Q. 1. **How errors can be minimized discuss.**

Ans. Errors can be minimized by following:

1. Calibration of apparatuses and application of correction. calibrated weights, flasks, burettes, pipettes should be used. If impurity is also weighed it should be ppted out and may be determined by reducing its weight.

2. **By running a blank determination:** In this separate determinate is made in which sample is omitted (not taken). Rest of the experimental conditions are same. If impurity is introduced by reagents/vessels, excess of standard solution of required to establish end point. But large Blank correction in undesirable since it decreases precision of analysis.

3. By Running a control determination:- It consists of carrying a determination under as nearly as possible identical experimental conditions upon a quantity of standard substance which contains the same weight of constituent as in contained in unknown sample weight of constituent in unknown is calculated :--
   Result found for standard   =   Wt. of constituent in standard
   Result found for unknown   x (Wt. of constituent in unknown)

4. **By use of independent methods of analysis:-** By using different methods like gravimetric and Titrimetric methods to determine the same constituent.

5. **By running parallel determination:-** This serves as check on result of a single determination. It indicates only precision of analysis. It involves measuring the values in duplicate or triplicate. Therefore a constant error may be present.

Q. 2. **Define accuracy and precision. What is absolute errors and relative error.**

Ans. Accuracy and precision are used synonymously.

Accuracy:- It is the concordant between true value and measured value. Accurate results agrees closely with true value and measured quantity. Smaller the error greater is the accuracy.

Precision:- It refers to agreement among a group of experiential results. It does not implies about their relation with true value. Precise value may be inaccurate. It is stated in terms of standard deviation, average deviation or range. It can be expressed in terms of absolute of relative basis.

Absolute errors:- It is difference between experimental value and true value.

Eg:-   Experimental value   = 20.44%
        True value   = 20.34%
        Absolute errors   = 20.44 – 20.34 = 0.10%

$$\text{Relative error} = \frac{\text{absolute error}}{\text{true value}} = \frac{0.10}{20.34} \times 100 = 0.5\%$$

$$\text{and in terms of part per thousand} = \frac{0.10}{20.34} \times 1000 = 5 \text{ ppt}$$