THE OPEN UNIVERSITY OF SRI LANKA
B.Sc. Degree Programme / Stand alone course – Level 4

CHU 2125/CHE 4125 – Analytical Chemistry I - 2006/2007
Answer guide to Assignment Test I

An advice to students.

Our experience in marking has proved the fact that most of the students haven't looked at the answer guides supplied for assignments I and II before they come for the final exam. **Time you spend to read the answer guide will not be wasted!**

1. (i)

To **report** the molarity of this solution we have to calculate the **mean** and **standard deviation** of these results.

$$\text{Mean} = \frac{1.2196}{6} = 0.203266 \cong 0.2033 \; mol\, dm^{-3}$$

$$\text{Standard deviation} = \sqrt{\frac{\left(x_i - \overline{x}\right)^2}{n-1}}$$

$$= \sqrt{\frac{\left(1.9x10^{-3}\right)^2 + \left(1.6x10^{-3}\right)^2 + \left(6x10^{-4}\right)^2 + \left(1x10^{-4}\right)^2 + \left(1.7x10^{-3}\right)^2 + \left(2x10^{-4}\right)^2}{5}}$$

$$= \sqrt{\frac{9.47x10^{-6}}{5}} = \sqrt{1.894x10^{-6}} = \pm 1.37622x10^{-3} = \pm 0.001376$$

$s.d. \cong \pm 0.0014 \; mol\, dm^{-3}$

Both mean and standard deviation have the same units. We can **report** the concentration as follows.

Concentration $= 0.2033 \pm 0.0014 \; mol\,dm^{-3}$

Now anybody can understand the fact that true value of the concentration lies between $0.2019 \; mol \; dm^{-3}$ and $0.2047 \; mol \; dm^{-3}$.

(ii)

$$\text{Coefficient of variation} = \left(\frac{s\tan dard \; deviation}{mean} \right) x \; 100\%$$

$$\text{Coefficient of variation} = \left(\frac{0.0014}{0.2033} \right) x \; 100\%$$

$$\text{Coefficient of variation} = 0.6886\% \cong 0.69\%$$

(iii)

We can carry out titrations taking increasing amounts of the solution of analyte. For example $15.00 \; cm^3$ for the first titration, $20.00 \; cm^3$ for the second titration etc.

If the error (concentration of analyte) increases, when we increase the sample size, then we can say that there is a proportional systematic error involved in the method (See page 44 of Unit I of CHU 2125).

If there is no big change in concentration, when we increase the sample size, then we can say that there is no proportional systematic error involved in the method and hence in results.

(iv)

Reason for the variation of results is the random error associated in the experimental results.

2.

When we titrate a strong acid with ammonia, it is a one step reaction. There are no several different complexes being formed during the cause of titration. Once all H_3O^+ in the titration flask is reacted with incoming ammonia from the burette, there will be a big change in pH inside the titration flask, since there is nothing to react with incoming

coming

ammonia from the burette. Due to this reason there will be a large vertical portion in the
∧
titration curve.

However, if we titrate a solution of Cu^{2+} with ammonia, pCu will rise gradually with added volume of ammonia and there will be no sharp increase in the vertical portion of the titration curve, even after adding sufficient ammonia to convert all Cu^{2+} into $Cu(NH_3)_4{}^{2+}$.

If all the ammonia is used up in one step to convert all Cu^{2+} into $Cu(NH_3)_4{}^{2+}$, without forming any other complex such as $Cu(NH_3)_3{}^{2+}$, $Cu(NH_3)_2{}^{2+}$ etc, then we will be able to see an increase in the vertical portion of the titration curve.

When all Cu^{2+} is reacted with ammonia all four complexes are there in the titration flask in different amounts. Hence we don't know the stoichiometry of the reaction. Therefore the titration of Cu^{2+} with ammonia is not feasible.