AS level Chemistry A

H032/02 Depth in chemistry

Question Set 7

1. (a) (i) A student carries out a titration to determine the molar mass and structure of a weak acid **A**.

The student follows the method below.

- Dissolve a weighed mass of **A** in 100 cm^3 of distilled water and make the solution up to 250 cm^3 in a beaker.
- Add the solution of **A** to a burette.
- Titrate the solution of **A** with a standard solution of sodium hydroxide, NaOH.

(ii) What is meant by the term standard solution? 1 mol dm^{-3}

[1]

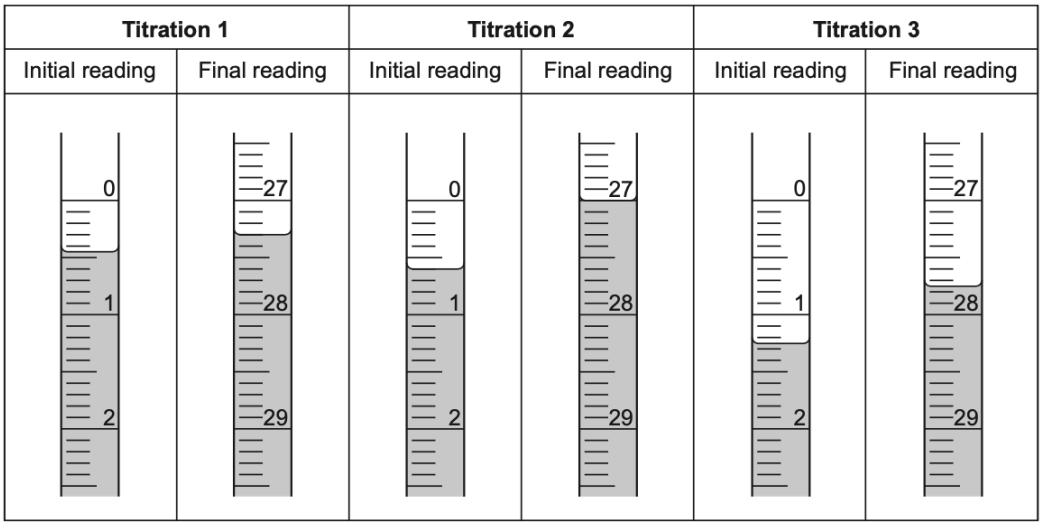
(b) Sodium hydroxide is an alkali. a soluble base that releases OH^- ions in solution

What is meant by the term alkali?

[1]

(c) The student carries out a trial, followed by three further titrations.
The diagram shows the initial and final burette readings for the three **further** titrations.

The student measures all burette readings to the nearest 0.05 cm^3.



(i) Record the student's readings and the titres in the table below.

Calculate the mean titre, to the nearest 0.05 cm^3, that the student should use for analysing the results.

	Titration 1	**Titration 2**	**Titration 3**
Final reading/cm^3	27.30	27.10	27.75
Initial reading/cm^3	0.45	0.60	1.25
Titre/cm^3	26.85	26.50	26.50

[4]

(ii) The uncertainty in each burette reading is ± 0.05 cm^3.

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

[1]

i) mean titre = $\frac{26.50 + 26.50}{2} = 26.50$

ii) $\frac{0.05 \times 2}{26.85} \times 100 = 0.372\ \%$

(iii) The student realised that the solution of **A** had not been prepared correctly.

How should the student have made up the solution? **[1]**

iii) Transfer the solution in the beaker to a volumetric flask and make up the solution to the 250cm³ mark with distilled water. Invert the flask several times to ensure the solute is well distributed.

(d) A student repeats the titration to determine the molar mass and structure of **A**.

The student prepares a 250.0 cm^3 solution from 1.513 g of **A**.

- The solution of **A** is added to the burette and titrated with 25.0 cm^3 volumes of 0.112 mol dm^{-3} NaOH(aq).
- 1 mol of **A** reacts with 2 mol of NaOH.
- The student obtains a mean titre of 27.30 cm^3.

(di) Calculate the molar mass of **A** from these results.

Give your answer to the nearest whole number.

Show your working. **[4]**

moles of NaOH = 0.025 x 0.112

= 0.0028

moles A = 0.0028 ÷ 2 = 0.0014 x 10 = 0.014 **[1]**

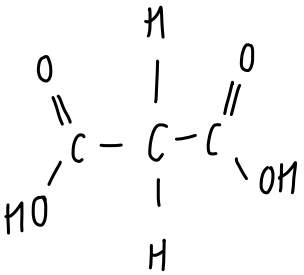
$Mr = \frac{mass}{moles} = \frac{1.513}{0.014} = 108$

(dii) **A** is an organic acid, containing C, H and O only.

One molecule of **A** contains two COOH groups.

Suggest the structure of **A**.

$HOOCCH_2COOH$



Total Marks for Question Set 1: 13