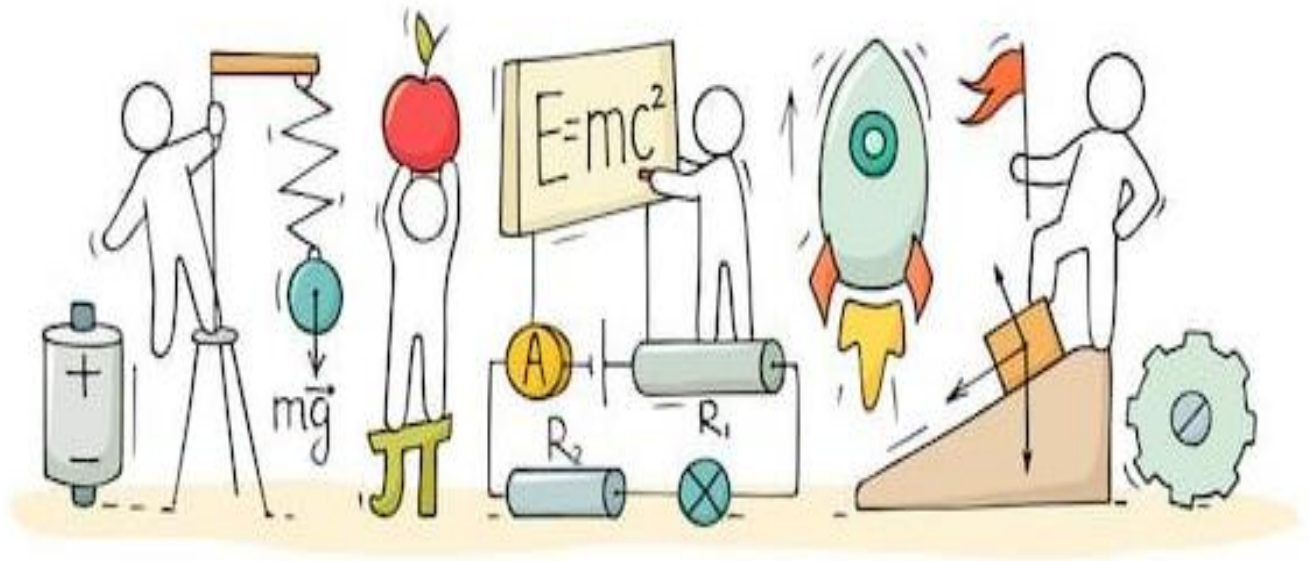


# SCIENCE

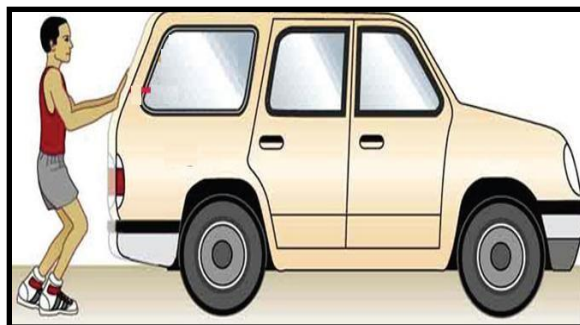
## Chapter 11: Force and Pressure



## Force and Pressure

### Force

- Force is a push or a pull on an object.
- It changes or tends to change the state of rest or the state of motion of an object by a push or pull.
- It cannot be seen, but its effect can be seen or felt.
- It is caused by an interaction. An interaction of one object with another object produces a force between the two objects.



- The forces acting on an object in the same direction add to each other.
- If the forces acting on an object are in opposite directions, then the net force acting on it is the difference between the two forces.
- The strength of force is called its magnitude.
- The SI unit of force is Newton.

