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Class 12
Chemistry

Chapter 16

Empirical data collection & Analysis

Handwritten Notes

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EMPIRICAL DATA COLLECTION & ANALYSIS

Types of Data

In chemistry, understanding substances and reactions depends on collecting and analyzing data. Chemical characterization is of two mains types; qualitative and quantitave data, and both are essential for explaining chemical phenoma.

- **Qualitative Data**: Qualitative data refers to non-numerical information obtained through observation. It describes the properties and behaviour of substances. For example, observing a color change in a solution to detect specific ions, identifying whether a reaction is exothermic or endothermic, or noting the odor, color, and physical state (solid, liquid, gas) of a substance. Thus, qualitative data helps in describing what is happening in a chemical process without using numbers.
- **Quantitativae Data**: Quantitative data refers to numerical measurements obtained from experiments using instruments. It includes values such as mass, volume, concentration, temperature, etc. This type of data is used for calculations and precise analysis. However, all measurements involve random errors and uncertainities, which arise due to limitations of instruments and human factors.
  For example, in determining concentration through titration, apparatus like burette, pipette, and volumetric flask are used. Errors can occur due to improper callibration, unclean glassware, or incorrect reading of the meniscus. Even small mistakes in initial and final readings of the burette can cause uncertainity in calculated concentration. Similarly, for mass measurement, an analytical balance is used, and errors may result from air currents, poor calliberation, or dust on the balance pan. Even slight disturbances can affect the accuracy of measured mass.

Graphical Techniques and Data of Variables

Graphs are an effective way to represent the relationship between two variables and to understand how one variable effects another. The independent variable is the one that is controlled or changed during an experiment and is plotted on the x-axis, while the dependent variable is the one that changes in response and is plotted on the y-axis.
For example, in a pressure-volume graph (Bayle's law), pressure is the independent variable and volume is the dependent variable. By ploting graphs, relationships between variables can be easily visualized, whether they are direct, inverse, or more complex.
Graphs are also useful for determining physical quantities. The slope of a graph (slope = $\tan\theta$) represents the rate of change between variables and can indicate important properties such as acceleration, rate of reaction, or consistancy of a reletionship. Therefore, graphical representation is often more effective than tables because it provides a clear visual understanding and ~~can~~ helps in drawing furthur conclusions from the data.