Friday Worksheet **Name: …….**

Volumetric analysis worksheet 8 chlorine investigation

A household cleaner was analysed for its available chlorine as hypochlorite (OCl^-)
A 20.0 mL sample of the bleach was placed in a 250 mL volumetric flask and made to the mark with distilled water. A 20.0 mL aliquot was taken from the volumetric flask and transferred to a conical flask. To the volumetric flask about 5 mL of acidified KI solution was added upon which the solution turned a dark brown colour due to the formation of I_2 according to the reaction below. The KI was added in excess.

1. $ClO^-_{(aq)} + 2I^-_{(aq)} + 2H^+_{(aq)} \Rightarrow I_{2(aq)} + Cl^-_{(aq)} + H_2O_{(l)}$

The solution in the conical flask was titrated against a 0.100 M $S_2O_3^{-2}$ and an average titre of 8.51 mL was obtained. The thiosulfate ($S_2O_3^{-2}$) reacts with the iodine molecule according to the equation below.

2. $I_{2(aq)} + 2S_2O_3^{-2}{}_{(aq)} \Rightarrow S_4O_6^{-2}{}_{(aq)} + 2I^-_{(aq)}$

1) Calculate the amount, in mol, of thiosulfate($S_2O_3^{-2}$) in the average titre.

   $n_{thiosulfate} = C \times V = 0.100 \times 0.00851 = 8.51 \times 10^{-4}$

2) Calculate the amount of I_2 present in the conical flask.
   $n_{iodine} = 8.51 \times 10^{-4} / 2 = 4.26 \times X \times 10^{-4}$

3) Calculate the amount of ClO^- in the 20.0 mL aliquot of the diluted bleach in the volumetric flask.
   According to equation 1 for every mol of I_2 formed one mol of ClO^- is present.
   Mol of ClO^- $= 4.26 \times X \times 10^{-4}$

4) Calculate the amount, in mol, of OCl^- in the volumetric flask
   $4.26 \times X \times 10^{-4} \times 250/20 = 5.33 \times 10^{-3}$

5) Calculate the amount, in mol, of OCl^- in a 1 litre container of the bleach.

   Keep in mind that all the OCl^- that was in the volumetric flask came from 20.0 mL of the bleach
   The mol per litre of OCl^- is
   $\Rightarrow 5.33 \times 10^{-3} / 0.0200 = 0.266$ M

6) Find the mass of chlorine atoms present as OCl^- ions in one litre of bleach.
   Mole of Cl atoms is equal to the mol of OCl^- ions
   Mole of Cl atoms in one litre is 0.266
   Mass of chlorine atoms = 0.266 X 35.5 = 9.44 grams

7) Calculate the amount of chlorine as a percentage (weight/volume)
   The percentage weight per volume id the mass in grams of chlorine in 100 mL of solution.
   (9.44/1000) X 100 = 0.944% w/v