### Effects of Force

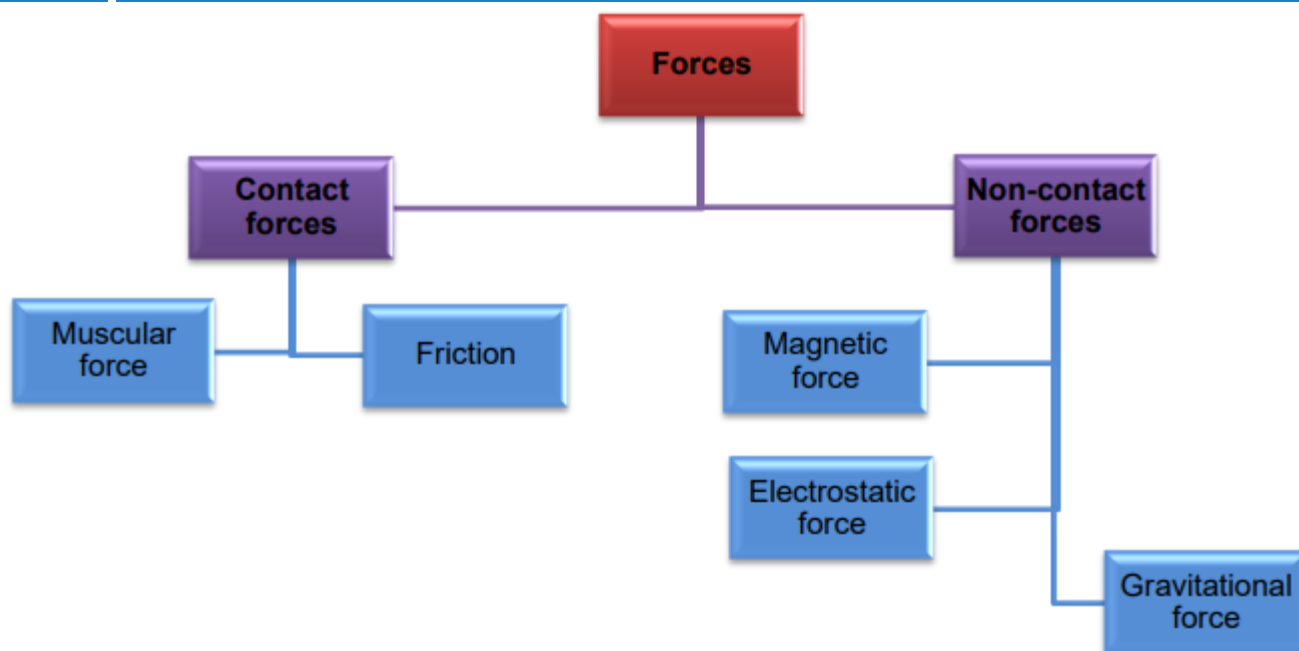
A force can change the state of motion of an object.

- A force can change the speed as well as direction of an object.
- If the force is applied in the direction of the motion, then the speed of the object increases.
- If the force is applied opposite to the direction of the motion, then the speed of the object decreases.

A force can change the shape and size of the object.

- A force can change the shape of an object.
- It can change the size of an object.
- It can change both the shape and the size of an object.

### Types of Forces



### Contact Forces

- A force which can cause or change the motion of an object by physical touching is called a contact force.

### Types of Contact Forces

#### Muscular Force

- The force caused by the action of muscles is called muscular force.
- Activities such as bending, movement, breathing and digestion of food involve muscular force.
- The point where the force is applied on an object is called the point of contact.

#### Friction

- The force responsible for changing the state of motion of an object is called friction.
- It always acts on all moving objects in the direction opposite to that of motion.
- It arises due to the contact between surfaces. If these surfaces are rough, then there is more friction.



- To reduce friction, the surfaces in contact are kept smooth and polished.

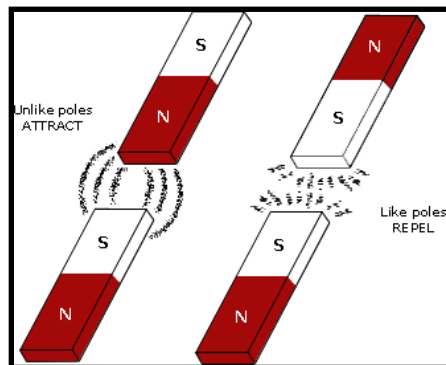
## Non-contact Forces

- These forces act at a distance without any physical contact.

