Chapter 4: Pressure in Fluids and Atmospheric Pressure

---

1. Thrust and Pressure

- **Thrust**: Force applied **perpendicularly** to a surface.
  - It's a **vector** quantity.
  - **SI unit**: newton (N), **CGS** unit: dyne
  - 1 N = 10^5 dyne, 1 kgf = 9.8 N, 1 gf = 980 dyne
- **Pressure**: Thrust per unit area
  - **Formula**: Pressure = Thrust / Area
  - It's a **scalar** quantity.
  - **SI unit**: Pascal (Pa), 1 Pa = 1 N/m^2
  - **Other units**:
    - 1 bar = 10^5 N/m^2
    - 1 atm = 760 mm Hg = 1.013×10^5 Pa
- **Factors affecting pressure**:
  - Pressure ↑ with ↑ thrust
  - Pressure ↓ with ↑ area
- **Examples**:
  - Pointed nails (↑ pressure),
  - Broad sleepers under tracks (↓ pressure)

---

2. Pressure in Fluids

- Fluids (liquids/gases) exert pressure in **all directions**.
- **Pressure in liquid column**:
  - Formula: **P = hρg**
  - Depends on: **depth (h)**, **density (ρ)**, and **gravity (g)**

Laws of Liquid Pressure:

1. Pressure ↑ with depth
2. Same depth = same pressure
3. Pressure is equal in all directions at a point
4. Higher density = more pressure
5. Liquids level themselves

Consequences:

- Dam walls are thicker at the bottom
- Sea water exerts more pressure than river water
- Water tanks placed high for better supply pressure
- Divers wear pressure-resistant suits
- Gas bubbles expand as they rise in water

---

3. Pascal's Law

- **Pascal's Law**: Pressure in a confined fluid is transmitted equally in all directions.

---

4. Atmospheric Pressure

- Caused by **air's weight** above the Earth.
- **Measured in**: atm, Pa, mm Hg, bar

Examples/Effects:

- **Straw**: Liquid rises due to lower internal pressure
- **Syringe & Fountain pen**: Atmospheric pressure pushes liquid in
- **Rubber suckers & siphons**: Use vacuum created by reducing pressure
- **Oil can**: Needs a second hole for air entry

---

5. Measurement of Atmospheric Pressure

- **Instrument**: Barometer
    - **Types**:
        - **Simple barometer** (uses mercury)
        - **Fortin barometer** (lab use)
        - **Aneroid barometer** (portable, no liquid)

Why Mercury is Preferred:

- High density (only 0.76 m needed)
- Low vapour pressure
- Doesn't stick to glass
- Shiny surface for easy reading

Problems with Water as Barometric Liquid:

- Requires tall column (≈10.4 m)
- High vapour pressure
- Sticks to glass
- Transparent surface

---

6. Variation of Atmospheric Pressure with Altitude

- Pressure **decreases with height**
    - Due to reduced air column and density

Effects:

- Breathing difficulty, nosebleeds at high altitude
- Pens leak due to internal air pressure
- Weather forecast based on pressure changes:
    - Sudden fall → storm
    - Gradual fall → rain
    - Gradual rise → dry weather

---

7. Altimeter

- A special **aneroid barometer** used in **aircraft** to measure altitude based on atmospheric pressure changes.
