Centrifugation Chemistry Questions with Solutions

Q-1: Define the following terms.

a) Centrifuge
b) Radial Acceleration
c) Centrifugal force

Answer:

a) **Centrifuge:** A centrifuge is a device that separates different components of a fluid using centrifugal force. This is accomplished by spinning the fluid at a high speed within a container, separating different densities of fluids or liquids from solids.

b) **Radial Acceleration:** Radial acceleration is defined as "the acceleration of the object along the radius, directed towards the core" in a uniform circular motion.

c) **Centrifugal force:**The centrifugal force is an outward-acting apparent force felt by a body travelling along a curved or round route.

Q-2: Give an overview of the centrifugation principle.

Answer:

The centrifugation technique works on the premise of separating particles suspended in liquid media using a centrifugal field. In the centrifuge, these are arranged in tubes or bottles in a rotor. The basic principle involved is: When particles are spun quickly, the denser particles are driven to the bottom, while the lighter ones remain at the top.

Q-3: Centrifugation is not employed in which of the following processes?

a) To squeeze out water from wet clothes
b) For blood and urine tests
c) To separate butter from cream
d) Different pigments from an extract of flower petals

Answer: d) Different pigments from an extract of flower petals

Explanation: Chromatography is used to separate distinct pigments from a floral extract in a fine manner.

Q-4: Centrifugation based on which of the following law?

a) Pascal's law
b) Stokes law
c) Stain law
d) Patrick's law

Answer: b) Stokes law

Explanation: Centrifugation is a basic laboratory procedure that is utilised by a wide spectrum of clinical and research specialists. Essentially, centrifugation is the sedimentation-based separation of particles.

Particles with a higher density or larger size travel quicker and will eventually separate from particles with a lower density or smaller size. Stoke's law, which governs the movement of a sphere in a gravitational field, can explain this sedimentation of particles.

Q-5: What is density gradient centrifugation used for?

a) Purification of viruses, ribosomes, and membranes
b) To remove small particles
c) To remove dirt
d). To get rid of big particles

Answer: a) Purification of viruses, ribosomes, and membranes

Explanation: Purification of viruses, membranes, and ribosomes is accomplished via density gradient centrifugation.In ultracentrifuges, a sucrose density gradient is made by gently overlaying lower concentrations of sucrose above higher concentrations in centrifuge tubes with particles of interest on top. The particles progress through the gradient until they reach the same sucrose density, at which point they are separated and examined.

Q-6: What is differential centrifugation and how does it work?

Answer:
It is the most often used type of centrifugation.At 32 degrees, tissue such as the liver is homogenised in a sucrose solution including buffer.The homogenate is then placed in a centrifuge and spun at a consistent temperature and centrifugal force.

A pellet and an overlaying solution termed supernatant form at the bottom of a centrifuge after some time.The overlaying solution is then transferred to another centrifuge tube, which is revolved at a faster speed in subsequent phases.

Q-7: Why are the fractions separated classified as "enriched" rather than "pure" from differential centrifugation?

Answer: This is because sedimentation takes place along the entire length of the centrifuge tube. When the tube is spun, the particles are subjected to centrifugal forces, which lead them to settle. Although heavier particles settle more quickly, those near the tube's top have a significantly longer journey than those towards the bottom. By the time all of the heavier particles have settled, some of the lighter particles near the tube's bottom or middle have settled as well. As a result, pure subcellular particle fractions cannot be obtained by simple differential centrifugation. Density gradient centrifugation can be used to further purify the sample.

Q-8: The most widely used method for EVs isolation is

a) Rate Zonal centrifugation
b) Differential centrifugation
c) Velocity centrifugation
d) Equilibrium Centrifugation

Answer: b) Differential centrifugation

Explanation: Differential centrifugation can segregate vesicle particles based on their size and density by successively increasing the centrifugal force.This approach is frequently used to isolate EVs from a variety of biological materials and is regarded as the gold standard.

