InkChemistry

QUESTION WORKBOOK

# Titration curves and choosing an indicator

Acids and bases · Unit C11

AQA 3.1.12.5 · OCR A 5.1.3

14 questions · 49 marks

PRINT EDITION

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## SECTION A · Short, 1 to 2 marks

**A1** TCCI-Q12 Suggest why, in the pH-curve practical, the base is added in 2.00 cm³ portions at first but in single drops close to the equivalence point. [2]

## SECTION B · Standard, 3 to 5 marks

**B1** TCCI-Q1 Explain why the pH at the equivalence point is 7.00 when hydrochloric acid is titrated with sodium hydroxide, but below 7 when hydrochloric acid is titrated with ammonia. [4]

**B2** TCCI-Q10 Explain how an indicator such as methyl orange, HIn, changes colour during a titration in which alkali is added to acid, and why only two or three drops of it are used. [4]

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**B3** TCCI-Q14 Compare the pH curve for 0.100 mol $dm^{-3}$ hydrochloric acid titrated with 0.100 mol $dm^{-3}$ sodium hydroxide with the curve for 0.100 mol $dm^{-3}$ ethanoic acid titrated with the same alkali. [4]

**B4** TCCI-Q16 Explain why, beyond the equivalence point, the pH curves for hydrochloric acid and for ethanoic acid titrated with the same sodium hydroxide solution follow the same line, and calculate the pH of both mixtures when 35.0 $cm^3$ of 0.100 mol $dm^{-3}$ NaOH has been added to 25.0 $cm^3$ of 0.100 mol $dm^{-3}$ acid. [4]

**B5** TCCI-Q19 Compare the pH curve for 0.100 mol $dm^{-3}$ hydrochloric acid titrated with 0.100 mol $dm^{-3}$ ammonia with the curve for 0.100 mol $dm^{-3}$ ethanoic acid titrated with 0.100 mol $dm^{-3}$ sodium hydroxide. [4]

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**B6** TCCI-Q2 Identify a suitable indicator, methyl orange or phenolphthalein, for each titration, or state that neither is suitable: (a) ethanoic acid with sodium hydroxide; (b) hydrochloric acid with ammonia; (c) ethanoic acid with ammonia. [3]

**B7** TCCI-Q7 Explain why the pH at the equivalence point is greater than 7 when ethanoic acid is titrated with sodium hydroxide. [3]

**B8** TCCI-Q8 Explain why the pH at the half-neutralisation point of a weak acid titrated with a strong base is equal to the pKa of the acid. [3]

**B9** TCCI-Q13 Suggest the most likely cause of this error, and how it should be put right: a student finds the pKa of benzoic acid by the half-neutralisation method and gets 4.42, against a data book value of 4.20, although the equivalence volume was correct. [3]

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**B10** TCCI-Q17 Explain why no indicator gives a sharp end point in a titration of ethanoic acid with ammonia, and how the equivalence volume can be found instead. [3]

**B11** TCCI-Q18 Calculate the ratio $[In^-]/[HIn]$ for methyl orange, pKIn = 3.70, in a solution of pH 4.40, and state the colour seen. [3]

**B12** TCCI-Q20 Justify the choice of phenolphthalein, which changes colour over pH 8.3 to 10.0, rather than methyl orange, which changes over pH 3.1 to 4.4, for the titration of ethanoic acid with sodium hydroxide. [3]

## SECTION C · Long, 6 marks or more

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**C1** TCCI-Q11 Describe how the pH curve for the titration of 25.0 $cm^3$ of ethanoic acid with sodium hydroxide is measured in the laboratory, and how the pKa of ethanoic acid is found from it. [6]

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