Friction

- Friction – It is an opposing force that acts between surfaces in contact moving with respect to each other.
- It always opposes relative motion between two surfaces.
- Cause of friction - Friction is cause by the irregularities on the two surfaces in contact.
- We are able to walk because of the force of friction.
- Nature of surfaces – Smooth surfaces: less friction, Rough surfaces: greater friction
- How hard an object is pressed – Greater pressing force: Greater friction
- Mass of object – Greater mass: Greater friction
- Sliding friction < Static friction
- Rolling friction < Sliding friction
- **Examples where friction is useful**
  - Walking
  - handling any object
  - rolling motion of ball or wheel
- **Examples where friction is harmful**
  - energy dissipation of engine due to friction between surfaces in motion.
  - more energy is lost in pulling or pushing an object in rough surfaces.
  - wear and tear of shoe soles and tyres.
- Lubrication – Powder on carom board, oil in machine
- Wheel – Wheels reduce friction (because rolling friction < sliding friction).
- Shoe soles and tires are threaded to increase friction for a better grip.
- Fluid friction is minimised by giving suitable shapes to vehicles moving through fluids.

- When a body rolls over the surface of another body, the resistance to its motion is called rolling friction.
- When a body slides over the surface of another body, the resistance to its motion is called sliding friction.

- Rolling friction < Sliding friction

- Ball bearings change sliding friction into rolling friction.

- Fluid friction is minimised by giving suitable shapes to vehicles moving through fluids.

- Fluid friction is also called drag.

- Friction force depends upon the speed of the object with respect to the fluid.

- Friction force depends upon the shape of the and nature of the fluid.