

Lesson at a Glance

- **Friction:** The force which opposes the relative motion between two surfaces in contact is called *friction*. The force of friction always opposes the applied force that may be push or pull.

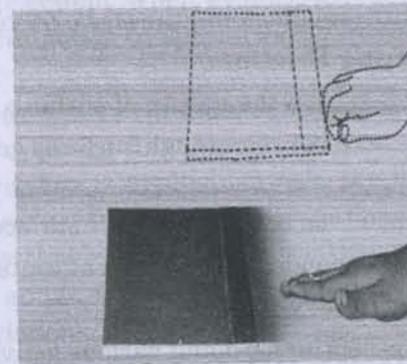


Fig. 12.1 Friction opposes relative motion between the surfaces of the book and the table.

Friction is caused by the *irregularities on the two surfaces in contact*. Irregularities on the two surfaces lock into one another (interlocking) causing friction.

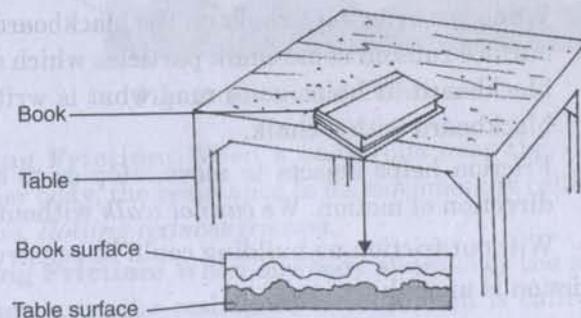


Fig. 12.2 Surface irregularities.

- **Spring Balance:** It is a device used for measuring the force acting on an object. It consists of a coiled spring, a pointer moving on a graduated scale. When a force is applied, stretching of spring takes place. The reading on the scale indicated by the pointer gives the magnitude of the force.
- **Static Friction:** The force required to overcome friction at the instant an *object starts moving from rest* is a measure of *static friction*.
- **Sliding Friction:** The *force* required to *keep an object moving* with the same speed is a measure of *sliding friction*. The sliding friction is slightly smaller than the *static friction*.

• Factors Affecting Friction:

- Friction depends on the nature of surfaces in contact.
- Friction is more between rough surfaces and less in smooth surfaces.
- Friction depends on how hard the two surfaces press together.
- Friction is independent of the area of contact.

• Friction: A necessary Evil

- Friction is essential for doing various activities of our daily life.

— We could not hold articles such as glass tumbler and other things *without friction*. It becomes very difficult to hold a greasy glass.

— We could not write with a pen or pencil if there is no friction.

When we write with chalk on the blackboard, its rough surface rubs off some chalk particles which stick to the blackboard. It helps us to read what is written on the blackboard with a chalk.

— Friction helps objects to move, stop or to change the direction of motion. We *cannot walk* without friction.

— Without friction no building could be constructed.

- Friction is an evil:

— It wears out materials. For example, soles of shoes, ball bearings, steps of a stair, parts of machines etc.

— Friction produces heat. When a machine is operated, heat generated causes much wastage of energy.

- We deliberately increase friction in some cases to get the desired results. For example:
 - Soles of shoes are grooved. It is done to provide the shoes better grip on the floor, so that we can safely.
 - The treated tyres of cars, trucks, buses, bull-dozers provide better grip with the ground.
 - Bicycles, scooters and other automobiles are provided with the brake system. When we press the brake lever, brake pads arrest the motion of the rim *due to friction*. The wheel stops moving.
- Sometimes we want to minimise the friction. Friction can be reduced by applying *fine powder* as in case of carrom. *Oil, grease* or *graphite* is applied between the moving parts of a machine to reduce friction. These things avoid interlocking of irregularities that lead to reduction of friction to a great extent. Sometimes an air cushion between the moving parts is used to reduce friction.
- **Lubricants:** The substances which reduce friction are called *lubricants*. Lubricants form a thin layer on the moving surfaces. So, they do not directly rub against each other.

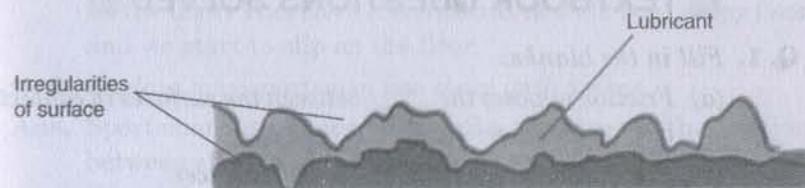


Fig. 12.3 Action of a lubricant.

