Force and Pressure Class 8

1. Introduction

- **What is Motion**:
  - Objects move when pushed or pulled.
  - Motion can be fast or slow.
  - Some objects change direction while moving.
- **Why Motion Changes**:
  - A ball slows down after being kicked.
  - It may stop or turn another way.
  - Something causes these changes.
- **What is Force**:
  - Force makes objects move or stop.
  - It can change how objects move.
  - It's behind every motion change.

2. Force - A Push or a Pull

- **Definition of Force**:
  - Force is a push or a pull.
  - It acts on an object to move it.
  - It changes the object's state.
- **Examples of Push**:
  - Kicking a football is a push.
  - Pushing a book moves it forward.
  - These actions start motion.
- **Examples of Pull**:
  - Pulling a rope draws it closer.
  - Opening a drawer is a pull.
  - These actions bring objects near.
- **Actions Involving Force**:
  - Lifting a bag uses force.
  - Throwing a ball applies force.
  - Every action changes motion.

3. Forces Due to Interaction

- **Need for Interaction**:
  - Force needs two objects to work.
  - One object affects the other.
  - Without interaction, no force happens.
- **Examples**:
  - A man pushes a car to move it.
  - Two girls pull a rope together.
  - A cow and man tug oppositely.
- **Key Fact**:
  - Interaction is essential for force.
  - Objects don't move on their own.
  - Force comes from contact or attraction.

4. Exploring Forces

- **Forces in Same Direction**:
  - Forces together make objects move easier.
  - Two people pushing a box add force.
  - The box moves faster this way.
- **Forces in Opposite Direction**:
  - Opposite forces reduce total force.
  - If equal, the object stays still.
  - If unequal, it moves toward stronger force.
- **Tug-of-War Example**:
  - Teams pull a rope oppositely.
  - Equal pulls keep the rope still.
  - Stronger team wins by pulling harder.
- **Force Characteristics**:
  - Force has strength called magnitude.
  - It also has a direction.
  - Both affect how objects move.

5. Force Changes State of Motion

- **What is State of Motion**:
  - It's an object's speed and direction.
  - Rest is zero speed.
  - Motion includes moving or stopping.
- **Force and Speed**:
  - Pushing a ball increases its speed.
  - Stopping it reduces speed to zero.
  - Force changes how fast it goes.
- **Force and Direction**:
  - Hitting a volleyball changes its path.
  - A cricket ball turns when hit.
  - Force alters where objects go.
- **Examples**:
  - A goalkeeper stops a football.
  - A batsman redirects a cricket ball.
  - Both show force changing motion.
- **Key Fact**:
  - Force can start, stop, or redirect motion.
  - It always affects the object's state.
  - Without force, motion stays same.

6. Force Changes Shape

- **Shape Change**:
  - Force can squeeze or stretch objects.
  - It changes how they look.
  - This happens without moving them.
- **Examples**:
  - Pressing dough flattens it.
  - Stretching a rubber band lengthens it.
  - Pushing a balloon changes its form.
- **Key Fact**:
  - Force doesn't always move objects.
  - It can deform them instead.
  - Shape change needs force.

7. Contact Forces

- **What Are They**:
  - Contact forces need touch to work.
  - The object must be physically reached.
  - They act through direct contact.
- **Muscular Force**:
  - Muscles create this force.
  - Lifting a bucket uses muscular force.
  - Pushing a bag needs it too.
- **Muscular Force Examples**:
  - Animals like horses pull carts.
  - Humans carry heavy loads.
  - Digestion pushes food in the body.
- **Friction**:
  - Friction slows moving objects.
  - It acts opposite to motion.
  - It stops a rolling ball eventually.
- **Friction Examples**:
  - A bicycle stops when pedalling ends.
  - A boat halts without rowing.
  - Friction works between surfaces.