### Types of Non-contact Forces

#### Magnetic Force

- The force exerted by a magnet is known as magnetic force.
- There is attraction or repulsion between the poles of magnets.
- Like poles of two magnets repel each other and unlike poles attract each other.



- A magnet can exert a force on another magnet without being in contact with it. Hence, it is known as a non-contact force.

#### Electrostatic Force

- The force exerted by a charged body on another charged or uncharged body is known as electrostatic force.
- It enables the charged substances to attract neutral substances.
- Example: Small pieces of paper attracted to a balloon



- Substances with unlike charges attract each other, and those with like charges repel each other.

#### Gravitational Force

- The attraction of objects towards the Earth is known as force of gravity or gravity.
- This force acts on all objects in the Universe.
- Every object in the Universe, whether small or large, exerts a force on every other object.

## Pressure

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- Pressure is the force per unit area applied in a direction perpendicular to the surface of an object.
- It is given as

$$\text{Pressure} = \frac{\text{Force}}{\text{Area}}$$

- It is also defined as the thrust acting per unit area.
- Example: A force applied perpendicular to the board.



- For pressure, we have
  - a. Pressure is directly proportional to the thrust or force, i.e. the more the thrust, more will be the pressure.
  - b. Pressure is inversely proportional to the area on which the force (thrust) is applied, i.e. lesser the area of contact, more is the pressure.
  - c. Examples:
    - ✓ Heavy trucks have six to eight tyres instead of the conventional four in order to increase the area of contact between the tyres and the road. Thus, the pressure on the ground is reduced.
    - ✓ Camels can walk easily in the desert as compared to the other animals because they have broader feet which exert less pressure on the sandy ground enabling them to walk properly.
    - ✓ Skiers use long flat skies to slide over the snow. The larger the area of contact, the lesser is the pressure on the snow. This helps the skier to slide comfortably without sinking in the snow.
- The unit of pressure is Newton/metre<sup>2</sup> (N/m<sup>2</sup> or Nm<sup>-2</sup>), which is equal to 1 Pascal (Pa).
- Liquids and gases exert pressure on the walls of the vessel.
- Air exerts pressure on all objects, and it is called the atmospheric pressure.

## Pressure Exerted by Liquids and Gases

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- A liquid exerts pressure on the base of the container (vessel) because of its weight.
- If the molecules of a liquid are in motion, then they strike (collide) with the walls of the

container. In every collision, these molecules exert a thrust on the walls of the container.

- Gases also exert pressure on the walls of the container.
- Example: Air filled in a balloon exerts pressure on the inner wall of the balloon.

### Characteristics of Liquid Pressure

It increases with depth.

It remains the same in all directions at a given depth.

It depends on the density of the liquid.

A liquid exerts pressure on the sides of the container.

A liquid seeks its own level.

