A Level Titration Calculations

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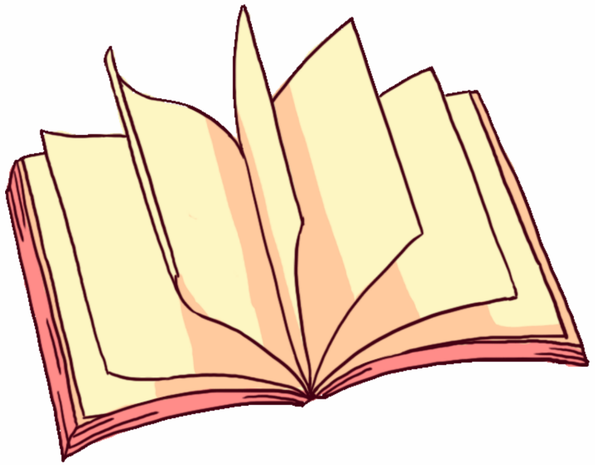

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Examiner and Tutor

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Step-by-step answers

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Acid–base titrations

(d) the techniques and procedures used when preparing a standard solution of required concentration and carrying out acid–base titrations

(e) structured and non-structured titration calculations, based on experimental results of familiar and non-familiar acids and bases.

7 After delivering a solution from a pipette, a droplet remains in the tip of the pipette.

How should a student ensure that the pipette delivers the volume of solution stated on the pipette?

A Fill the pipette just above the graduation line to compensate for the volume of the droplet that remains in the tip.

B Leave the droplet in the tip.

C Shake the pipette to force out the droplet left in the tip.

D Use a pipette filler to force the droplet out of the tip.

Your answer ☐ **[1]**

3 Glutaric acid is used in the production of polymers.

The formula of glutaric acid can be represented as $HOOC(CH_2)_nCOOH$, where n is a whole number.

A student carries out a titration to find the value of n.

1. The student dissolves 2.891 g of glutaric acid in water and makes up the solution to 250.0 cm^3 in a volumetric flask.
2. The student transfers 25.0 cm^3 of this solution into a conical flask.
3. The student titrates the solution with 0.240 mol dm^{-3} NaOH(aq) in the burette.

Equation:

$$HOOC(CH_2)_nCOOH(aq) + 2NaOH(aq) \rightarrow NaOOC(CH_2)_nCOONa(aq) + 2H_2O(l)$$

The student uses phenolphthalein as the indicator.
Phenolphthalein is colourless in acid and pink in alkali.

(a) State the colour change observed at the end point of the titration.

Colour from ..... to ..... **[1]**

(b) The student carries out a trial titration followed by three further titrations, **1**, **2** and **3**.

The results are shown in the table below.

Titration	Trial	1	2	3
Final reading/cm^3	18.70	36.55	18.30	36.60
Initial reading/cm^3	0.20	18.50	0.10	18.30
Titre/cm^3				

(i) Complete the table to show the titre in each titration. **[1]**

(ii) Why does the student carry out a trial titration?

.....

..... **[1]**

(iii) Calculate the mean titre of NaOH(aq) that the student should use for analysing the results.

mean titre = ... cm^3 **[1]**

(iv) In the titration, the uncertainty in each burette reading is ± 0.05 cm^3.

Calculate the percentage uncertainty in the titre for **Titration 1**.

percentage uncertainty = ... % **[1]**

(c) Calculate the value of n in $HOOC(CH_2)_nCOOH$.

Give your answer to the nearest whole number.

. .

23 This question is about barium hydroxide.

(a) Barium hydroxide is an alkali which releases hydroxide ions, OH^-, in aqueous solution.

A barium hydroxide solution contains 3.89 g of $Ba(OH)_2$ in 100 cm^3 at 20 °C.

Calculate the concentration of hydroxide ions, OH^-, in mol dm^{-3}, of this solution at 20 °C.

Give your answer to **3** significant figures.

(b) A student carries out a titration to determine the concentration of an aqueous solution of $Ba(OH)_2$.

The student adds $25.0\,cm^3$ of the $Ba(OH)_2(aq)$ solution to a conical flask.
The student titrates this solution by adding $0.160\,mol\,dm^{-3}$ $HNO_3(aq)$ from the burette.

The equation is shown below.

$$Ba(OH)_2(aq) + 2HNO_3(aq) \rightarrow Ba(NO_3)_2(aq) + 2H_2O(l)$$

The student repeats the titration until concordant titres are obtained.

The mean titre of $0.160\,mol\,dm^{-3}$ $HNO_3(aq)$ is $26.75\,cm^3$.

(i) What is meant by concordant titres?

.....

..... **[1]**

(ii) Calculate the concentration, in $mol\,dm^{-3}$, of the $Ba(OH)_2(aq)$ solution.

concentration of $Ba(OH)_2(aq)$ = ... $mol\,dm^{-3}$ **[3]**