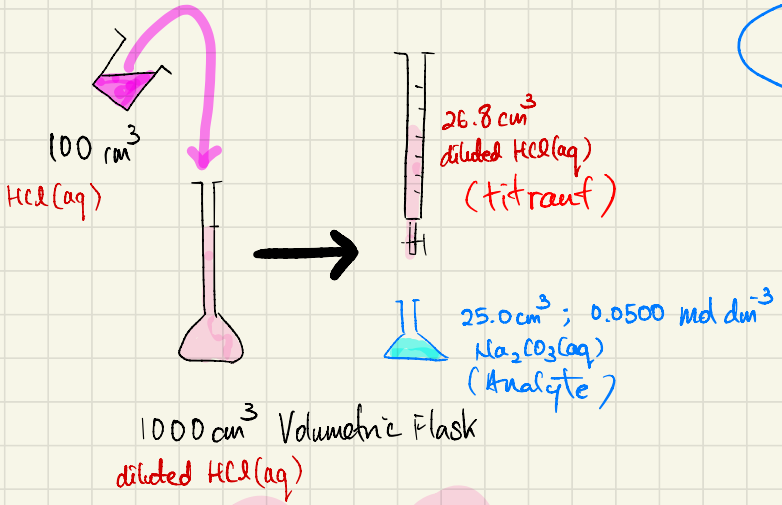

25.0 ± 0.10 ?
1dp 2dp

Assume :

25.0 ± 0.1 cm^3

0.0500 ± 0.0005 mol dm^{-3}

26.8 ± 0.1 cm^3

Step 1 : $2HCl(aq) + Na_2CO_3(aq) \rightarrow 2NaCl(aq) + CO_2(g) + H_2O(l)$

Chemical Equation identified

Step 2 : Include all quantities

26.8 cm^3 ✓ 25.0 cm^3 ✓

0.0500 mol dm^{-3} ✓

2n n

no. of moles = conc. × Vol.

$$\frac{n}{c \mid V}$$

Molar ratio of HCl : Na_2CO_3

2 : 1

No. of moles of HCl in 26.8 cm^3

= 2 × No. of moles of ~~HCl~~ Na_2CO_3 in 25.0 cm^3

$= 2 \times \underset{3sf}{0.0500} \times \underset{3sf}{\frac{25.0}{1000}}$

= 0.00250 mole 3sf

No. of moles of HCl in 1000 cm^3 diluted acid

$= 0.00250 \times \frac{1000}{26.8} = 0.0933$ mol dm^{-3}

$$\pm\%\Delta = \left(\frac{\overset{1sf}{0.0005}}{\underset{3sf}{0.0500}} \times 100\%\right) + \left(\frac{\overset{1sf}{0.1}}{\underset{3sf}{25.0}} \times 100\%\right)$$

$= \overset{2dp}{1.00} + \overset{3dp}{0.400}$

= 1.40 %

$$\pm\%\Delta = 1.40\% + \left(\frac{0.1}{26.8} \times 100\%\right)$$

= 1.40 + 0.373

= 1.77 %

concentration of original HCl ($100\ cm^3$)

$$= \frac{0.0933}{\left(\frac{100}{1000}\right)} = 0.933\ mol\ dm^{-3}$$

Absolute uncertainty $= \overset{3sf}{0.933} \times \frac{\overset{3sf}{1.77}}{100}$

$= \underline{0.017}$ b/c main body 3dp.

$0.933 \pm 0.017\ mol\ dm^{-3}$ ✓

$0.933 \pm 1.77\%\ mol\ dm^{-3}$ ✓

concentration of original HCl ($100\ cm^3$)

$$= \overset{3sf}{0.933} \times \underbrace{(\overset{4sf}{1.01 + 35.45})}$$

$= 34.0\ g\ dm^{-3}$

Absolute uncertainty $= 34.01 \times \frac{1.77}{100}$

$= \underline{0.61}$

$\overset{1dp}{34.0} \pm \overset{1dp}{0.7}\ g\ dm^{-3}$ (Round Up)

$34.0 \pm 1.77\%\ g\ dm^{-3}$

Learning pts.

1. Calculate the uncertainties as given in the question. Do not adopt any other values not included in the question.

2. Random uncertainties provided may not necessary the same as those given in our laboratory. Adapt to what is given in qn.

Assume:

$25.0 \pm 0.1\ cm^3$

$0.0500 \pm 0.0005\ mol\ dm^{-3}$

$26.8 \pm 0.1\ cm^3$