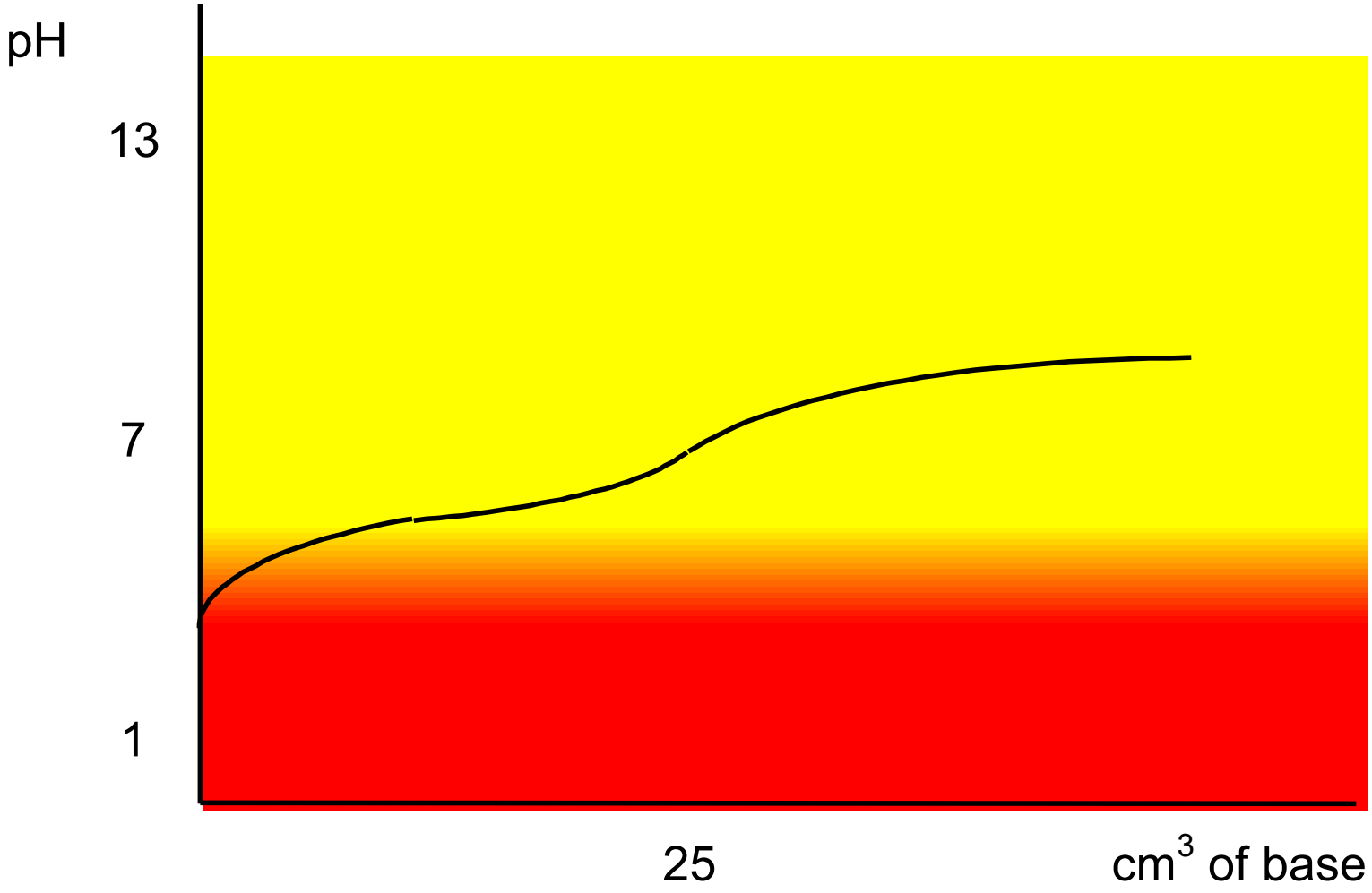
