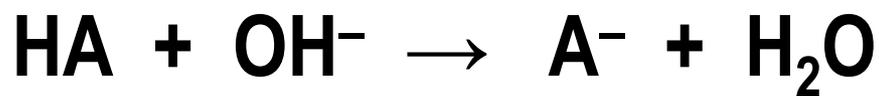


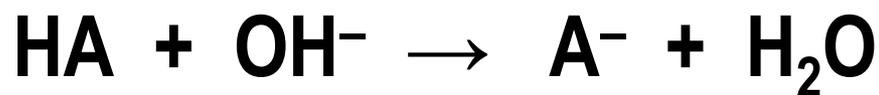


[WWW.CHEMSHEETS.CO.UK](http://www.chemsheets.co.uk)

pH of WEAK ACIDS + STRONG BASES



before reaction	3	1	0	(lots)
change	-1	-1	+1	(+1)
after reaction	2	0	1	(lots)

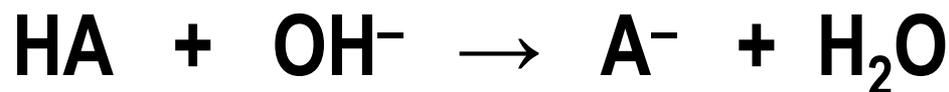


before reaction	3	10	0	(lots)
change	-3	-3	+3	(+3)
after reaction	0	7	3	(lots)

EXCESS OH⁻ EXAMPLE

Calculate the pH of the solution formed when 30 cm³ of 0.200 mol dm⁻³ ethanoic acid (pK_a = 4.76) is added to 100 cm³ of 0.100 mol dm⁻³ NaOH

$$\text{moles HA} = 0.200 \times \frac{30}{1000} = 0.00600 \quad \text{moles OH}^- = 0.100 \times \frac{100}{1000} = 0.0100$$



before reaction	0.00600	0.0100	0	(lots)
change	-0.00600	-0.00600	+0.00600	(+0.00600)
after reaction	0	0.00400	0.00600	(lots)

EXCESS OH⁻ EXAMPLE

Calculate the pH of the solution formed when 30 cm³ of 0.200 mol dm⁻³ ethanoic acid (pK_a = 4.76) is added to 100 cm³ of 0.100 mol dm⁻³ NaOH



$$\text{XS moles OH}^- = 0.00400$$

$$\text{excess [OH}^-] = \frac{0.00400}{\frac{130}{1000}} = 0.0308$$

$$[\text{H}^+] = \frac{K_w}{[\text{OH}^-]} = \frac{1 \times 10^{-14}}{0.0308} = 3.25 \times 10^{-13}$$

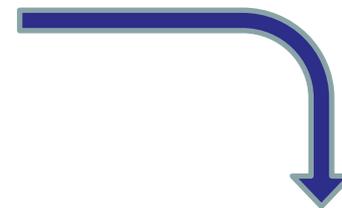
$$\text{pH} = -\log [\text{H}^+] = -\log 3.25 \times 10^{-13} = 12.49$$

Calculate moles HA and OH⁻



Calculate moles excess HA or OH⁻

Excess OH⁻



Calculate OH⁻



Use K_w to find [H⁺]



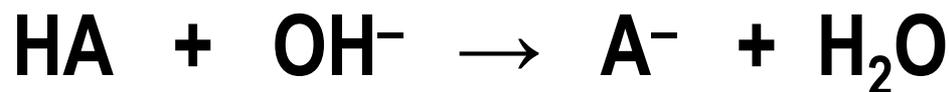
Calculate pH

EXCESS HA EXAMPLE

Calculate the pH of the solution formed when 50 cm³ of 0.500 mol dm⁻³ ethanoic acid (pK_a = 4.76) is added to 75 cm³ of 0.200 mol dm⁻³ NaOH

$$\text{moles HA} = 0.500 \times \frac{50}{1000} = 0.025$$

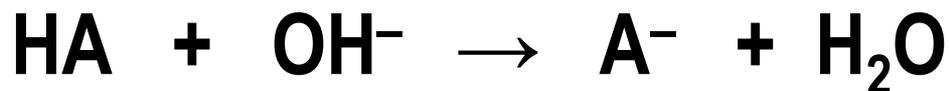
$$\text{moles OH}^- = 0.200 \times \frac{75}{1000} = 0.0150$$



before reaction	0.0250	0.0150	0	(lots)
change	-0.0150	-0.0150	+0.0150	(+0.0150)
after reaction	0.0100	0	0.0150	(lots)

EXCESS HA EXAMPLE

Calculate the pH of the solution formed when 50 cm³ of 0.500 mol dm⁻³ ethanoic acid (pK_a = 4.76) is added to 75 cm³ of 0.200 mol dm⁻³ NaOH



