**Paper: Lab Instrumentations**

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**Q : 1 Define the following terms,?**

**Ph Meter:**

A **pH meter** is a [scientific instrument](https://en.m.wikipedia.org/wiki/Scientific_instrument) that measures the [hydrogen-ion](https://en.m.wikipedia.org/wiki/Hydrogen-ion) [activity](https://en.m.wikipedia.org/wiki/Thermodynamic_activity) in [water-based solutions](https://en.m.wikipedia.org/wiki/Aqueous_solution), indicating its [acidity](https://en.m.wikipedia.org/wiki/Acidity) or [basicity](https://en.m.wikipedia.org/wiki/Basicity) expressed as [pH](https://en.m.wikipedia.org/wiki/PH%22%20%5Co%20%22PH). The pH meter measures the difference in [electrical potential](https://en.m.wikipedia.org/wiki/Electrical_potential) between a pH electrode and a reference electrode, and so the pH meter is sometimes referred to as a "potentiometric pH meter". The difference in electrical potential relates to the acidity or pH of the solution.

**Vortex Mixer:**

A **vortex mixer**, or **vortexer**, is a simple device used commonly in laboratories to mix small vials of liquid. It consists of an [electric motor](https://en.m.wikipedia.org/wiki/Electric_motor) with the drive shaft oriented vertically and attached to a cupped rubber piece mounted slightly off-center. As the motor runs the rubber piece oscillates rapidly in a circular motion. When a test tube or other appropriate container is pressed into the rubber cup, the motion is transmitted to the liquid inside and a [vortex](https://en.m.wikipedia.org/wiki/Vortex) is created. Most vortex mixers are designed with 2 or 4-plate formats, have variable speed settings ranging from 100 to 3,200 rpm.

**Balance:**

Used for determining the weight or mass of a sample, scientific balances are among the more vital pieces of laboratory equipment. These weighing devices are available in a variety of sizes, variable resolutions and multiple weight capacities. The more precision the balance offers the smaller the unit of measurement resolution, each varying by additional decimal points.

**Water Still:**

A **water still** works by first heating **water** until it turns into steam, then collecting the steam in tubes or on a glass plate, and finally condensing the steam into new, purified **water** droplets that can be collected in a clean vessel.

**Deionizer :**

Deionized water **systems** (or water **deionizers**) remove nearly all ions from your water, including minerals like iron, sodium, sulfate, and copper. Since these ions make up most non-particulate water contaminants, we will get high purity water quickly and affordably.

**Q 2: Describe Electrophoresis and it’s importance?**

[**Electrophoresis**](https://en.m.wikipedia.org/wiki/Gel_electrophoresis) (from the Greek " meaning "to bear electrons") is the motion of [dispersed particles](https://en.m.wikipedia.org/wiki/Interface_and_colloid_science) relative to a fluid under the influence of a spatially uniform [electric field](https://en.m.wikipedia.org/wiki/Electric_field). Electrophoresis of positively charged particles ([cations](https://en.m.wikipedia.org/wiki/Cation)) is sometimes called **cataphoresis**, while electrophoresis of negatively charged particles (anions) is sometimes called **anaphoresis**.

The [electrokinetic phenomenon](https://en.m.wikipedia.org/wiki/Electrokinetic_phenomena%22%20%5Co%20%22Electrokinetic%20phenomena) of electrophoresis was observed for the first time in 1807 by Russian professors Peter and Ferdinand Frederic at [Moscow University](https://en.m.wikipedia.org/wiki/Moscow_University) who noticed that the application of a constant electric field caused [clay](https://en.m.wikipedia.org/wiki/Clay) particles dispersed in [water](https://en.m.wikipedia.org/wiki/Water) to migrate. It is ultimately caused by the presence of a charged interface between the particle surface and the surrounding fluid. It is the basis for analytical techniques used in chemistry for separating molecules by size, charge, or binding affinity.

Electrophoresis is used in laboratories to separate [macromolecules](https://en.m.wikipedia.org/wiki/Macromolecule) based on size. The technique applies a negative charge so proteins move towards a positive charge. Electrophoresis is used extensively in [DNA](https://en.m.wikipedia.org/wiki/DNA), [RNA](https://en.m.wikipedia.org/wiki/RNA) and [protein](https://en.m.wikipedia.org/wiki/Protein) analysis.

