Question 2 : Calculate the pH of a solution of 20mL of 0.250 M of the acid HA, (A is acid group) Ka (HA)=7.1 10^{-5}

$$[H^+] = \sqrt{K_a \cdot M} = \sqrt{7.1 \times 10^{-5} \cdot 0.250}$$

$$= 0.42 \cdot 10^{-2}$$

pH = 2.375

Buffer

Question 3: Calculate the pH of a solution of 250mL of 0.055M KA (aq) (Ka is potassium salt, A is acid group) to which 25mL of a 0.2 M HCl (aq) is added. Ka (acid HA)=7.1 10^{-5}

A^- $\quad .0250_{V} \cdot 0.055_{M} = 0.01375$ mol Base

HCl $\quad .025 \cdot 0.2 = 5 \cdot 10^{-3}$ mol Acid

$\Delta = 8.75 \cdot 10^{-3}$ mol new B

$$pH = -\log 7.1 \cdot 10^{-5} + \log \frac{8.75 \cdot 10^{-3}}{5 \cdot 10^{-3}}$$

pH = 4.39

Question 4: Calculate the concentration in molarity of 30mL of NaF if 60mL of 0.55 M HCl is needed to titrate to the end point.

$n_{base} = mol\ F^-$ $\quad F^- + HCl \rightarrow HF$

$$0.030 \cdot M_{F^-} = 0.060 \cdot 0.55_{HCl}$$

$M = 1.1$

M

15
17g titration end point

Question 5: In an assay for an analyte, ~~17~~ g of a solid sample containing that analyte was taken and 77% of analyte (%w/w or %m/m) was found. The measurement included dissolving the solid sample in water to 200mL, and removing from that a 50mL aliquot for the titration with 40mL 0.24M of KOH to the end point. What was the Molar Mass (or MW) of the analyte in g/mol?.

$15.0 \cdot 0.77 = 11.55\ g$

$$\frac{\left(\frac{11.55\ g}{MM}\right) mol}{0.2\ L} \cdot \underbrace{0.050}_{V} = 0.24_M \cdot 0.04\ L$$

$= M$

→ MM = 300 g/mol

Question 6 : How many grams (g) of FeI_3 you need to prepare 2 M solution of I^- if it was completely dissolved in 500mL of a solvent?

$MM_{FeI_3} = 436.55$

$$\frac{\left(\frac{mass}{MM}\right)}{0.5}\ mol\ FeI_3 \cdot \frac{3\ mol\ I^-}{1\ mol\ FeI_3} = 2\ M\ I^-$$

→ Mass. 14.6 g

Question 7 : Calculate how many M of $La(IO_3)_3$ will dissolve in 350 mL of 0.07M $LiIO_3$? **Ksp for $La(IO_3)_3 = 0.99\ 10^{-10}$**

$La(IO_3)_3 \rightarrow La^{3+} + 3\ IO_3^-$

$x \quad 3x + 0.07$

$K_{sp} = 0.99 \cdot 10^{-10} = (x) \cdot (3x + 0.07)^3$

$x = M$

$= 3.43 \cdot 10^{-4} x$

$M = 2.9 \cdot 10^{-7}\ M$

Question 8 : Calculate the molarity of 40mL of HCl solution that was used in titration to completely react with 50mL of 0,5M Na_2CO_3 solution.

$2HCl + Na_2CO_3 \rightarrow H_2CO_3 + 2NaCl$

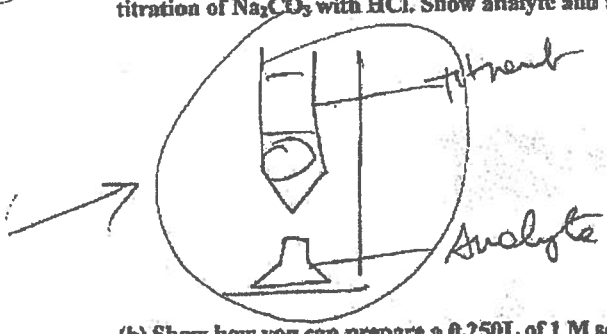
$0.04\,L \cdot \frac{M}{M_{HCl}} = 0.050\,L \cdot 0.5\,M \cdot \frac{2\ mol\ HCl}{1\ mol\ H_2}$

$V \qquad M$

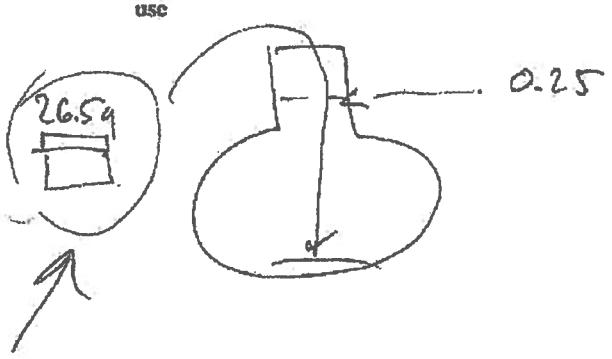
$mol\ Na_2CO_3$

$M = \frac{0.050 \cdot 0.5 \cdot 2}{0.04} = 1.25$

Question 9: (a) Draw a simple diagram that shows titration instrumentation for titration of Na_2CO_3 with HCl. Show analyte and titrant.



(b) Show how you can prepare a 0.250L of 1 M solution of Na_2CO_3 using a volumetric flask. (MM = 106g/mol) Na_2CO_3). Draw the glassware you are going to use



$$\frac{26.5\,g}{106\,g/mol} = 0.25\,mol \Rightarrow \frac{0.25\,mol}{0.25\,L} = 1M$$

Question 10: Calculate the pH of a solution made from 0.050 moles of NaOH dissolved in 10000cm^3 of water:

$1cm^3 = 1ml \Rightarrow 10^{-3} L$

$$M_{NaOH} = \frac{0.05\,mol}{10\,L} = 0.005\,M\ [OH^-]$$

$$pOH = -\log(0.005) = 2.3$$

$pH = 14 - 2.3$

pH = 11.7

Question 11: What is the pH of 2.50L of a buffer made of 1.9M of acetic acid and 1.85M of sodium acetate ($K_a=10^{-4.8}$)

$$pH = -\underbrace{\log 10^{-4.8}}_{4.8} + \underbrace{\log \frac{(1.85)}{1.9}}_{-0.01158} =$$

→ pH= 4.79

Question 12: Calculate the pH of a 0.500 M solution of $NaC_2H_3O_2$ ($K_a= 1.8\ 10^{-5}$)

$$K_b = \frac{10^{-14}}{K_a} = \frac{10^{-14}}{1.8 \cdot 10^{-5}} = 5.56 \cdot 10^{-10}$$

$$K_b = \frac{x^2}{M - x}$$

$$[OH^-] = x = \sqrt{K_b \cdot 0.5} = \sqrt{5.56 \cdot 10^{-10} \cdot 0.5}$$

$$= 1.67 \cdot 10^{-5}$$

$$pOH = -\log 1.67 \cdot 10^{-5} = 4.78$$

$$pH = 14 - 4.78 = 9.22$$

→ pH = 9.22