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Pressure, Winds, Storms and Cyclones

Fill in the Blanks

1. Pressure is defined as _____ per unit area.
2. The SI unit of pressure is _____, which is also called _____.
3. Pressure increases when the same force acts on a _____ area.
4. Liquids exert pressure in _____ directions.
5. The pressure exerted by the air around us is called _____ pressure.
6. Air moves from a region of _____ pressure to a region of _____ pressure.
7. During the day, a _____ breeze blows from the sea towards the land.
8. The calm central region of a cyclone is called the _____ of the cyclone.
9. A storm accompanied by lightning and thunder is called a _____.
10. A metallic rod installed on buildings to provide an easy path for electric charges to reach the ground is called a _____.

Multiple Choice Questions

1. Which of the following is the correct formula for pressure?
 - (a) Pressure = Force $\times$ Area
 - (b) Pressure = Force $\div$ Area
 - (c) Pressure = Area $\div$ Force
 - (d) Pressure = Force + Area
2. Which of the following produces greater pressure when the same force is applied?
 - (a) A smaller area
 - (b) A larger area
 - (c) Both produce equal pressure
 - (d) None of these
3. Why are overhead water tanks placed at a height?
 - (a) To reduce the pressure of water
 - (b) To increase the pressure of water in taps
 - (c) To make the water colder
 - (d) To reduce the amount of water required
4. Which statement about liquids is correct?
 - (a) Liquids exert pressure only at the bottom.
 - (b) Liquids exert pressure only on the sides.
 - (c) Liquids exert pressure in all directions.
 - (d) Liquids do not exert pressure.
5. Air generally moves from:
 - (a) Low pressure to high pressure
 - (b) High pressure to low pressure
 - (c) High temperature to low temperature only
 - (d) Low temperature to high temperature only
6. What causes a sea breeze during the day?
 - (a) Sea heats faster than land.
 - (b) The sea has higher temperature throughout the day.
 - (c) Both heat at the same rate.
 - (d) Land heats faster than sea.
7. Which part of a cyclone has the lowest pressure and calm winds?
 - (a) Outer region
 - (b) Eye
 - (c) Upper cloud
 - (d) Rain band
8. What causes the formation of electric charges in thunderclouds?
 - (a) Heating of the ground
 - (b) Rubbing and collision of water droplets and ice particles
 - (c) Movement of seawater
 - (d) Evaporation alone

9. Which of the following is comparatively safer during lightning?
- (a) Standing under a tall tree (b) Standing in an open field
(c) Sitting inside a car (d) Standing near a metal pole
10. Cyclones generally form over:
- (a) Cold deserts (b) Warm ocean waters
(c) Mountains (d) Dry land

True or False

1. Pressure is force acting per unit area.
2. Broad straps of a school bag exert more pressure on the shoulders than narrow straps.
3. Liquids exert pressure only at the bottom of a container.
4. The pressure exerted by a liquid increases with the height of its column.
5. Air exerts pressure on objects around us.

Assertion – Reason Questions

Directions:

- (a) Both A and R are true and R is the correct explanation.
(b) Both A and R are true but R is not the correct explanation.
(c) A is true but R is false.
(d) A is false but R is true.

1. Assertion: Broad straps of a school bag are more comfortable than narrow straps.
Reason: Broad straps increase the area over which the weight of the bag acts.
2. Assertion: A sharp knife cuts an apple more easily than a blunt knife.
Reason: A sharp edge has a smaller area of contact and therefore produces greater pressure.
3. Assertion: Overhead water tanks are placed at a height.
Reason: The pressure exerted by water increases with the height of the water column.
4. Assertion: Liquids exert pressure on the walls of their containers.
Reason: Liquids exert pressure in all directions.
5. Assertion: Air moves from high-pressure regions to low-pressure regions.
Reason: A pressure difference causes air to move.

Short Answer Questions

1. What is pressure? Write its formula and SI unit.
2. Why are broad straps used in school bags?
3. Why is it easier to cut an apple with the sharp edge of a knife than with its blunt edge?
4. How does the pressure exerted by a liquid depend on the height of the liquid column?
5. Why are overhead water tanks placed at a height?
6. What is atmospheric pressure?
7. Why does air move from a region of high pressure to a region of low pressure?
8. What is the difference between a sea breeze and a land breeze?
9. Why can high-speed winds blow away the roofs of houses?
10. What is the eye of a cyclone? Describe the conditions at the eye.

Long Answer Questions

Q1. Explain the relationship between force, area, and pressure.

Define pressure and write its formula. Explain what happens to pressure when the area of contact is increased or decreased. Give suitable examples from daily life.

Q2. Explain how liquids exert pressure.

Describe an activity that demonstrates that liquids exert pressure on the walls of a container. Also explain how the pressure of a liquid changes with the height of its column.

Q3. Explain why dams have a broader base than their top.

Describe how water exerts pressure on the walls and floor of a dam. Explain why the pressure is greater near the bottom and why the base of a dam is made broader.

Q4. Explain the formation of a thunderstorm and lightning.