8. Non-Contact Forces

- **What Are They**:
  - Non-contact forces work without touch.
  - They act at a distance.
  - Objects move without physical contact.
- **Magnetic Force**:
  - Magnets attract or repel objects.
  - Like poles push away.
  - Unlike poles pull together.
- **Magnetic Example**:
  - A magnet pulls iron without touching.
  - Magnets affect each other remotely.
  - This force moves things far away.
- **Electrostatic Force**:
  - Charged objects create this force.
  - Rubbed straws attract or repel.
  - It works without contact.
- **Electrostatic Example**:
  - A charged balloon sticks to walls.
  - It pulls objects without touching.
  - Charge causes the force.
- **Gravitational Force**:
  - Gravity pulls objects downward.
  - It acts on everything, always.
  - Every object has gravitational pull.
- **Gravity Examples**:
  - A coin falls when dropped.
  - Water flows down from a tap.
  - Fruits fall from trees.

9. Pressure

- **Definition**:
  - Pressure is force on a unit area.
  - It's force divided by area.
  - Smaller area means more pressure.
- **Examples**:
  - A nail's point pushes easier than its head.
  - Sharp knives cut better than blunt ones.
  - Small areas increase pressure.
- **Practical Use**:
  - Porters use cloth to spread load.
  - Wide bag straps reduce pressure.
  - Sharp tools work with less area.

10. Pressure by Liquids and Gases

- **Liquids Exert Pressure**:
  - Water pushes on container walls.
  - Pressure depends on water height.
  - More water means more pressure.
- **Liquid Example**:
  - Water presses sides of a bottle.
  - It pushes equally at same depth.
  - Containers feel liquid force.
- **Gases Exert Pressure**:
  - Air pushes on balloon walls.
  - Gases press in all directions.
  - A punctured tube loses air fast.
- **Gas Example**:
  - Inflated balloons stay firm.
  - Air escapes if there's a hole.
  - Gases always exert pressure.

11. Atmospheric Pressure

- **What It Is**:
  - Air around us creates pressure.
  - It's called atmospheric pressure.
  - It comes from air's weight.
- **Magnitude**:
  - Atmospheric pressure is very strong.
  - It equals a heavy weight's force.
  - It acts on all surfaces.
- **Example**:
  - A rubber sucker sticks to surfaces.
  - Air pressure holds it tight.
  - Pulling it off is hard.
- **Historical Fact**:
  - Otto von Guericke showed air's force.
  - Horses couldn't pull airless hemispheres apart.
  - Air pressure is powerful.
- **Why We Don't Feel It**:
  - Body pressure balances air pressure.
  - Inside and outside pressures match.
  - This keeps us from being crushed.

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FORCE AND PRESSURE

I. VERY SHORT ANSWER (1M)

1. What is the SI unit of pressure? [N/m^2 or Pascal (Pa)]
2. Define pressure. [The force acting on a unit area of a surface is called **pressure**. Pressure = force / area]
3. Identify the type of force in the below situations.
   i) A coin or a pen falls to the ground when it slips out of your hand. (Force of gravity)
   ii) A boat comes to rest if we stop rowing it. (Frictional force)
   iii) When a person hammers a nail. (Muscular force)
4. Give two examples of situations in which force can bring about a change in the state of the body. (When we push a bicycle to move it, when we pull the table it leads to a change in the position of the table.)
5. What is the similarity between electrostatic and magnetic forces?
   (Both are non-contact forces, both are attractive as well as repulsive forces.)
6. What happens when the forces are applied to an object in the same direction? (Forces applied to an object in the same direction add to one another.)
7. Where does friction act and what is its direction? (Friction acts on all the moving objects and its direction is always opposite to the direction of motion of the object.)
8. Give the two examples of the gases exerting pressure. (When air is filled into a balloon, the balloon gets inflated (gets bigger). When air is filled into a bicycle tube with a pump, the tube gets inflated and makes the tyre feel 'hard'.)