**Importance:**

**Gel** **electrophoresis** is used for separation and isolation of dna fragments.it is a technique used for separation of substances of different ionic properties . on electric field, dna fragments are -ive charged molecules moves toward anode according to their molecular size through agrose gel.

**Q3: write a note on flow cytometry?**

**Flow**[**cytometry**](https://en.m.wikipedia.org/wiki/Cytometry) (FCM) is a technique used to detect and measure physical and chemical characteristics of a population of [cells](https://en.m.wikipedia.org/wiki/Cell_%28biology%29) or particles.

In this process, a sample containing cells or particles is suspended in a fluid and injected into the flow cytometer instrument. The sample is focused to ideally flow one cell at a time through a laser beam, where the light scattered is characteristic to the cells and their components. Cells are often labeled with fluorescent markers so light is absorbed and then emitted in a band of wavelengths. Tens of thousands of cells can be quickly examined and the data gathered are processed by a computer.

Flow cytometry is routinely used in basic research, clinical practice, and [clinical trials](https://en.m.wikipedia.org/wiki/Clinical_trial). Uses for flow cytometry include:

* [Cell counting](https://en.m.wikipedia.org/wiki/Cell_counting)
* [Cell sorting](https://en.m.wikipedia.org/wiki/Cell_sorting)
* Determining cell characteristics and function
* Detecting [microorganisms](https://en.m.wikipedia.org/wiki/Microorganism)
* [Biomarker](https://en.m.wikipedia.org/wiki/Biomarker) detection
* [Protein engineering](https://en.m.wikipedia.org/wiki/Protein_engineering) detection
* Diagnosis of health disorders such as [blood cancers](https://en.m.wikipedia.org/wiki/Hematological_malignancy).

**Q 4: what do you know about Beer Lambert law, it’s principal and uses?**

* The Beer-Lambert law states that the quantity of light absorbed by a substance dissolved in a fully transmitting solvent is directly proportional to the concentration of the substance and the path length of the light through the solution.
* Because Beer's law states this, it means we can both calculate the concentration of a solution by using the absorbancies, or plot a graph of various concentrations, align them to their correct absorbencies, and use a colorimeter to find the concentration of an unknown solution
* The law states that:

*A*(*λ*) = *e*(*λ*) *l* *c*.

The proportionality constant *e* (*λ*) is called the absorptivity of the substance at the wavelength *λ*. *e* (*λ*) is called the molar absorptivity if the concentration is measured in moles/liter.

* The absorbance is inversely proportional to the transmittence of the solution.

**Uses:**

Beer-Lamberts law is applied to the analysis of a mixture by spectrophotometry, without the need for extensive pre-processing of the sample. Examples include the determination of bilirubin in blood plasma samples. The spectrum of pure bilirubin is known thus the molar absorbance is known. Measurements are made at one specific wavelength almost unique for bilirubin and another measurement at a second wavelength so interferences or deviations can be eliminated or corrected. Generally, it can be used to determine concentrations of a particular substance, or determine the molar absorptivity of a substance.

**Q 5: Explain Autoclave, it’s uses and components?**

An **autoclave** is a machine used to carry out industrial and scientific processes requiring elevated temperature and pressure in relation to [ambient pressure](https://en.m.wikipedia.org/wiki/Ambient_pressure)/[temperature](https://en.m.wikipedia.org/wiki/Ambient_temperature). Autoclaves are used in medical applications to perform [sterilization](https://en.m.wikipedia.org/wiki/Sterilization_%28microbiology%29) and in the chemical industry to cure coatings and [vulcanize](https://en.m.wikipedia.org/wiki/Vulcanization) rubber and for [hydrothermal synthesis](https://en.m.wikipedia.org/wiki/Hydrothermal_synthesis). [Industrial autoclaves](https://en.m.wikipedia.org/wiki/Autoclave_%28industrial%29) are used in industrial applications, especially in the manufacturing of composites.

**Uses :**

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**Components of an Autoclave:**

* Chamber. The chamber is the primary component of a steam autoclave, consisting of an inner chamber and outer jacket. ...
* **Controls** System. ...
* Thermostatic Trap. ...
* Safety **Valve**. ...
* Waste-**Water** Cooling Mechanism. ...
* Vacuum System (if applicable) ...
* **Steam Generator** (if applicable).