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Course Title: Biomedical instrumentation (MLT 4TH) **Instructor: Saima hadi**

Q1. What is Microscope? And also explain principle of microscope?

The word microscope comes from the fusion of the Greek words micros which suggests small and skopien, to see.

A microscope is an instrument that uses a lens or a mixture of lenses to supply highly magnified images of small specimens or objects especially once they are too small to be seen by the naked (unaided) eye.

Principle: Many lenses are arrange in sequence to see the fine details. Based on three important features

Magnification: To enlarge the image

Resolution: Separate the details of two particle in image

Contrast: To produce the details visible to eye the difference in light intensity between the image and the adjacent background relative to overall background intensity.

Q2.Describe chromatography and also its phases?

It is a Separation technique used for the efficient separation of a number of similar components present in a mixture.

It is a physical separation technique during which the components of a mix are separated by variances in their distribution between two phases, one among which is stationary (stationary phase) while the opposite (mobile phase) moves through it during a definite direction.

Phases of chromatography

Stationary phase:

The substance on which absorption/adhesion/attain of the analytic phase takes place. Typically, the stationary phase may be a porous solid (e.g., glass, silica, or alumina) that's packed into a glass or metal tube or that constitutes the walls of an open-tube capillary.

Mobile Phase:

The phase in which the solvent carries the analytic sample. The sample to be separated is injected at the start of the column and is transported through the system by the mobile phase.

Q3.Write down the applications of Flame photometry?

Flame photometry (more precisely called Flame Atomic Emission Spectrometry) may be a branch of spectroscopy through which the species observed within the spectrometer are within the sort of atoms

A photoelectric flame photometer is an instrument utilized in inorganic qualitative analysis to work out the concentration of certain metal ions among them sodium, potassium, calcium and lithium.

Application of flame photometry

- To estimate sodium, potassium, calcium, lithium, etc. level in a sample of serum, urine, CSF and other body fluids
- Flame photometry is useful for the determination of alkali and alkaline earth metals
- Used in determination of lead in petrol
- Used the study of equilibrium constants involving in ion exchange resins
- Used in determination of calcium and magnesium in cement

Q4.Explain the components of Centrifuge?

A centrifuge may be a part of equipment that puts an object in rotation around a hard and fast axis (spin during a circle), applying a potentially strong interaction perpendicular to the axis of spin.

Components of centrifuge

Motor: A motor may be a component which provides rotatory motion

Drive shaft: The component which is attached to motor

Rotor: it's placed on drive shaft having space to put tubes.

Centrifuge rotor: A rotor is that the rotating unit of the centrifuge which has fixed holes drilled at an angle. Test tubes are placed inside these holes and therefore the rotor spins to assist within the separation of the materials.

Q5. Write note on Water bath?

A water bath is a device used in the laboratories to incubate samples in water preserved at a persistent temperature. Temperature may be controlled digitally or by a dial and once set, the water bath cycles on and off to safeguard constancy of the temperature. Some water baths have an added shaking or stirring mechanism that can be set at changing speeds.

Components:

1. A rack of insulated metal, usually stainless steel or of heat-resistant glass, with without, an insulated lid.
2. An electric element to heat the water contained in the trough.
3. A propeller or stirrer to circulate the water in the holder in order to sustain a uniform temperature throughout the trough.
4. A thermometer to check the temperature. This may be built-in or located separately in the holder.
5. A thermostat to sustain the temperature at a persistent level.

Operation:

1. Fill the holder with clean (preferably distilled water to a desired level and then switch on the machine.
2. Set the thermostat to the desired temperature and let the water to warm to that temperature. Check the temperature from the thermometer.
3. Place the containers that are to be warmed or incubated in the trough.

Precautions and Maintenance:

1. Clean the rack‘s interior and change the water daily or use de-ionized water to prevent encrustation of the rack, stirrer, heat probe and thermostat with the salts contained in raw water. It will also prevent the growth of fungi and algae.
2. Keep the lid closed when not in use to avoid evaporation of water.
3. Occasionally check and counter-check the water temperature with an inner, as well as exterior, thermometer. The thermometer should be located in such a way that it is away from the heating element and the walls.

Q6.Explain the types of centrifuge?

Types of centrifuge:

1. **Small Bench top**
    - It works with or without refrigeration
    - It is of a slow speed (e.g. up to 4000 RPM)
    - It is common used in clinical lab (blood/plasma/serum separation)
    - It can take approx. (up to) 100 tubes, depending on diameter
2. **Micro centrifuges ("microfuge", "Eppendorf")**
    - It take tubes of small volumes (up to 2 mL)
    - It is very common in biochemistry/molecular biology/ biological labs
    - It Can generate forces up to ~15,000 x g with or without refrigeration
3. **High Speed centrifuges**

- Speed range is 15,000 – 20,000 RPM
- It has a centrifugal field of 100,000 g
- It has a large sample capacity depending on rotor
- Normally refrigerated
- Differentiation separation of nucleus, mitochondrial, protein precipitate, large intact organelle, cellular debris, bulky protein aggregates.

4. **Ultracentrifuges**
    - 65,000 RPM (100,000's x g)
    - It has a limited lifetime
    - It is Expensive
    - It require special rotors
    - It is widely used in research applications
    - The high speeds used in such devices generate considerable amounts of heat, Therefore cooling arrangements and vacuum are required in ultracentrifuges
5. **Large-capacity preparative centrifuge**
    - Centrifugal fields of 3000 to 7000g.
    - Efficient separation of coarse precipitates or whole cells.