For question numbers 9 to 11, two statements are given- one labelled Assertion (A) and the other labelled Reason (R). **Select the correct answer to these questions from the codes (i), (ii), (iii) and (iv) as given below:**

i) Both A and R are true and R is the correct explanation of the assertion.

ii) Both A and R are true but R is not the correct explanation of the assertion.

iii) A is true but R is false.

iv) A is false but R is true.

9. **Assertion (A):** Water begins to flow towards the ground as soon as we open a tap.
   Reason (R): It is because of the force of gravity, which makes things/objects fall towards the earth as it pulls them.

10. **Assertion (A):** The relationship between force, pressure, and area is given by P=F/A.
    Reason (R): The SI unit of pressure is N/m^2 or Pascal (Pa).
11. **Assertion (A):** Fountains of water come out of the leaking joints or holes in pipes.
    Reason(R): It is because liquids (water) exert pressure on the walls of the pipes.

II. CASE STUDY BASED QUESTIONS

The discovery of atmospheric pressure gives a fact that air has weight. The weight of the atmosphere presses down on the earth's surface and creates pressure on it. The pressure at any point exerted by the weight of the air above is called atmospheric pressure.
The atmospheric pressure on the earth's surface at sea level is one hundred thousand pascals i.e.100 K Pa. The atmospheric pressure at a place decreases with an increase in altitude. The atmospheric pressure at a place is the force exerted by the weight of the air column above that place. As we go up the length of the air column above us decreases. This means that its weight and the atmospheric pressure are smaller at higher places than at sea level.

If the pressure of the atmosphere is removed suddenly, our blood vessels and tissues will rupture due to the pressure of the blood and other fluids inside. Thus, the spacemen also wear special pressurised suits as in space there is no air and hence, no air pressure. At the top of a mountain, some people can feel their ears "popping" due to a decrease in air pressure. The ears pop to balance the difference in pressure inside and outside the body.

a) What is atmospheric pressure? [The pressure exerted by the air around us is known as atmospheric pressure.]
b) We know that there is a huge amount of atmospheric pressure on us. But we do not experience its effect. Why? (The pressure of the air inside our body is the same as that of the pressure outside. Therefore, we do not experience its effect.)
c) Why do some people feel their ears "popping" at the top of the mountain? (Some people feel their ear-popping at the top of the mountain due to the decrease in the air pressure. The ears pop to balance the difference in pressures inside and outside of the body.)

III.PASSAGE BASED QUESTIONS:

Read the following passage and answer the questions:
In our daily life, we perform or observe activities such as opening or shutting a door, lifting or pushing a weight, squeezing a bottle of ketchup, cutting vegetables, and making different shapes with clay. All these activities require us to apply some kind of push or pull. A push or pull is also used to hit the striker in a game of carom, kick a football, catch a ball, etc., A push or pull that tends to affect an object in some way is called a force and a force arises only when two objects interact. Force has magnitude as well as direction. Force can make a stationary object move, change the shape, increase or decrease the speed of the object, change the direction or even bring a moving object to rest.

a) What is force? [A push or pull that tends to affect an object in some way like a change in speed, shape, or direction of motion is called force.]

b) How does an applied force changes the speed of an object? (If the applied force is in the direction of motion, the speed of the object increases. But if the force is applied in the direction opposite to the motion, then it decreases the speed of the object.)

c) In the following situations. State the effect of the force in each case.