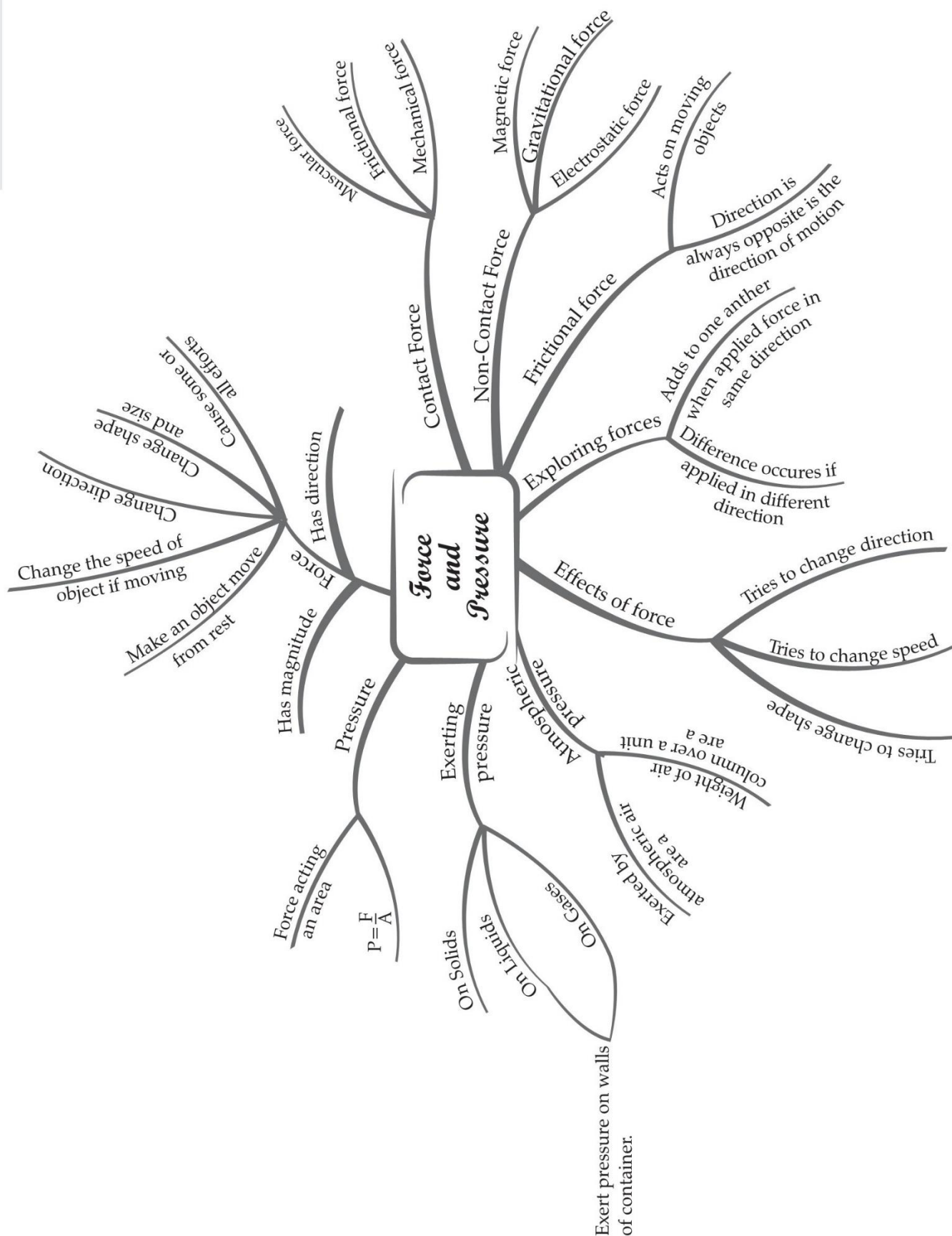
### Atmospheric Pressure

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- The Earth is surrounded by a layer of air up to a certain height, and this layer of air is called the atmosphere.
- As we gradually move up, the density of the layer of air decreases. At a particular height, it reduces to zero.
- Air has mass, so it exerts force on the Earth's surface and on the different objects. This force acting on a unit area is called atmospheric pressure.
- Atmospheric pressure is the weight of air in a column of unit area.
- Atmospheric pressure decreases as we go up in the atmosphere.
- Its SI unit is pascal (Pa).
- The pressure inside our body is equal to the atmospheric pressure outside. So, we are not crushed because of this air pressure.

## MIND MAP : LEARNING MADE SIMPLE

## CHAPTER-11





# Important Questions

## Multiple Choice questions-

Question 1.

The pressure which is exerted by air around us is known as

- (a) force
- (b) atmospheric pressure
- (c) muscular force
- (d) friction

Question 2.

Force acting on per unit area is called

- (a) non-contact forces
- (b) contact forces
- (c) force
- (d) pressure

Question 3.

A \_\_\_\_\_ exerted by an object on another is a force.

- (a) Push or pull
- (b) Contact or non-contact force
- (c) Pressure
- (d) Magnitude

Question 4.

The force exerted by the earth to pull the object towards itself is called

- (a) electrostatic force
- (b) gravitational force
- (c) muscular force
- (d) contact force

Question 5.

Muscular force is also called \_\_\_\_\_ force.



- (a) non-contact
- (b) contact
- (c) gravitational
- (d) magnetic

Question 6.

The force exerted by a charged body on another charged body is called

- (a) gravitational force
- (b) electrostatic force
- (c) non-contact force
- (d) contact force

Question 7.

