FAQ:

Q.1. Defferentiate between Wave length and Wave number:

a) Ans: The distance along the direction of propagation for one complete cycle is known as wavelength. It is denoted by 'λ'. Wave length may be measured in centimeters (cm), micrometers (μm), nanometers (nm), or angstrom units (Å), where 1 nm = 10^{-3} μm = $^{6-}10$ mm = 10^{-7} m, and 1 Å = 10^{-8} cm. Wave number is defined as the number of complete cycles occurring per centimeter. It is denoted by the symbol '□'.

Q.2. What is spectroscopy. State its principle?

Ans: Spectroscopy is the analysis of the electromagnetic radiation emitted, absorbed or scattered by atoms or molecules as they undergo transitions between two energy levels. The frequency, *v,* of the electromagnetic radiation associated with a transition between a pair of energy levels *E*1 and *E*2 is given by:

$$\mathbf{hv = |E1-E2| = |\Delta E|}$$

The principle of spectroscopy is based on Beer-Lambert Law which states that **"**the amount of light absorbed (absorption or extinction) is proportional to the concentration of the absorbing substance and to the thickness of the absorbing material (path-length)". It is written as:

Where, I = the intensity of the transmitted light.

I_o = the intensity of the incident light.

a = constant.

b = the absorbing thickness, better known by the path-length.

C = the concentration of the absorbing material.

Q. 3. What is Fluorescence?

Ans: The phenomenon whereby a molecule after absorbing radiations, emits radiation of a longer wavelength is known as fluorescence. Thus a compound which absorbs in the ultraviolet range might emit radiation in the visible range. This shift towards a longer wavelength is known as Stoke's shift.

Q. 4. Differentiate between fluorescence and phosphorescence?

Ans: The main difference between fluorescence and phosphorescence are as under:

- When light is supplied to a sample of molecules, we immediately see the fluorescence. Fluorescence stops as soon as we take away the light source. But phosphorescence tends to stay little longer even after the irradiating light source is removed.
- Fluorescence takes place when excited energy is released, and the molecule comes back to the ground state from the singlet-excited stage. Phosphorescence takes place when a molecule is coming back to the ground state form the triplet excited state (metastable state).
- The energy released in the fluorescence process is higher than that in the phosphorescence.
- In fluorescence, the absorbed amount of energy is released back but, in phosphorescence, released energy is lower than what is absorbed.

Q. 5. Enlist the factors affecting fluorescence?

Ans: The factors affecting fluorescence are:

1) Quenching.
2) Inner filter.
3) Concentration.
4) Molecular environment.
5) Scatter.

Q. 6. Differentiate between:

a) Static and dynamic quenching.

b) Fluorophore and chromophore.

a) Ans: Static quenching takes place when the fluorescent molecule forms a non-fluorescent complex with the quencher molecule which inhibits the formation of an excited state. It does not depend on diffusion or molecular collisions. While as, dynamic quenching is caused

by deactivation of the excited state by contact with another molecule in the sample matrix called the quencher. It depends on molecular movements.

b) Ans: A molecule or substructure able to emit fluorescence is called a fluorophore. While as, a molecule that absorbs photons is called a chromophore.

Q.7. What are the two main differences between a spectrophotometer and a spectrofluorometer?

Ans: The instrumentation of a spectrofluorometer differs from that of the spectrophotometer in two important respects in addition to other minor variations. These are:

a) There are two monochromators in a spectrofluorometer one of which is placed before the sample holder and one after it, while as spectrophotometer has only one monochromator.

b) As fluorescence is maximum between 25-30^{o}C, the sample holder has a device to maintain the temperature.

Q.8. What are the main components of a spectrofluorometer. Show diagrammatically?

Ans: The main components of a spectrofluorometer, indicated in Figure (A) are:

I. A continuous source of radiant energy (mercury lamp or xenon arc);

II. A monochromator usually a prism, to choose the wavelength with which the sample is to be irradiated;

III. A second monochromator, placed after the sample, enables the determination of the fluorescent spectrum of the sample;

IV. A detector, usually a photomultiplier suited for wavelengths greater than 500 nm; and

V. An amplifier.

Q.9. What is polarization?

Ans: Polarization is a property of waves that can oscillate with more than one orientation. Electromagnetic waves such as light exhibit polarization, as do some other types of waves, such as gravitational waves.

Q.10. Which compound is said to be optically active. Give an example?

Ans: A compound is considered to be optically active if linearly polarized light is rotated clockwise (+) or counterclockwise (-) when passing through it. The amount of optical rotation is determined by the molecular structure and concentration of chiral molecules in the substance. For example, 2-butanol is optically active.

Q.11. What is racemic mixture?

Ans: When the d and l isomers are present in exactly equal concentrations they are still chiral, but their rotations cancel out and the sample is referred to as a racemate or racemic mixture.

Q.12. What is Polarimetry?

Ans: Polarimetry is a method used to analyze the extent to which a beam of linearly polarized light is rotated during its transmission through a medium containing optically active species.

Q.13. Name the device using rotation of polarized light by some substances as a measure of their concentration in a solution. What are its components?

Ans: The device using rotation of polarized light by some substances as a measure of their concentration in a solution is called a polarimeter. The main components of the polarimeter are, a light source (usually a sodium vapour lamp), polarizer (Nicol prism), analyzer (Nicol prism) and the sample tube. The polarizer is used to obtain polarized light. The analyzer is used to measure the angle of rotation.

Q.14. Write two applications of polarimetery?

Ans: I) Polarimetry provides an additional check on a pure substance before it is added to an expensive batch to determine the ingredient's concentration or purity. For example a 25% glucose syrup will have an observed rotation that is five-sixths that of a 30% syrup.

II) Polarimetry is used by organic chemists to test the effectiveness of catalysts and asymmetric synthetic processes.

Q.15. What do you mean by polychromatic?

Ans: A beam of radiation consisting of several wave lengths is known as polychromatic.