after reaction

0.0100

0

0.0150

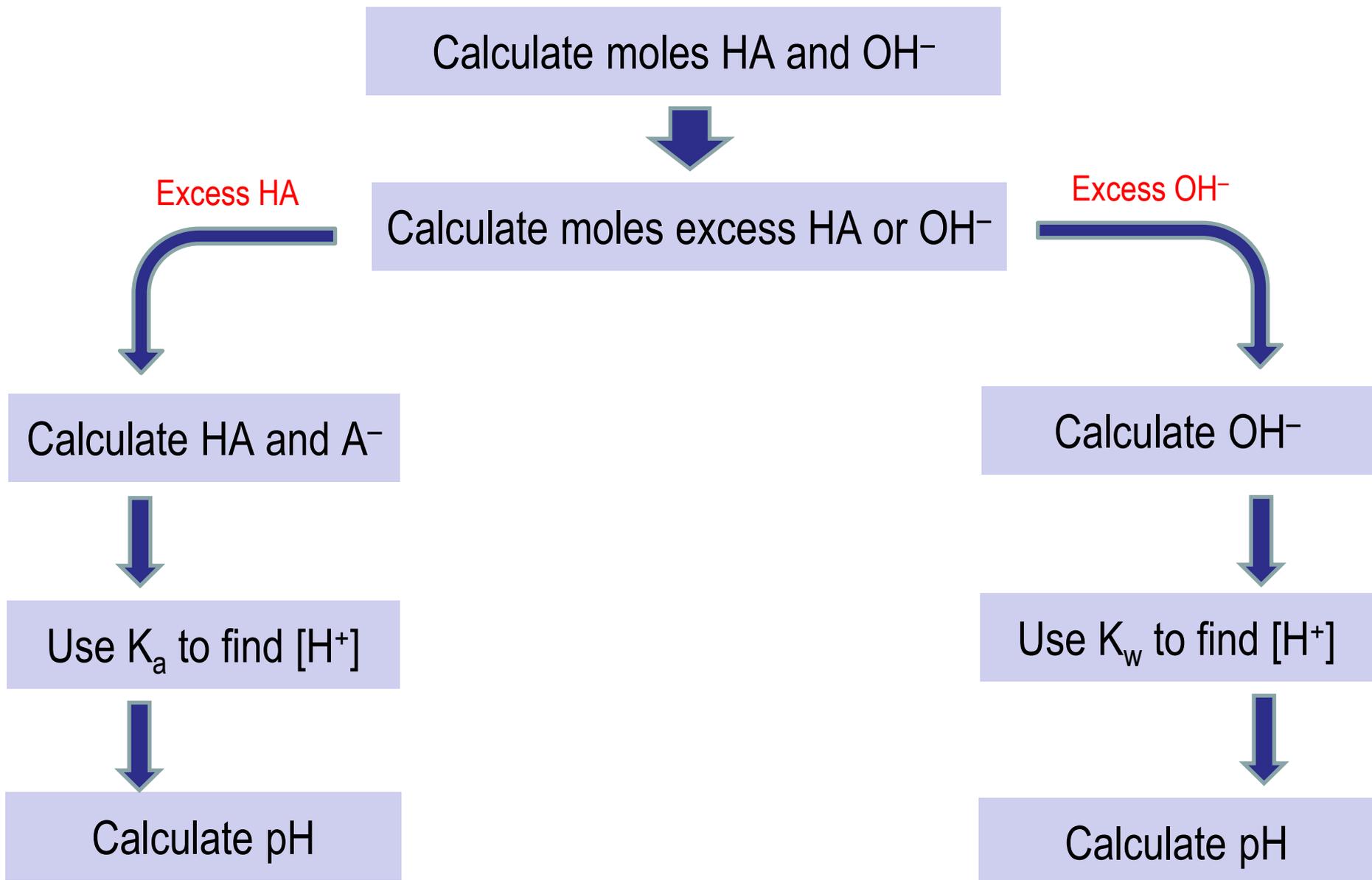
(lots)

$$K_a = \frac{[\text{H}^+][\text{A}^-]}{[\text{HA}]}$$

$$[\text{H}^+] = \frac{K_a [\text{HA}]}{[\text{A}^-]}$$

$$[\text{H}^+] = \frac{10^{-4.76} \times \frac{0.0100}{125}}{\frac{0.0150}{125}} = 1.16 \times 10^{-5}$$

$$\text{pH} = -\log [\text{H}^+] = -\log 1.16 \times 10^{-5} = 4.94$$

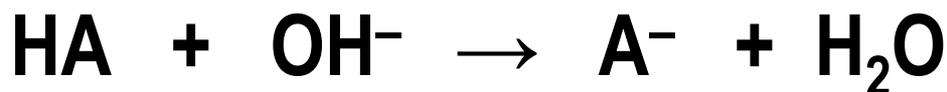


HA = 2 x OH⁻ EXAMPLE (Half neutralisation)

Calculate the pH of the solution formed when 100 cm³ of 0.200 mol dm⁻³ ethanoic acid (pK_a = 4.76) is added to 40 cm³ of 0.250 mol dm⁻³ KOH

$$\text{moles HA} = 0.200 \times \frac{100}{1000} = 0.020$$

$$\text{moles OH}^- = 0.250 \times \frac{40}{1000} = 0.010$$

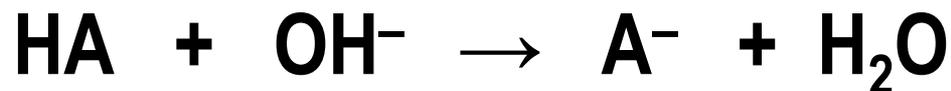


before reaction	0.020	0.010	0	(lots)
change	-0.010	-0.010	+0.010	(+0.010)
after reaction	0.010	0	0.010	(lots)

i.e. moles HA = moles OH⁻

HA = 2 x OH⁻ EXAMPLE (Half neutralisation)

Calculate the pH of the solution formed when 100 cm³ of 0.200 mol dm⁻³ ethanoic acid (pK_a = 4.76) is added to 40 cm³ of 0.250 mol dm⁻³ KOH



after reaction

0.010 0 0.010 (lots)

$$K_a = \frac{[\text{H}^+][\text{A}^-]}{[\text{HA}]}$$

$$[\text{HA}] = [\text{A}^-]$$

$$K_a = [\text{H}^+]$$

$$\text{pH} = \text{p}K_a = 4.76$$

