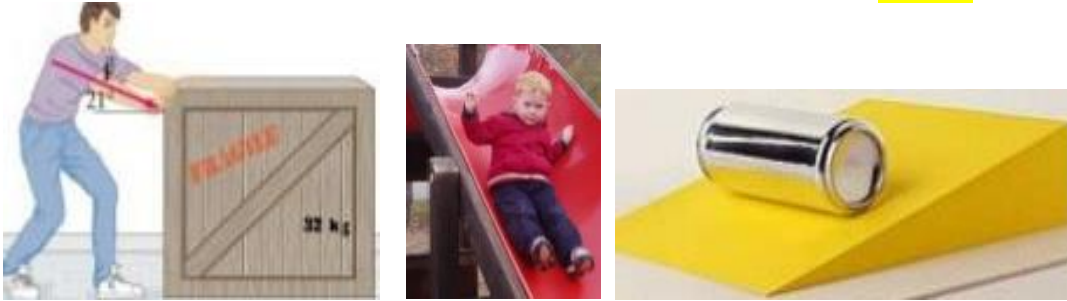


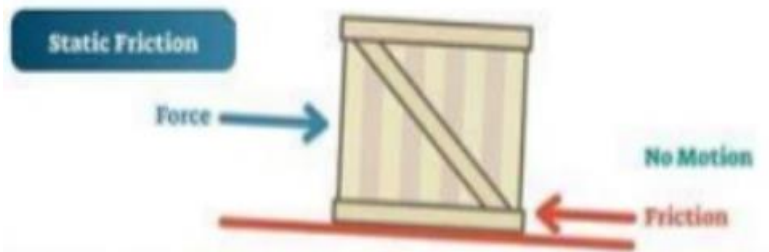
1. **FRICTION**- They are 3 types of Friction:

- **STATIC** Friction: is the friction exerted on an object at rest.
- **SLIDING** Friction is the friction exerted when an object slides over surface *with a working fluid in between the two bodies.*
- **ROLLING** Friction is the friction exerted when an object rolls over *another* surface.



2. **STATIC FRICTION :**

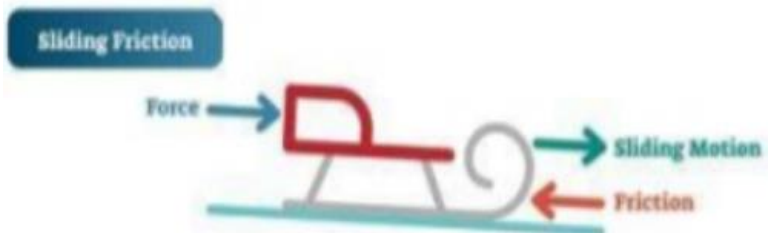
- **STATIC FRICTION :** is the friction exerted on an object at rest.
- It **depends** on the **roughness** between the two surfaces.
- Even if a person may not be able to lift an object, he or she can still pull or push it.
- **Force required** in this case is @ **8-10%** of that required for lifting.



3. **SLIDING FRICTION :**

Sliding FRICTION : is the friction exerted when an object slides over surface *with a working fluid in between the two bodies.*

- The working fluid can be **moisture** on the surface.
- **Speed of motion** prevents Static friction.
- Force required in this case is @ **1-2 %** of that required for lifting.



4. **ROLLING FRICTION :**

- When one **body** rolls over the **surface of another body**, the **resistance to its motion** is called the **rolling friction**.
- **Rolling** reduces friction. It is **always easier to roll** than to **slide** a body over another. That is the reason it is **convenient to pull the luggage fitted with rollers**. Can you now understand **why wheel is said to be one of the greatest inventions of mankind?**
- Since the **rolling friction is smaller than the sliding friction**, **sliding is replaced in most machines by rolling by the use of ball bearings**.
- Force required in this case is @ **0.01 – 0.1 %** of that required for lifting. Depending on **roughness / smoothness and irregularity / balancing of the ball**

- Common examples are the use of ball bearings between hubs and the axles of ceiling fans and bicycles.
- Spherical Ball or roller bearings are used in machines to prevent Static & Sliding Friction.



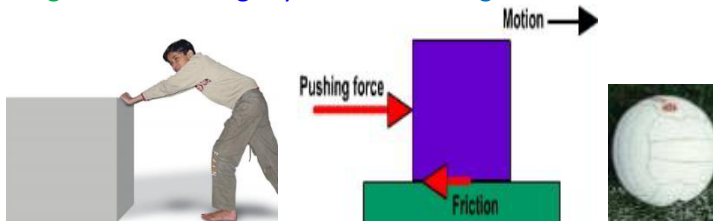
5. IDENTIFYING FRICTIONAL FORCES

- The force required to overcome friction at the instant an object starts moving from rest is a measure of static friction. On the other hand, the force required to keep the object moving with the same speed is a measure of sliding friction.
- When the box starts sliding, the contact points on its surface, do not get enough time to lock into the contact points on the floor. So, the sliding friction is slightly smaller than the static

Hence,

Sliding FRICTION is slightly less (<) than Static FRICTION

Rolling FRICTION is slightly less than Sliding & Static FRICTION



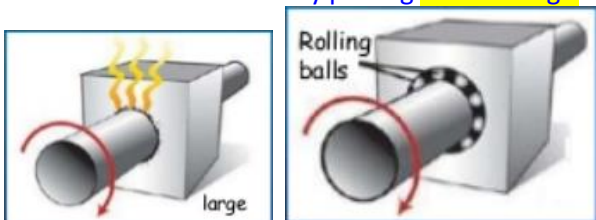
6. ADVANTAGES OF FRICTION



Light matchstick - Write with a pen- write with a chalk - Fix a nail in the wall – Gymnast Rod surface

7. DISADVANTAGES OF FRICTION

- Unless a force is constantly applied Friction will slow all motion to a stop eventually.
- It is impossible to completely get rid of friction, but it can be reduced.
- The friction between a shaft (the long rod in the picture) and an outer part of a machine in bush type bearings produces a lot of heat.
- Friction can be reduced by placing ball bearings between the shaft and the outer part.



End of MODULE 2 of 4, Thank You