# Scaffolding to prevent cognitive overload

***Education in Chemistry***September 2019  
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This series of questions starts with a fully scaffolded question; in the following questions scaffolding is removed.

## Coping with tritration

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

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| * 1. Symbol equation | HCl + NaOH 🡪 NaCl + H2O |
| * 1. Stoichiometric ratio | HCl : NaOH = \_\_\_\_\_\_ : \_\_\_\_\_\_\_ |
| * 1. Volume of substances in dm3 | V(NaOH) = \_\_\_\_\_\_\_\_\_\_\_ / 1000 = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ dm3  V(HCl) = \_\_\_\_\_\_\_\_\_\_\_ / 1000 = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ dm3 |
| * 1. Amount of ‘known’ substance | n(HCl) = c(HCl) x V(HCl)  = \_\_\_\_\_\_\_\_\_\_\_ x \_\_\_\_\_\_\_\_\_\_\_ = \_\_\_\_\_\_\_\_\_\_\_ mol |
| * 1. Amount of ‘unknown’ substance | n(NaOH) = n(HCl) x ratio  = \_\_\_\_\_\_\_\_\_\_\_ x \_\_\_\_\_\_  = \_\_\_\_\_\_\_\_\_\_\_ mol |
| * 1. Concentration of ‘unknown substance’ | c(NaOH) = n(NaOH) / V(NaOH)  = \_\_\_\_\_\_\_\_\_\_\_ / \_\_\_\_\_\_\_\_\_\_\_  = \_\_\_\_\_\_\_\_\_\_\_ mol/dm3 |

1. 20.00 cm3 of NaOH is just neutralised by 17.00 cm3 of 0.100 mol/dm3 H2SO4. Calculate the concentration of NaOH.

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| * 1. Symbol equation | H2SO4 + 2NaOH 🡪 Na2SO4 + 2H2O |
| * 1. Stoichiometric ratio | H2SO4 : NaOH = \_\_\_\_\_\_ : \_\_\_\_\_\_\_ |
| * 1. Volume of substances in dm3 | V(NaOH) = \_\_\_\_\_\_\_\_\_\_\_ / 1000 = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ dm3  V(H2SO4) = \_\_\_\_\_\_\_\_\_\_\_ / 1000 = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ dm3 |
| * 1. Amount of ‘known’ substance | n(H2SO4) = c(H2SO4) x V(H2SO4)  = \_\_\_\_\_\_\_\_\_\_\_ x \_\_\_\_\_\_\_\_\_\_\_ = \_\_\_\_\_\_\_\_\_\_\_ mol |
| * 1. Amount of ‘unknown’ substance | n(NaOH) = n(H2SO4) x ratio  = \_\_\_\_\_\_\_\_\_\_\_ x \_\_\_\_\_\_  = \_\_\_\_\_\_\_\_\_\_\_ mol |
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1. 25.00 cm3 of NaOH is just neutralised by 31.50 cm3 of 0.100 mol/dm3 HNO3. Calculate the concentration of NaOH.

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| * 1. Symbol equation | HNO3 + NaOH 🡪 NaNO3 + H2O |
| * 1. Stoichiometric ratio | HNO3 : NaOH = \_\_\_\_\_\_ : \_\_\_\_\_\_\_ |
| * 1. Volume of substances in dm3 | V(NaOH) = \_\_\_\_\_\_\_\_\_\_\_ / 1000 = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ dm3  V(HNO3) = \_\_\_\_\_\_\_\_\_\_\_ / 1000 = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ dm3 |
| * 1. Amount of ‘known’ substance | n(HNO3) = c(HNO3) x V(HNO3)  = \_\_\_\_\_\_\_\_\_\_\_ x \_\_\_\_\_\_\_\_\_\_\_ = \_\_\_\_\_\_\_\_\_\_\_ mol |
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1. 40.00 cm3 of HCl is just neutralised by 36.70 cm3 of 0.150 mol/dm3 KOH. Calculate the concentration of HCl.

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| * 1. Symbol equation | HCl + KOH 🡪 KCl + H2O |
| * 1. Stoichiometric ratio | HCl : KOH = \_\_\_\_\_\_ : \_\_\_\_\_\_\_ |
| * 1. Volume of substances in dm3 | V(KOH) = \_\_\_\_\_\_\_\_\_\_\_ / 1000 = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ dm3  V(HCl) = \_\_\_\_\_\_\_\_\_\_\_ / 1000 = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ dm3 |
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1. 40.00 cm3 of H2SO4 is just neutralised by 36.70 cm3 of 0.150 mol/dm3 KOH. Calculate the concentration of H2SO4.

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| * 1. Symbol equation | H2SO4 + 2KOH 🡪 K2SO4 + 2H2O |
| * 1. Stoichiometric ratio | H2SO4 : KOH = \_\_\_\_\_\_ : \_\_\_\_\_\_\_ |
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1. 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.

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| * 1. Symbol equation | 2HCl + Ba(OH)2 🡪 BaCl2+ 2H2O |
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1. 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.
2. 41.40 cm3 CH3COOH is just neutralised by 32.05 cm3 of 0.250 mol/dm3 NaOH. Calculate the concentration of CH3COOH.
3. 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.
4. 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