

8 Force and Pressure

Answers to Exercises

- A.
1. We apply a force on a moving body to change its speed or direction.
 2. Frictional force makes a moving ball come to rest even if no other force is applied.
 3. Everything on or near the earth is attracted towards it by the force of gravity. This makes a ball thrown up into the air fall back to the ground.
 4. Magnetic, electrostatic and gravitational forces can act from a distance.
 5. (a) Friction makes surfaces wear down.
(b) It wastes energy.
(c) Friction generates heat, damaging machine parts.
 6. Pressure is the force acting over a unit area of a surface. $\text{Pressure} = \text{force} / \text{area}$. The SI unit of pressure is N/m^2 .
 7. The cutting edge of a knife is made sharp in order to reduce the surface area of the edge. This means that we can exert a large pressure even by applying little force ($\text{pressure} = \text{force} / \text{area}$).
 8. The atmospheric pressure acting on the coaster after the glass of water is inverted helps balance the pressure of the water (acting downwards). So the coaster sticks to the glass.
 9. The SI unit of force is the newton (N).
- B.
1. When there is very little friction, as on a smooth floor, it is difficult to walk. Also, vehicles would skid on too smooth a road as they sometimes do after it rains. The soles of our shoes and the tyres of vehicles, for example, have grooves to increase friction.
 2. Air and water offer resistance to movement. A streamlined body has smooth outlines. When such a body moves through water or air, it disturbs the natural flow of water or air as little as possible. This reduces the resistance offered by air or water to its movement. For example, nature's fliers (birds) and swimmers (fish) have streamlined bodies. Cars, planes and ships are designed to have streamlined bodies.
 3. (a) Oil reduces friction by filling up the dents on the surfaces that move against each other in a machine. It also prevents direct contact between the surfaces by forming a film between them.
(b) Ball bearings are used to reduce friction especially when a rod rotates inside a hole, as in a bicycle wheel. The ones used between the wheel hub and the axle of a bicycle are small steel balls.
 4. When a force is applied to move a body, frictional force resists the movement. As the force increases, the frictional force also increases, until the force applied becomes greater than the frictional force. Just as the force applied becomes greater than the frictional force, the body starts moving. And as the body starts moving, the frictional force decreases.
 5. (a) The common characteristic in the magnetic, electrostatic and gravitational forces is that they can act from a distance.
(b) When a body leaves the earth's gravitational field, it is no longer pulled back to the earth. For example, a spacecraft sent into space is not attracted by the earth.
 6. (a) Everything in the universe attracts everything else with a force called the force of gravitation, which depends on the masses of the two bodies concerned. Unless one of the bodies is massive, the force of gravitation cannot be felt. So we do not attract each other.
(b) The moon's mass, and therefore its force of gravity, is much less than that of the earth.

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- C. 1. A spring balance is a device used to measure the weight of a body. Let us see how it works. Hang a spring from a nail and note its length. Hang a small stone from the other end of the spring and note the increase in its length. Hang a bigger stone and note the change in the length of the spring again. We will notice that the bigger the stone, the more the spring gets extended. This is because a bigger stone has a greater mass, so it is pulled by the earth with a greater force (gravitational force depends on mass). This is the principle on which a spring balance works. Refer to Figure 8.10 on page 85.
2. Pressure increases with the depth of a liquid. Let us see how. Make a manometer (an instrument used to measure pressure differences) by fixing a U-tube on a board and filling half of it with water. The water level is the same in both arms of the U-tube. Slip one end of a 1-m rubber tube over one end of the U-tube and attach a funnel to the other end of the rubber tube. Stretch a thin balloon over the mouth of the funnel and fix it with thread or a rubber band. Lower the funnel slowly into a bucket of water. The difference between the heights of water in the two arms (which indicates the pressure at a certain depth) will increase as the funnel goes deeper into the bucket of water.

3. Problematic friction

- (a) Air resistance wastes energy.
(b) Friction between moving parts wastes energy, causes wearing down.

Helpful friction

- (a) Helps us to sit on the saddle
(b) Helps us to grip the handlebar
(c) Helps us to apply brakes
(d) Keeps our feet on the pedals
(e) Helps the cycle move

- D. 1. less 2. gravitational 3. frictional 4. less 5. smaller
6. less 7. the same
- E. 1. (c) 2. (c) 3. (b) 4. (d) 5. (c)
- F. 1. Gravitational force - B, n, r, t 2. Frictional force - A, m, o, s
3. Magnetic force - B, p 4. Electrostatic force - B, q

