Settling or separation of particles from fluid by centrifugal forces acting on the particles. The particles can be solid, gas or liquid drops and the fluid can be a liquid or a gas.

**Centrifuges**
- bowl with liquid rotates

**Cyclones**
- stationary apparatus, mixture rotates

**Action of centrifugal force on particle**

\[
F_o = V \rho_s a_o = V \rho_s r \omega^2 = V \rho_s \frac{u_{\varphi}^2}{r} = 4\pi^2 V \rho_s n^2 r
\]

**Centrifugal force**

Buoyant force by centrifugal power on liquid with density \( \rho \) having same angular velocity as particle acts on rotating particles.

\[
F_{ov} = 4\pi^2 V \rho n^2 r
\]

Action of Gravitation force on particle and fluid has practically negligible effect in centrifuges compared to centrifugal forces. Ratio of centrifugal to gravitation force has for centrifuges value in range \( 50 \div 5 \cdot 10^4 \) and for ultra-centrifuges up to \( 1 \cdot 10^6 \).

**Froude number**

\[
Fr = \frac{F_o}{G} = \frac{u_{\varphi}^2}{rg}
\]
**Action of centrifugal force on fluid**

Low value of \( Fr \)

Great value of \( Fr \)

Pressure acting on the bowl shell

\[
p = p_a + \frac{1}{2} \rho \omega^2 \left( R_2^2 - R_1^2 \right)
\]