Force changes the

- (a) motion of body
- (b) speed of body
- (c) shape of body
- (d) all of these

Question 8.

The force exerted by our muscle is called

- (a) electrostatic force
- (b) muscular force
- (c) gravitational force
- (d) non-contact force

Question 9.

1 kilogram weight is equal to

- (a) 98 N
- (b) 9.8 N
- (c) 0.98 N
- (d) 0.098 N

Question 10.

A spring balance is used for measuring

- (a) mass
- (b) weight
- (c) pressure
- (d) speed

Question 11.

Two boys A and B are applying force on a block. If the block moves towards the boy A, which one of the following statements is correct?

- (a) Magnitude of force applied by A is greater than that of B.
- (b) Magnitude of force applied by A is smaller than that of B.
- (c) Net force on the block is towards B.
- (d) Magnitude of force applied by A is equal to that of B.

Question 12.

When two forces act in opposite directions, then net force acting is the

- (a) sum of two forces
- (b) difference between two forces
- (c) both of these
- (d) none of these

Question 13.

The strength of force is expressed by its

- (a) weight
- (b) mass
- (c) magnitude
- (d) longitudinal force

Question 14.

Leaves fall down on the ground due to

- (a) electrostatic force
- (b) magnetic force
- (c) gravitational force

(d) muscular force

Question 15.

State of motion is described by

(a) Position of rest

(b) Position of motion

(c) Both by the state of rest or motion

(d) None of these

### Very Short Questions :

1. How can we decide whether an object is moving faster than the other?
2. What is the distance moved by an object in unit time called?
3. How can we change the speed and the direction of a moving body?
4. What is force?
5. What is the requirement for a force to come into play?
6. What is the resultant force when two forces act in same direction?
7. What will be the resultant force when two forces act in opposite directions on an object?
8. What happens in a tug of war when two teams pull equally hard?
9. Name the term used to express the strength of a force.
10. When does the net force become zero?

### Short Questions :

1. What is force? What is its unit?
2. What is change in state of motion? What brings change in state of motion?
3. What is the difference between contact forces and non-contact forces?
4. Give two example each of the situation in which you apply force to change state of motion of an object and to change shape of an object?
5. Why is it difficult to hold a school bag having a strap made of a thin and strong string?
6. Why Porters wear turbans when they have to carry heavy loads on their heads?
7. Force applied on an object may change its speed. How?
8. Why Lorries and trucks carrying heavy loads have 8 tyres instead of four?
9. Why the sucker sticks to the surface over which it is pressed?
10. What is pressure? How is pressure related to the surface area on which it acts?

**Long Questions :**

1. What is force? State the difference between contact force and non-contact force. A push or pull on an object is called a force.
2. Define the different types of forces.
3. Why it is easier to walk on soft sand if we have flat shoes rather than shoes with sharp heels (or pencil heels)?
4. What is pressure? What is the relation of pressure with area on which it is applied?

**ANSWER****MCQ Answer :**

1. Answer: (b) atmospheric pressure
2. Answer: (d) pressure
3. Answer: (a) Push or pull
4. Answer: (b) gravitational force
5. Answer: (b) contact
6. Answer: (b) electrostatic force
7. Answer: (d) all of these
8. Answer: (b) muscular force
9. Answer: (b) 9.8 N
10. Answer: (b) weight
11. Answer: (b) Magnitude of force applied by A is smaller than that of B.
12. Answer: (b) difference between two forces
13. Answer: (c) magnitude
14. Answer: (c) magnitude
15. Answer: (c) Both by the state of rest or motion

**Very Short Answer :**

1. Answer: By their speed.
2. Answer: Speed.
3. Answer: By applying force.
4. Answer: A push or a pull on an object is called force.
5. Answer: Interaction between two objects is required for a force to come into play.
6. Answer: Forces applied on an object in the same direction add to one another.
7. Answer: When two forces act in opposite directions on an object then the net force will

be the difference between two forces.

8. Answer: When two teams pull equally hard then the rope does not move in any direction.
9. Answer: Magnitude.
10. Answer: When two forces acting on an object in opposite directions are equal then the net force becomes zero.

