🧩 9.1 Force of Friction

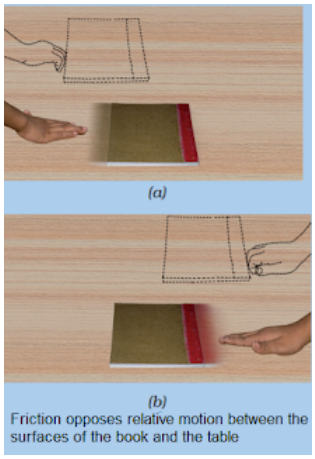
- **Friction: The force that opposes motion between two surfaces in contact.**
- **Example: A ball rolling on ground slows down and stops because of friction.**

✅ **Friction always acts opposite to the direction of motion.**

🌟 Activity 9.1 — Book on Table

Steps:

- **Push a book gently on a table.**
- **It moves a little and stops.**
- **Push from the other side, same result.**



Conclusion:

- **Friction opposes motion and stops the book.**

🔍 9.2 Factors Affecting Friction

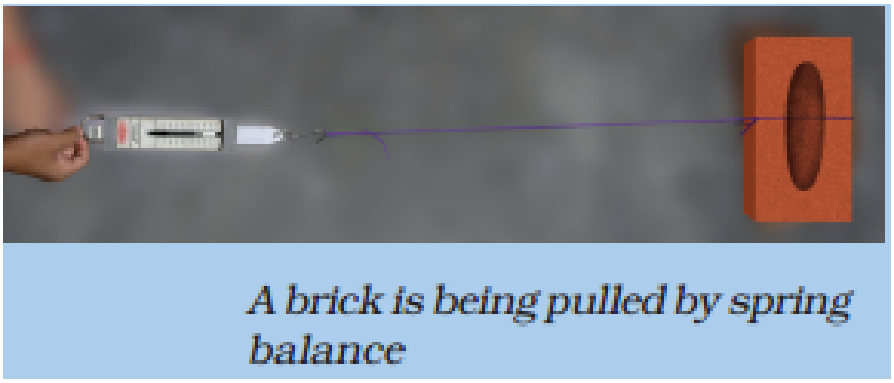
- **Friction depends on:**
  - **Nature of surfaces (smooth or rough)**
  - **How hard the surfaces are pressed together.**

✅ **Rough surfaces ➔ more friction.**
✅ **Smooth surfaces ➔ less friction.**

🌟 Activity 9.2 — Pulling a Brick

Steps:

- **Tie a string to a brick and pull it with a spring balance.**
- **Wrap the brick with jute and polythene and repeat.**



A brick is being pulled by spring balance

Observation:

- **More roughness ➔ More friction ➔ More force needed.**
- **Polythene (smoother) ➔ Less friction.**

🌟 Activity 9.3 — Rolling a Pencil Cell

Steps:

- **Roll a pencil cell down an inclined plane onto different surfaces:**
  - **Table directly**
  - **Cloth spread on table**
  - **Sand on table**

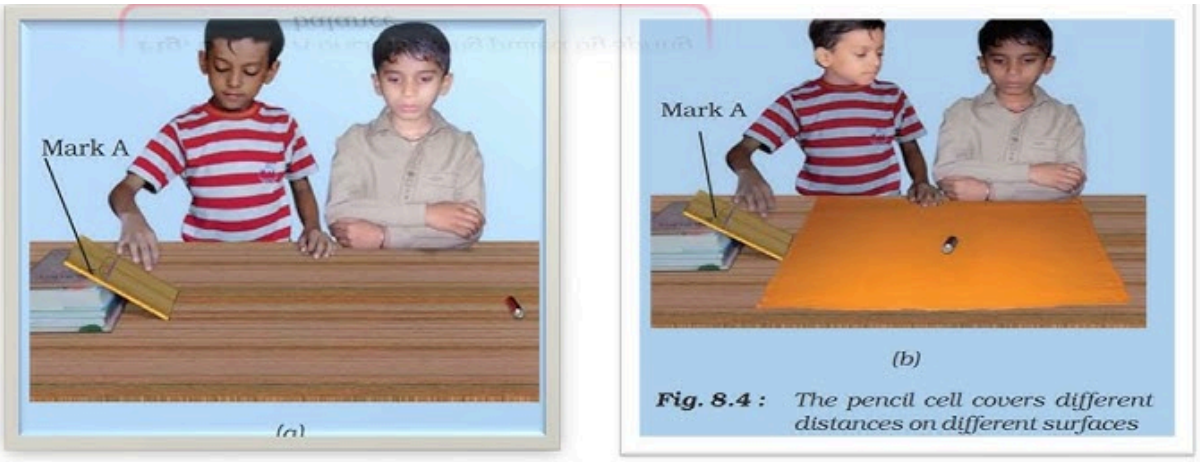
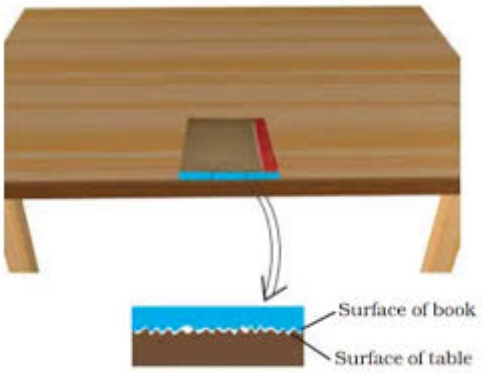