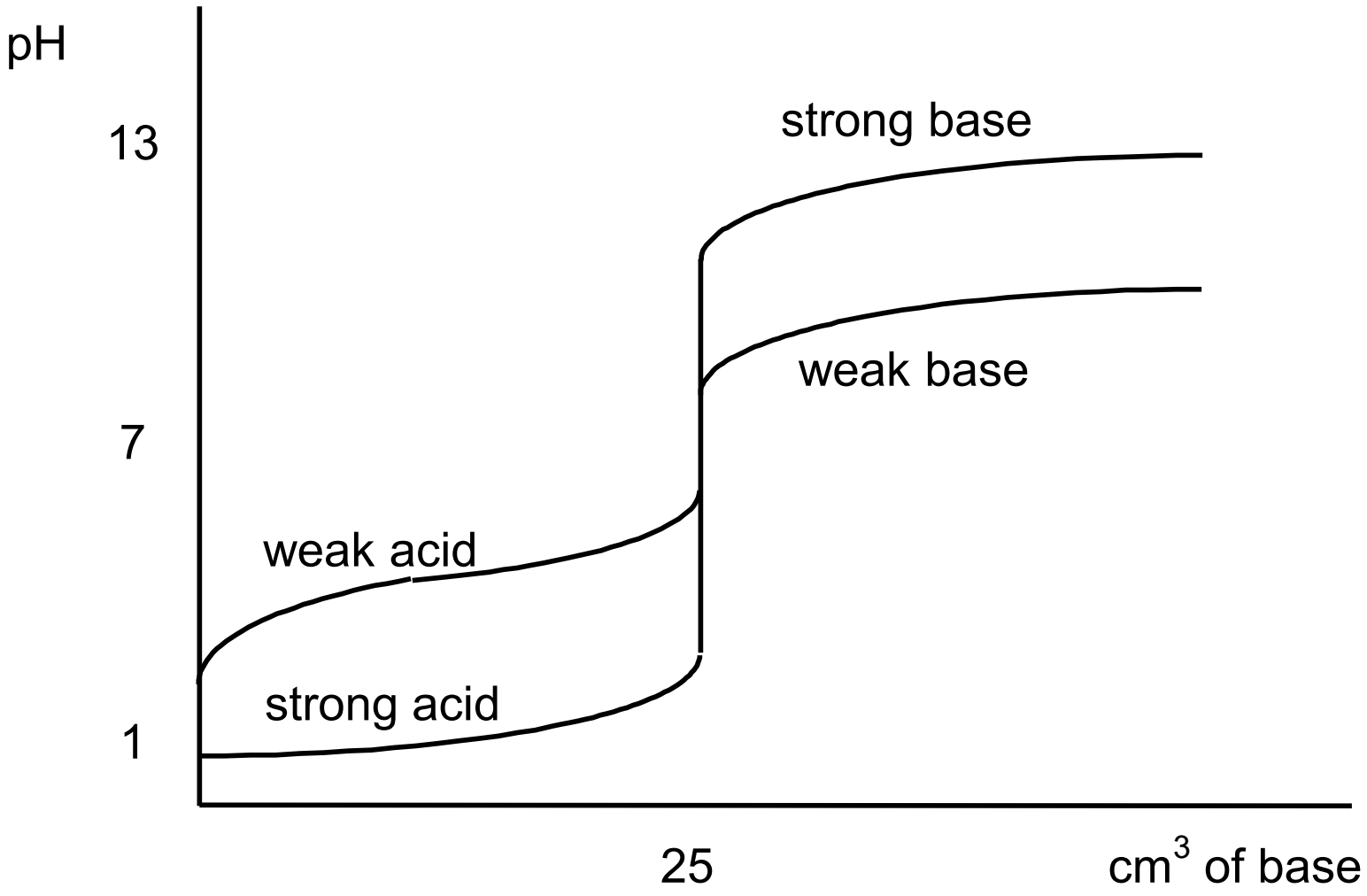