(i) Squeezing a piece of lemon between the fingers to extract its juice. (Change in shape)

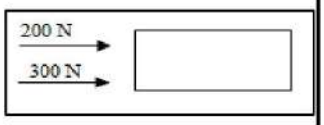
(ii) Taking out paste from a toothpaste tube. (Change in shape)

(iii) A load suspended from a spring while its other end is on a hook fixed to a wall. (Change in shape)

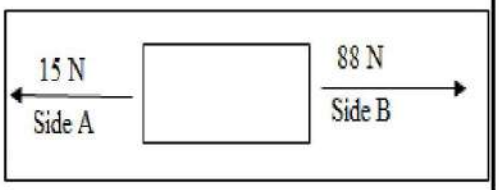
(iv)An athlete making a high jump to clear the bar at a certain height. (Change in state of motion)

IV. a) SHORT ANSWER TYPE QUESTIONS (2 M):

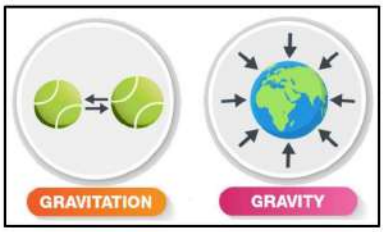
1. Two forces 200N and 300N are acting on a body in the same direction. What is the resultant force? (When two or more forces act in the same direction, the net force or the resultant force is the sum of the two forces i.e., 200 N + 300 N = 500 N)



2. What will be the net force on an object if two forces acting on it in opposite directions are equal? Why? (If two forces acting in opposite directions are **equal**, then they cancel each other's effect, hence net force will be zero.)
3. a) Why do you think that a ball rolling down the ground comes to rest? (It is the force of friction between the surface of the ball and the ground that brings the rolling ball to rest.)
   b) Why does the porter place a round piece of cloth above his head before he places his luggage? [This helps in increasing the area of contact between the luggage and his head. The increased area of contact reduces the pressure, enabling him to carry heavy loads.]
4. In a tug of war, Side A applies 15N force and side B applies 88N force. Which side will the rope move? What will be the net force acting on the rope? (If two forces are acting in opposite directions, then the net force will be the difference between the two forces. Therefore, the net force is 88-15=73N. The rope will move towards B.)



5. Distinguish between the force of gravity and gravitational force. (Force of gravity is the earth's gravitational pull on a body. It is always attractive. Gravitational force is the force of attraction acting between any two bodies of the universe.)



IV. b) SHORT ANSWER TYPE QUESTIONS (3 M)

1. In a tug of war, three boys of team A pull the rope with forces of 100 N, 120 N and 170N. In team B, the three members pull the rope with forces of 130 N, 150 N and 155 N. Who will win the tug of war? What is the resultant force?

   Force applied by team A = F_A = 100 + 120 + 170= 390 N
   Force applied by team B = F_B = 130 + 150 + 155= 435 N
   As $F_B > F_A$, the resultant force is in the direction of F_B. So, team B will win the tug of war. Resultant force = $F_B - F_A$
   = 435 - 390
   = 45 N

2. Write one point of difference between contact and non-contact forces with an example.
   [Contact force- The force between two objects that are in physical contact. E.g. lifting a bucket of water. The non-contact force-The force applied to a body by another body that is not in direct contact with it. E.g. A plastic comb gets charged when it is run through dry hair. This charged comb attracts small bits of paper.]

3. How would you distinguish between balanced and unbalanced force.

BALANCED FORCE	UNBALANCED FORCE
Equal forces acting on one object in opposite directions are called balanced forces.	Unequal forces acting on one object in opposite directions are called unbalanced forces.
The state of motion of the object remains unchanged.	There is a change in the state of motion of the object.
The net force is zero	The net force is not zero

4. a) Describe the state of motion of an object. [The state of motion of an object is described by its speed and the direction of motion. The state of rest is considered to be the state of zero speed. An object may be at rest or in motion; both are its states of motion.]

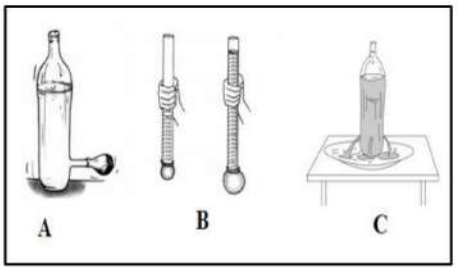
   b) What are the effects of the application of force on an object? (A force may make an object
   move from rest may change the speed of an object if it is moving, may change the the direction of motion of an object may bring about a change in the shape of an object, may cause some or all of these effects.)