Fig. 8.4 : *The pencil cell covers different distances on different surfaces*

Observation:

- **On rough surfaces (cloth, sand), the cell moves less distance.**
- **Smoother surface ➔ Longer distance ➔ Less friction.**

✅ **Friction is caused by interlocking of tiny irregularities on surfaces.**



⚡ 9.3 Friction: A Necessary Evil

Friend	Foe
Helps us walk	Causes wear and tear
Helps to write	Produces unwanted heat
Helps fix nails	Wears out shoes, machine parts

✅ **Friction is useful but also causes energy loss.**

🔧 9.4 Increasing and Reducing Friction

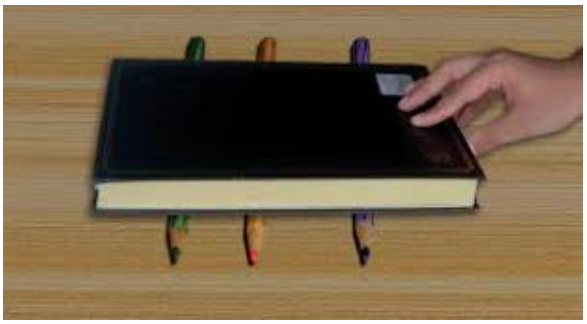
- **Increasing Friction:**
  - **Rough surfaces (treaded tyres, shoe soles).**
  - **Gymnasts and kabaddi players use powder for better grip.**
- **Reducing Friction:**
  - **Using lubricants (oil, grease).**
  - **Using ball bearings.**
  - **Polishing surfaces.**

✅ **Lubricants form a layer and reduce direct rubbing.**

🌟 Activity 9.4 — Book on Pencils (Rollers)

Steps:

- **Place pencils parallel on table.**
- **Put a book on them and push.**



Observation:

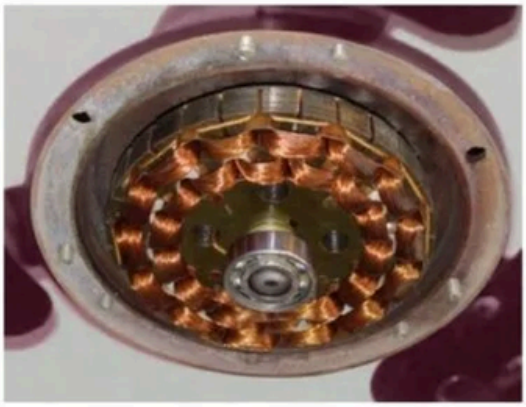
- **Book moves easily because pencils act like rollers, reducing friction.**

🛞 9.5 Wheels Reduce Friction

- **Rolling friction is less than sliding friction.**
- **That's why vehicles and suitcases have wheels.**

✅ **Ball bearings are used in machines to reduce friction by rolling.**

🌬️ 9.6 Fluid Friction (Drag)



- **Fluids (liquids and gases) also offer resistance to motion ➔ called Drag.**
- **Streamlined shapes reduce fluid friction:**
  - **Birds, fishes, and aeroplanes have streamlined bodies.**