### Short Answer :

1. **Answer:** A push or a pull on an object is called a force. It arises due to the interaction between two objects. Force has magnitude as well as direction. It may change in the state of motion of an object or it may bring about a change in the shape of an object. The unit of force is Newton.
2. **Answer:** A change in either the speed of an object, or its direction of motion, or both, is described as a change in its state of motion. Force may bring the change in the state of motion of an object.
3. **Answer:** Forces which act only when there is physical contact between two interacting objects are known as Contact forces. Example: Muscular force. Whereas Forces which can act without physical contact between objects i.e. those that can act from a distance, are called non-contact forces or field forces. Example: Magnetic force.
4. **Answer:** A goal keeper applies force for saving a goal. By his action the goal keeper tries to apply a force on the moving ball. This leads to change in state of motion of ball.  
Force is applied to the shape of a ball of dough when it is rolled to make a chapatti.
5. **Answer:** It is difficult to hold a school bag having a strap made of a thin and strong string because it apply the large pressure on the shoulders due to very small contact surface area. The pressure is inversely proportional to the surface area on which the force acts. Therefore, pressure decreases if surface area increases.
6. **Answer:** Porters wear turbans when they have to carry heavy loads on their heads, to increase the area of contact. This reduces the pressure on the head.
7. **Answer:** force applied on an object may change its speed. If the force applied on the object is in the direction of its motion, the speed of the object increases. If the force is applied in the direction opposite to the direction of motion, then it results in a decrease in the speed of the object.
8. **Answer:** Lorries and trucks carrying heavy loads have 8 tyres instead of four. Also the tyres are broader because this increases the area of contact with the ground, thus reducing the pressure exerted on the ground.
9. **Answer:** When we press the sucker, most of the air between its cup and the surface escapes out. The sucker sticks to the surface because pressure of atmosphere acts on it. To pull the sucker off the surface, the applied force should be large enough to overcome the atmospheric pressure.

10. **Answer:** Force per unit area is called pressure. Pressure is inversely proportional to the surface area on which it acts. Smaller the area, larger the pressure on the surface for the same force.

### Long Answer:

#### 1. Answer:

Contact force	Non-contact force
Force that can be applied only when it is in contact with an object is called a contact force, e.g., muscular force, frictional force	The force exerted on an object without touching it is known as non-contact force, e.g., gravitational force, magnetic force

#### 2. Answer:

Force can act on a body from a distance or by being in contact with it. Depending on this, forces can be classified as contact and non-contact forces.

(a) Contact forces: When force is applied on an object by direct or indirect physical contact the applied force is called contact force. Muscular and frictional force are example of contact force.

- Muscular force: The force resulting due to the action of muscles is known as the muscular force.
- Frictional force: The force resisting the relative motion of solid surfaces, fluid layers, and material elements sliding against each other.

(b) Non-contact forces: When a force is applied to an object by another body that is not in direct contact with it is called non-contact force. Gravitational, magnetic and electrostatic force are example of non-contact force.

- Gravitational force: The attractive force of the earth which acts upon all the objects is known as the force of gravity or just gravity.
- Electrostatic force: The force exerted by a charged body on another charged or uncharged 1 body is known as electrostatic force.
- Magnetic force: The force exerted between a magnet and other magnet or magnetic material is known as magnetic force.

#### 3. Answer:

A flat shoe has a greater area in contact with the soft sand and exerts less pressure on the soft ground. Due to this the 'flat' shoes do not sink much in soft sand and it is easy to walk on it. On the other hand, a sharp heel has a small area in contact with the soft sand and exerts a greater pressure on the sand. Due to this, the sharp heels sink deep into soft sand making it difficult for the wearer to walk on it.

**4. Answer:**

Force exerted on per unit area is called pressure. Pressure is related with area on which it is applied. When the area is increased the pressure exerted is less. But when the area on which pressure is exerted is decrease the pressure increases. So we can conclude that pressure increases with decrease in area.

List the characteristics of pressure exerted by a liquid.

- Liquid exerts pressure in all directions.
- Pressure in liquid does not depends on shape, size and surface area of the container.
- Pressure increases with depth.
- All points at the same level in a liquid are at the same pressure.
- Pressure does not depend on the surface of the immersed object.