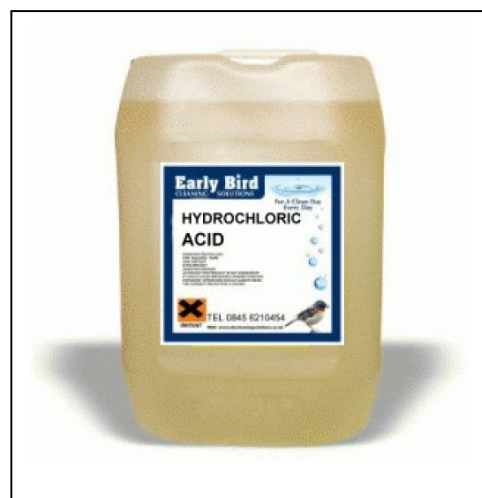**Friday Worksheet - Volumetric 5**   **Name: ……………….**

The active ingredient in brick cleaner is hydrochloric acid,
HCl. To find the concentration of HCl in the brick cleaner,
 a pipette is used to deliver 20.0 mL of the cleaner into a
250 mL, volumetric flask. A 20.0 mL aliquot of this diluted
solution is then titrated with a standardised solution of
0.100 M sodium carbonate in a burette.

1) Write the equation to the reaction between the carbonate and hydrochloric acid.
   a. *$Na_2CO_3(aq) + 2HCl(aq) \rightarrow 2NaCl(aq) + H_2O(l)$*

   b.   If an average titre of 21.10 mL was obtained, what is the concentration in
        gL⁻ of HCl in the cleaner.

   Step 1 Mol of Na_2CO_3 needed to react with the HCl in the aliquot
   = C X V = 0.100 X 0.02110 = 0.00211

   Step 2 Mol of HCl in the aliquot
   = 0.00211 X 2 = 0.00422

   Step 3 Calculate the mass of HCl in the aliquot
   = Fm X mol = 36.5 X 0.00422 = 0.154 g

   Step 4 Find the mass of HCl in the volumetric flask
   = (250/20) X 0.154 = 1.925 g

   Step 5 Find the concentration of HCl in the cleaner in g/L
   = 1.925 / 0.020 = 96.3g/L

c. A student delivers a 20.00 mL aliquot of undiluted brick cleaner with a concentration of HCl of 3.65 gL⁻ into a conical flask and places two drops of indicator into the flask. The student then makes up a standard solution by carefully weighing a pure sample of Na_2CO_3 and placing it in a 250 mL volumetric flask. If the student needs to obtain a titre of 12.25 what should the mass of Na_2CO_3, placed into the volumetric flask be?

Step 1 Calculate the mol of HCl in the 20.0 mL sample
Concentration of HCl in mol/litre = 3.65/36.5 = 0.100 M

n_{HCl} = 0.100 X 0.0200 = 0.00200 mol

Step 2 find the mol of sodium carbonate needed to react with the HCl in the conical flask
$n_{sodium\ carbonate}$ = 0.00100 mol
Step 3 find the concentration of carbonate solution that must be delivered in the 12.25 mL
C =n/V = 0.00100 / 0.01225 = 0.0816 M
Step 4 calculate the mol of sodium carbonate in the 250 mL volumetric flask

n = C X V = 0.0816 X 0.250 = 0.0204

Step 5 find the mass of Na_2CO_3
mass = mol X molar mass$_{sodium\ carbonate}$

Mass = 0.0204 X 106.0 = 2.16 g

d. Why is Na_2CO_3 considered to be a <u>primary standard</u> and NaOH is not?

Na_2CO_3 does not react with the atmosphere like NaOH. NaOH absorbs water from the atmosphere and so its weight cannot accurately be determined.

e. The student accidentally placed three drops of indicator into the conical flask. How will this influence the mass of sodium carbonate calculated, in 3) above?
   No difference.