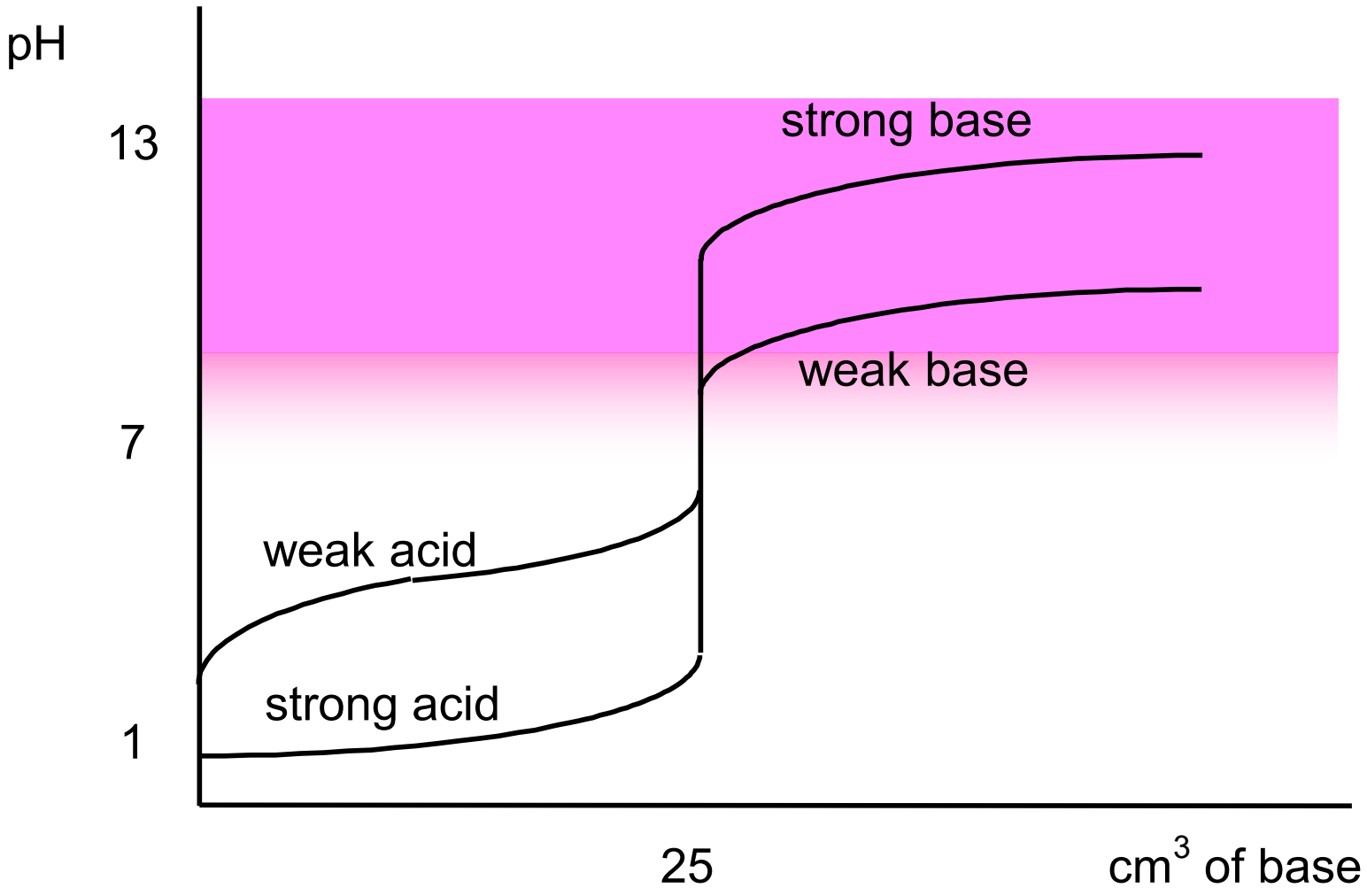
Weak acid – Weak base



SUMMARY


pH
13
7
1
strong base
weak base
weak acid
strong acid
25
cm3 of base

SUMMARY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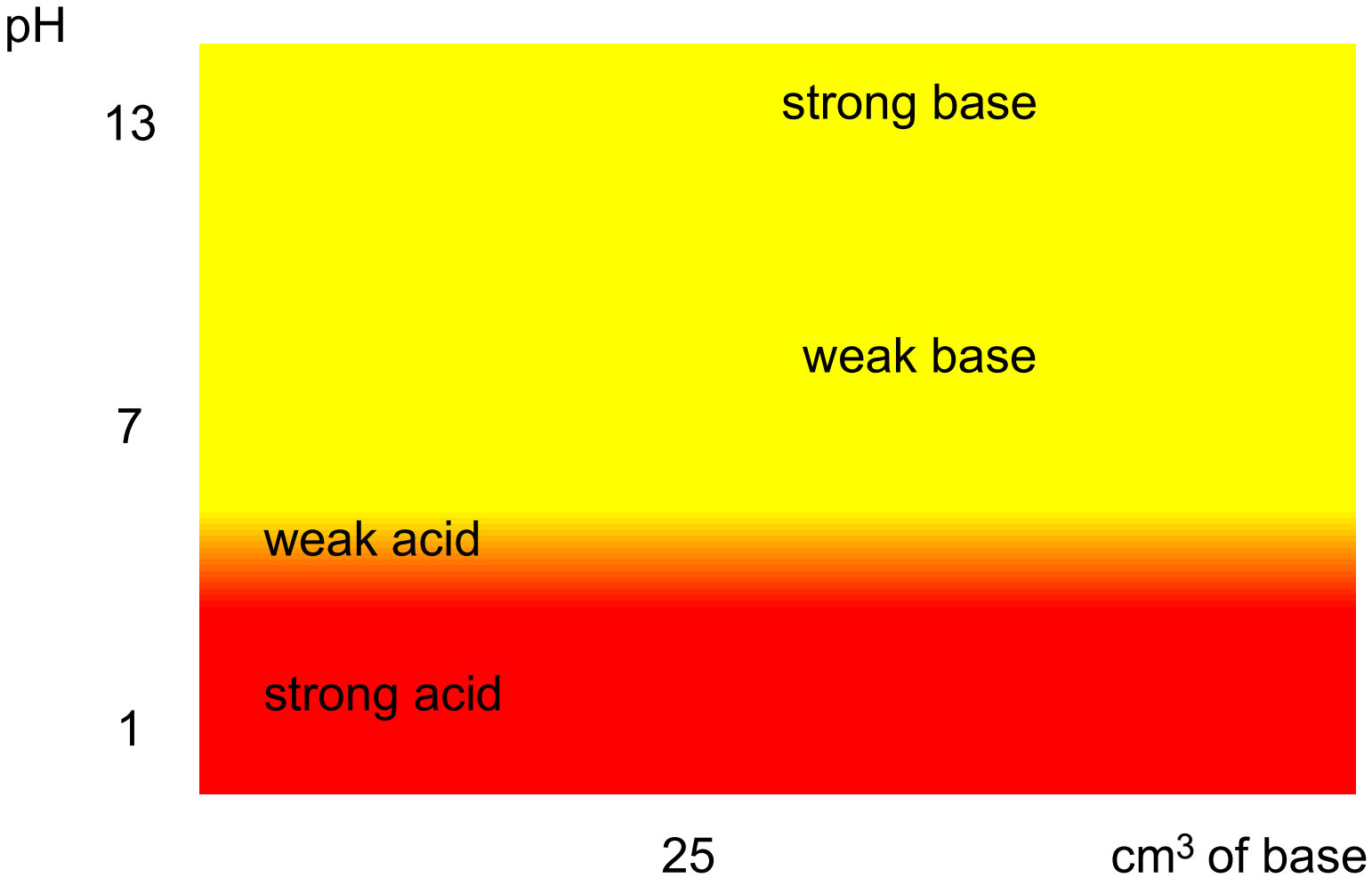
SUMMARY


pH
13
7
1
strong base
weak base
weak acid
strong acid
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cm3 of base

SKETCHING pH CURVES

Sketch the pH curve when 50 cm^3 of 0.100 mol dm^{-3} NaOH is added to 15 cm^3 of 0.200 mol dm^{-3} ethanoic acid. Identify a suitable indicator.

- Start pH: weak acid so 3-4 ish?
- Weak acid so mini rise at the start
- Volume for equivalence: 1:1 reaction, [acid] is double [alkali] so 30 cm^3
- Final pH: tending towards pH of 0.100 mol dm^{-3} NaOH which is 13