

Scaffolding to prevent cognitive overload

Education in Chemistry

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This series of questions starts with a fully scaffolded question; in the following questions scaffolding is removed.

Coping with titration

1. 25.00 cm³ of NaOH is just neutralised by 23.45 cm³ of 0.100 mol/dm³ HCl. Calculate the concentration of NaOH.

a. Symbol equation	$\text{HCl} + \text{NaOH} \rightarrow \text{NaCl} + \text{H}_2\text{O}$
b. Stoichiometric ratio	$\text{HCl} : \text{NaOH} = \underline{\hspace{1cm}} : \underline{\hspace{1cm}}$
c. Volume of substances in dm ³	$V(\text{NaOH}) = \underline{\hspace{1cm}} / 1000 = \underline{\hspace{1cm}} \text{ dm}^3$ $V(\text{HCl}) = \underline{\hspace{1cm}} / 1000 = \underline{\hspace{1cm}} \text{ dm}^3$
d. Amount of 'known' substance	$n(\text{HCl}) = c(\text{HCl}) \times V(\text{HCl})$ $= \underline{\hspace{1cm}} \times \underline{\hspace{1cm}} = \underline{\hspace{1cm}} \text{ mol}$
e. Amount of 'unknown' substance	$n(\text{NaOH}) = n(\text{HCl}) \times \text{ratio}$ $= \underline{\hspace{1cm}} \times \underline{\hspace{1cm}}$ $= \underline{\hspace{1cm}} \text{ mol}$
f. Concentration of 'unknown substance'	$c(\text{NaOH}) = n(\text{NaOH}) / V(\text{NaOH})$ $= \underline{\hspace{1cm}} / \underline{\hspace{1cm}}$ $= \underline{\hspace{1cm}} \text{ mol/dm}^3$

2. 20.00 cm³ of NaOH is just neutralised by 17.00 cm³ of 0.100 mol/dm³ H₂SO₄. Calculate the concentration of NaOH.

a. Symbol equation	$\text{H}_2\text{SO}_4 + 2\text{NaOH} \rightarrow \text{Na}_2\text{SO}_4 + 2\text{H}_2\text{O}$
b. Stoichiometric ratio	$\text{H}_2\text{SO}_4 : \text{NaOH} = \underline{\hspace{1cm}} : \underline{\hspace{1cm}}$
c. Volume of substances in dm ³	$V(\text{NaOH}) = \underline{\hspace{1cm}} / 1000 = \underline{\hspace{1cm}} \text{ dm}^3$ $V(\text{H}_2\text{SO}_4) = \underline{\hspace{1cm}} / 1000 = \underline{\hspace{1cm}} \text{ dm}^3$
d. Amount of 'known' substance	$n(\text{H}_2\text{SO}_4) = c(\text{H}_2\text{SO}_4) \times V(\text{H}_2\text{SO}_4)$ $= \underline{\hspace{1cm}} \times \underline{\hspace{1cm}} = \underline{\hspace{1cm}} \text{ mol}$
e. Amount of 'unknown' substance	$n(\text{NaOH}) = n(\text{H}_2\text{SO}_4) \times \text{ratio}$ $= \underline{\hspace{1cm}} \times \underline{\hspace{1cm}}$ $= \underline{\hspace{1cm}} \text{ mol}$
f.	

3. 25.00 cm³ of NaOH is just neutralised by 31.50 cm³ of 0.100 mol/dm³ HNO₃. Calculate the concentration of NaOH.

a. Symbol equation	$\text{HNO}_3 + \text{NaOH} \rightarrow \text{NaNO}_3 + \text{H}_2\text{O}$
b. Stoichiometric ratio	$\text{HNO}_3 : \text{NaOH} = \underline{\hspace{1cm}} : \underline{\hspace{1cm}}$
c. Volume of substances in dm ³	$V(\text{NaOH}) = \underline{\hspace{1cm}} / 1000 = \underline{\hspace{1cm}} \text{ dm}^3$ $V(\text{HNO}_3) = \underline{\hspace{1cm}} / 1000 = \underline{\hspace{1cm}} \text{ dm}^3$
d. Amount of 'known' substance	$n(\text{HNO}_3) = c(\text{HNO}_3) \times V(\text{HNO}_3)$ $= \underline{\hspace{1cm}} \times \underline{\hspace{1cm}} = \underline{\hspace{1cm}} \text{ mol}$
e.	
f.	

4. 40.00 cm³ of HCl is just neutralised by 36.70 cm³ of 0.150 mol/dm³ KOH. Calculate the concentration of HCl.

a. Symbol equation	$\text{HCl} + \text{KOH} \rightarrow \text{KCl} + \text{H}_2\text{O}$
b. Stoichiometric ratio	$\text{HCl} : \text{KOH} = \underline{\hspace{1cm}} : \underline{\hspace{1cm}}$
c. Volume of substances in dm ³	$V(\text{KOH}) = \underline{\hspace{1cm}} / 1000 = \underline{\hspace{1cm}} \text{ dm}^3$ $V(\text{HCl}) = \underline{\hspace{1cm}} / 1000 = \underline{\hspace{1cm}} \text{ dm}^3$
d.	
e.	
f.	

5. 40.00 cm³ of H₂SO₄ is just neutralised by 36.70 cm³ of 0.150 mol/dm³ KOH. Calculate the concentration of H₂SO₄.

a. Symbol equation	$\text{H}_2\text{SO}_4 + 2\text{KOH} \rightarrow \text{K}_2\text{SO}_4 + 2\text{H}_2\text{O}$
b. Stoichiometric ratio	$\text{H}_2\text{SO}_4 : \text{KOH} = \underline{\hspace{1cm}} : \underline{\hspace{1cm}}$
c.	
d.	
e.	
f.	

6. 40.00 cm³ of Ba(OH)₂ is just neutralised by 28.00 cm³ of 0.100 mol/dm³ HCl. Calculate the concentration of Ba(OH)₂.

a. Symbol equation	$2\text{HCl} + \text{Ba}(\text{OH})_2 \rightarrow \text{BaCl}_2 + 2\text{H}_2\text{O}$
b.	
c.	
d.	
e.	
f.	

7. 35.00 cm³ of Ba(OH)₂ is just neutralised by 21.35 cm³ of 0.100 mol/dm³ H₃PO₄. Calculate the concentration of Ba(OH)₂.

8. 41.40 cm³ CH₃COOH is just neutralised by 32.05 cm³ of 0.250 mol/dm³ NaOH. Calculate the concentration of CH₃COOH.

9. 12.05 cm³ of citric acid (tribasic) is just neutralised by 12.50 cm³ of 0.050 mol/dm³ potassium hydroxide. Calculate the concentration of citric acid.
10. 33.50 cm³ of ammonia solution is just neutralised by 23.50cm³ of 0.125 mol/dm³ sulphuric acid. Calculate the concentration of ammonia solution.

Answers

1. 0.0938 mol/dm³
2. 0.170 mol/dm³
3. 0.126 mol/dm³
4. 0.138 mol/dm³
5. 0.0688 mol/dm³
6. 0.0350 mol/dm³
7. 0.0915 mol/dm³
8. 0.194 mol/dm³
9. 0.0173 mol/dm³
10. 0.175 mol/dm³