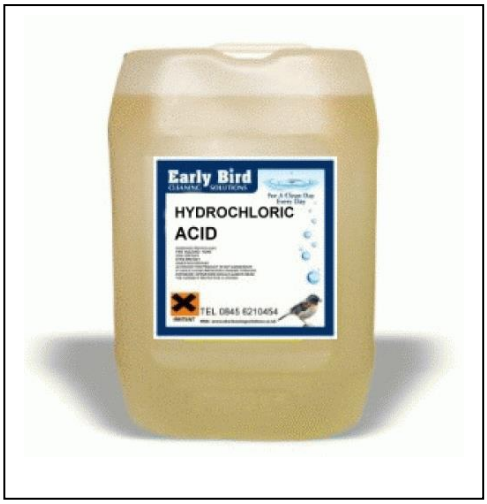
Friday Worksheet **Name:**

…….

Volumetric 6



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 primary standard 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.