Ans. Classification on the basis of application:

Centrifuges are classified into three groups for:

1. Separation of immiscible liquids

2. Clarification of liquids by removal of small amounts of solids (centrifugal clarifiers)

3. Removal of solids (desludging or dewatering centrifuges).

Classification on the basis of volume handled:

- 1. Laboratory Centrifuges
- 2. Preparative Centrifuges

Q4. Write down few applications of centrifugation in food industry. Ans: Applications of centrifugation in food industry are:

Sugar crystal recovery

Dewatering of fresh-cut salad and vegetables

Milk processing, bacterial removal, cream separation

Pulp-free orange juice

Formation of fruit and vegetable juices

Frying oil clean-up

Q5. What are the forces determinant to sedimentation rate during centrifugation?

Ans: The instantaneous sedimentation rate of a particle during centrifugation

is determined by three forces:

(1) F_{c} , the centrifugal force,

(2) $F_{\rm B}$, the buoyant force of the medium, and

(3) $F_{F'}$ the frictional resistance to the particle's movement.

Q6. Define centrifugal force .What are the factors affecting centrifugal force?

Ans. Centrifugal force, word from Latin centrum, meaning "center", and fugere, means "to flee", is the apparent force that draws a rotating body away from the center of rotation. It is caused by the inertia of the body as the body's path is continually redirected. Centrifugal force is generated when materials are rotated; the size of the force depends on the radius and speed of rotation and the density of the centrifuged material.

Q7. What is the basis of separation for particles in a centrifuge?

Ans: The particles get separated according to their size, shape, density, viscosity of the medium and rotor speed.

Q8. Write down the general formula for calculation RPM.

Ans: The general formula for calculating the revolutions per minute (RPM) of a centrifuge is

RPM= square root (g/r)

Where g represents the respective force of the centrifuge and r the radius from the center of the rotor to a point in the sample. However, depending on the centrifuge model used, the respective angle of the rotor and the radius may vary, thus the formula gets modified.

Q9. Explain the working of tubular bowl centrifuge?

Ans: The simplest type of equipment is the tubular bowl centrifuge. It consists of a vertical cylinder (or bowl), typically 0.1 m in diameter and 0.75 m long, which rotates inside a stationary casing at between 15000 rev per min and 50 000 rev per min depending on the diameter. Feed liquor is introduced continuously at the base of the bowl and the two liquids are separated and discharged through a circular weir system into stationary outlets

Q10. How does density effect the separation during centrifugation?

Ans: In a solution, particles whose density is higher than that of the solvent sink (sediment), and particles that are lighter than it float to the top. The greater the difference in density, the faster they move. If there is no difference in density (isopycnic conditions), the particles stay steady. To take advantage of even tiny differences in density to separate various particles in a solution, gravity can be replaced with the much more powerful "centrifugal force" provided by a centrifuge.

Q11. What is the difference between settling and sedimentation?

Ans: Settling is the falling of suspended particles through the liquid, whereas sedimentation is the termination of the settling process.

Q12. What are the two types of rotors found in high –powered centrifuge? Ans: Fixed angle rotor and swing-out rotors. Q13. What are the two distinct forces that come under the "centrifugal force"?

Ans: Inertial force and Reaction force.

Q14. For a centrifuge of radius 0.07m and rpm 10000, find out centrifugal force developed.

Ans: $r = 0.07 m^2$

 $\omega = 2\pi N / 60$

 $F_{c}/F_{a} = 0.001118 rN^{2}$

=0.001118x0.07)108

=7826

F_c=7826F_a

Q14.Write down the capacity and the use of basket centrifuge.

Ans: Capacities of basket centrifuges are up to 90 000 l h1 and they are used to recover animal and vegetable proteins, to separate coffee, cocoa and tea slurries and to desludge oils.