- **Rolling Friction:** When a body rolls over the surface of another body, the resistance to its movement is called *rolling friction*. *Rolling reduces friction*.
- **Sliding Friction:** When one body slides over the surface of another body, the resistance to its motion is called *sliding friction*. It is easier to roll than to slide a body over another. Common example is use of ball bearing between hubs and the axles of various machines.

- The *wheel* is said to be one of the greatest inventions of mankind.
- **Fluids:** In Science, the common name of *gases and liquids* is fluid.
- **Fluid Friction:** The force exerted by fluids on objects in motion through them is called *fluid friction*. The frictional force exerted by fluids is also called **drag**.
- The frictional force on an object in a fluid depends on
 - its *speed* with respect to the fluid,
 - the shape of the object, and
 - the nature of the fluid.
- To overcome drag objects are provided with special shape called *streamlined*. For example, shape of an aeroplane, a bird and a fish.

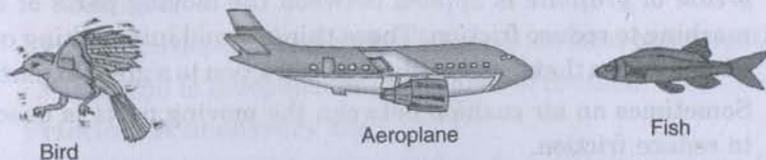


Fig. 12.4 Streamlined shapes help to reduce friction.

TEXTBOOK QUESTIONS SOLVED

Q. 1. Fill in the blanks:

- Friction opposes the _____ between the surfaces in contact with each other.
- Friction depends on the _____ of surfaces.
- Friction produces _____.
- Sprinkling of powder on the carrom board _____ friction.
- Sliding friction is _____ than the static friction.

Ans. (a) relative motion (b) nature
(c) heat (d) reduces
(e) less.

Q. 2. Four children were asked to arrange forces due to rolling, static and sliding frictions in a decreasing order. Their arrangements are given below. Choose the correct arrangement:

- rolling, static, sliding (b) rolling, sliding, static
- static, sliding, rolling (d) sliding, static, rolling

Ans. (c) Static, sliding, rolling.

Q. 3. Alida runs her toy car on a dry marble floor, wet marble floor, newspaper and towel spread on the floor. The force of friction acting on the car on different surfaces in increasing order will be

- wet marble floor, dry marble floor, newspaper, towel.
- newspaper, towel, dry marble floor, wet marble floor.
- towel, newspaper, dry marble floor, wet marble floor.
- wet marble floor, dry marble floor, towel, newspaper.

Ans. (a) wet marble floor, dry marble floor, newspaper, towel.

Q. 4. Suppose your writing desk is tilted a little, a book kept on it starts sliding down. Show the direction of frictional force acting on it.

Ans. The book moves downwards. The frictional force is acting opposite to the movement of book. So it acts upwards.

Q. 5. You spill a bucket of soapy water on a marble floor accidentally. Would it make it easier or more difficult for you on the floor? Why?

Ans. The layer of soap makes floor smooth due to which the friction is reduced and the foot cannot make a proper grip on the floor. Therefore it is difficult to walk on a soapy floor and we start to slip on the floor.

Q. 6. Explain why sportsmen use shoes with spikes.

Ans. Sportsmen use shoes with spike to increase the friction between shoes and the surface. The shoes with spike do not slip while they run or play.

Q. 7. Iqbal has to push a lighter box and Seema has to push a similar heavier box on the same floor. Who will have to apply a larger force and why?

Ans. The heavy object will be pressed hard against the opposite surface and produces more friction. So Seema will have to apply a larger force due to more friction.

Q. 8. Explain why sliding friction is less than static friction.

Ans. The two sliding objects find less time to get interlocked against each other (objects and irregularities of surface). So

they get less friction. Therefore sliding friction is always less than static friction.

Q. 9. Give examples to show that friction is both a friend and a foe.

Ans. Examples to show that friction is a friend and a foe:

Friction is a friend:

- (i) Friction allows us to grip and catch different objects.
- (ii) It helps us to walk comfortably on the surface.
- (iii) It helps to minimise the speed or to stop the moving objects.
- (iv) It helps us to write on paper or blackboard.
- (v) The things do not move from their place due to the friction between the surfaces.

Friction is a foe:

- (i) Friction causes wear and tear in objects.
- (ii) It causes damage to the parts of machines.
- (iii) The machines or tools require regular maintenance due to which a lot of money is wasted.
- (iv) It reduces the speed of moving objects, so more force is required.
- (v) It does not allow the free movement of objects.

Q. 10. Explain why objects moving in fluids must have special shapes.

Ans. The object moving in fluids must have a special shape. This type of shape is called streamlined shape. The streamlined shape helps to overcome the friction between objects and fluids. The objects have pointed fronts with little broader middle portion which gets tapered at the back.