5. a)Why is it difficult to pull out a toy having a rubber sucker, which is stuck to the wall?
   [It is difficult, because of the difference in internal and external air pressure. There is less air pressure inside than outside, so outside air pressure pushes the surface of the rubber sucker towards the wall, making it difficult to pull.]

   b) Why do some people suffer from nose bleeding at high altitudes? (The atmospheric pressure is at a maximum on the surface of the earth. When we go to a higher altitude (say

a high mountain), then the atmospheric pressure decreases. So, at high altitudes, the atmospheric pressure becomes much less than the pressure exerted by the fluids inside our body. Since our internal pressure by fluids is greater than the external air pressure some of the thin blood vessels in our nose burst and bleeding can occur.)

6. What do the following activities prove?
[A-Liquid exerts pressure on the walls of the container. B- Pressure exerted by the water at the bottom of the container depends upon the height of the water column. C- Liquid exerts equal pressure at the same depth.]



V. LONG ANSWER TYPE QUESTIONS (5 M):

1. Explain the various types of contact and non-contact forces.
(Muscular force is the force that is caused by the action of muscles inside the body. It is also a contact force. E.g. Athletes use muscular force for running.
The frictional force is the force that opposes the motion of one body over the surface of another body. It is a contact force. E.g. A bicycle eventually comes to rest when you stop pedaling it.
Magnetic force is the force exerted by magnets on magnetic materials like iron. It can be either attractive or repulsive. E.g. A magnet attracting magnetic materials.
The electrostatic force is the force of attraction or repulsion exerted between charged particles. E.g. A straw rubbed with paper attracts another straw but repels it if it has also been rubbed with a sheet of paper.
Gravitational force is the force exerted by the earth's gravity on all objects. It is always attractive. Falling of apple from tree or falling of any object when we through anything up.)
2. Give a reason for the following.
   a) If you walk in the snow, your feet will sink. But if you put on skies, you can move over the snow easily. (Skies increase the area of contact with the snow, thereby reducing the pressure on it. The reduced pressure enables the skies to slide over the snow without sinking much.)
   b) Iron rails of railway tracks are fixed over wide wooden or concrete sleepers. [Iron rails are fixed over wide wooden or concrete sleepers to reduce pressure received from the train by increasing the area of contact, because if surface area increases pressure decreases and vice versa.]
   c) It is easier to sew with a pointed needle than a blunt needle. [It is easier to sew with a pointed needle because the pointed end reduces the area of contact thereby increasing pressure and enabling us to stitch easily.]
   d) Foundations of high-rise buildings are kept wide. [It is because wide foundations increase the area of contact. The increased area reduces the pressure.]

e) A heavy truck is fitted with six to eight wheels. [A heavy truck is fitted with six to eight wheels because increased area reduces the pressure on wheels so they do not burst or damage on the road. That is why the truck has broad tyres so that there is less pressure on the ground and the tyres do not sink.]

f) It is easy to peel vegetables with a sharp knife. [It is easy to peel vegetables with a sharp knife instead of using a blunt knife because less area of contact is the pressure exerted.]

3. a) Calculate the pressure produced by a force of 1000 N acting on an area of 2 m^2. (P= F/A, 1000/2= 500N/m^2)

   b) Over what area should a force of 200 N act to produce a pressure of 1000Pascal? (A=F/P=200/1000=1/5=0.2m^2)

   c) The pressure of a gas contained in a cylinder with a movable piston is 300 Pa. The area of the piston is 50 m^2. Calculate the force exerted on the piston. (F=P xA = 300 x 50 = 15000N)

   d) If a force of 5N is applied over an area of 2.5 m^2. Calculate the pressure produced. (Pressure = F/A, 5/2.5 = 2 Pa)