Q-9: Which process is widely used in the dairy industry?
a) Crystal growth
b) Centrifugal separation
c) Distillation
d) Evaporation

Answer: b) Centrifugal separation

Q-10: What is the purpose of a centrifugal pump?

Answer: Centrifugal pumps are hydraulically powered machines that use centrifugal forces to convey energy to fluids (particularly liquids). Their primary function is to move fluids by increasing pressure.

Q-11: In centrifugation, which of the following force is not used?
a) Electrostatic force
b) Gravitational force

c) Centripetal force
d) Centrifugal force

Answer: a) Electrostatic force

Explanation: A centrifuge separates substances by rotating at high speeds, employing the strength of centripetal force and the apparent centrifugal force. Since a centrifuge works by using the principle of sedimentation therefore it works under the influence of gravitational force that separates substances according to their density.

Q-12: State the factors that affect centrifugation.

Answer: There are many factors that affect the centrifugation process and are listed below:

1) Liquid viscosity
2) Liquid density
3) Particle size distribution
4) Type and shape of particle
5) Agitation speed

Q-13: What are high speed centrifuges used for? Name the three different types of rotors used in high-speed centrifugation.

Answer: Higher speeds and temperature control of the rotor chamber are required in more complicated biochemical applications, hence high-speed centrifuges are used.
The highest speed of the high-speed centrifuge is 15,000–20,000 RPM.
This instrument's operator can precisely manage the speed and temperature required for sensitive biological samples.

For high-speed centrifugation, three types of rotors are available:

1. Fixed position
2. Swinging bucket
3. Vertical rotors

Q-14: Differentiate between isopycnic and rate zonal centrifugation.

Answer:

Rate zonal Centrifugation	**Isopycnic centrifugation**
It separates particles of solution depending on the size not on density.	It separates particles of solution depending on density not on size.

Particles differ in size.	Particles differ in density.
Gradient is shallow	Gradient is steep.
It is used for the separation of cellular organelles and tissues.	It is used for the separation of nucleic acids.

Q-15: Define the term density gradient.

Answer: A density gradient is a variation in density over space. The term is used in natural sciences to describe stuff with varied densities.

Practise Questions on Centrifugation

Q-1: Centrifugation does not separate particles from the solution based on their size. Indicate whether the statement is correct or incorrect.

Answer: Incorrect

Explanation: The centrifugal force is used in the centrifugation process to separate material. The particles in a solution are sorted based on their size, shape, density, medium viscosity, and rotor speed.

Q-2: Which of the following is used to separate cellular components, RNA/DNA, and peptides from biological samples?

a) Low-speed clinical centrifuges
b) Centrifuges for microsamples
c) High-speed multi-purpose centrifuges
d) High-speed centrifuges with a large capacity

Answer: b) Centrifuges for microsamples

Explanation: Micro centrifuges are appropriate high-speed centrifuges for micro-sample applications, such as the separation of cellular components, RNA/DNA, and peptides in biological samples. With low noise levels and great capacity, the micro-sample versions provide complete freedom and versatility in use.

Q-3: Sedimentation principle is involved in

a) Chromatography
b) Crystallisation
c) Centrifugation

d) Sublimation

Answer: c) Centrifugation

Explanation: Centrifugation works on sedimentation principle.Due to centrifugal acceleration, denser things migrate outward in the radial direction, while less dense substances are displaced and move to the centre of the centrifuge.

Q-4: List the name of four main types of centrifugation.

Answer: The four main types of centrifugation are:

1) Rate zonal Centrifugation
2) Differential Centrifugation
3) Density Gradient Centrifugation
4) Isopycnic Centrifugation

Q-5: What do you mean by ultracentrifuge? Name the two main kinds of ultracentrifuge.

Answer: The ultracentrifuge is a centrifuge designed to spin a rotor at extremely high speeds, with accelerations of up to 1 000 000 g. The preparative and analytical ultracentrifuges are the two types of ultracentrifuges.