Describe how warm, moist air rises, clouds form, electric charges develop inside clouds, and lightning and thunder are produced.

Q5. Explain how a cyclone is formed.

Describe the role of warm ocean water, rising moist air, condensation, release of heat, low pressure, surrounding air, and Earth's rotation in the formation of a cyclone. Also explain the significance of the eye.

Q6. Describe the effects of cyclones and the precautions that should be taken during a cyclone.

Explain the dangers caused by strong winds, heavy rainfall, storm surges, floods, landslides, and seawater entering coastal areas. Also describe the importance of weather alerts, emergency kits, and cyclone shelters.

One Point Learning

Answers

Fill in the blanks

1. force
2. N/m^2 , pascal (Pa)
3. smaller
4. all
5. atmospheric
6. high, low
7. sea
8. eye
9. thunderstorm
10. lightning conductor

MCQs

1. (b) Pressure = Force $\div$ Area
2. (a) A smaller area
3. (b) To increase the pressure of water in taps
4. (c) Liquids exert pressure in all directions
5. (b) High pressure to low pressure
6. (d) Land heats faster than sea
7. (b) Eye
8. (b) Rubbing and collision of water droplets and ice particles
9. (c) Sitting inside a car
10. (b) Warm ocean waters

True/False

1. True
2. False
3. False
4. True
5. True

Assertion – Reason

1. (a)
2. (a)
3. (a)
4. (a)
5. (a)

Short Questions – Answers

Ans 1: Pressure is defined as the force acting per unit area of a surface. It is given by the formula:

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

The SI unit of force is newton (N) and the SI unit of area is square metre (m^2). Therefore, the SI unit of pressure is newton per square metre (N/m^2), which is also called pascal (Pa).

Ans 2: Broad straps are used in school bags because they increase the area over which the weight of the bag acts on our shoulders. Since pressure is force per unit area, a larger area produces less pressure. Therefore, broad straps exert less pressure on the shoulders and make the bag more comfortable to carry.

Ans 3: The sharp edge of a knife has a smaller area of contact with the apple. When the same force is applied, a smaller area produces greater pressure. Therefore, the sharp edge exerts greater pressure on the apple and cuts it more easily than the blunt edge.

One Point Learning

Ans 4: The pressure exerted by a liquid increases as the height of the liquid column increases. When the height of the water column is increased, the pressure at the bottom also increases. This can be observed by filling more water into a pipe fitted with a balloon at its bottom—the balloon bulges more as the height of the water column increases.

Ans 5: Overhead water tanks are placed at a height because the pressure exerted by water increases with the height of the water column. Placing the tank higher increases the pressure of water in the pipes, allowing water to flow from taps with a stronger stream, especially at lower levels of a building.

Ans 6: The envelope of air surrounding the Earth is called the atmosphere. Air exerts pressure on all objects around us, and this pressure is called atmospheric pressure.

Atmospheric pressure is exerted because of the weight of the column of air above us. We are not crushed by this pressure because the pressure inside our bodies also balances the atmospheric pressure outside.

Ans 7: Air moves from a region of high air pressure to a region of low air pressure because of the difference in pressure between the two regions. Air continues to flow as long as there is a pressure difference. When the pressure becomes equal, the flow of air stops.

Ans 8: A sea breeze occurs during the day. Land gets heated faster than water, so the air above the land becomes warm and rises, creating a low-pressure area. Cooler air from the sea moves towards the land, producing a sea breeze.

A land breeze occurs at night. The land cools faster than the sea, so a low-pressure area develops over the warmer sea. Air then moves from the land towards the sea, producing a land breeze.

Ans 9: High-speed winds are accompanied by reduced air pressure. When strong winds blow over a house, the air pressure above the roof becomes lower than the pressure inside the house. This pressure difference produces an upward force on the roof. If the pressure difference is large and the roof is weak, the roof may be blown away.

Keeping doors and windows open during such storms can reduce the pressure difference and help protect the roof.

Ans 10: The eye of a cyclone is the central region of the cyclone where the air pressure is lowest. Unlike the surrounding region, the eye generally has calm winds and relatively quieter weather.

The region surrounding the eye experiences very strong winds and heavy rainfall. Thus, although the centre appears calm, the area around the eye can be extremely dangerous.

Long Questions – Answers

Ans 1. Pressure is defined as the force acting per unit area of a surface. It is expressed by the formula:

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

Thus, pressure depends on both the force applied and the area over which the force acts.

- For the same force, pressure increases when the area of contact decreases.
- For the same force, pressure decreases when the area of contact increases.
- A greater force acting on the same area produces greater pressure.

For example, a sharp knife cuts an apple more easily than a blunt knife because its sharp edge has a smaller area of contact and therefore produces greater pressure. Similarly, broad straps of a school bag exert less pressure on our shoulders because the weight of the bag is spread over a larger area.

The SI unit of pressure is newton per square metre (N/m^2), also called pascal (Pa).

Ans 2.

Liquids exert pressure on the surfaces with which they are in contact. They exert pressure not only at the bottom but also on the sides of a container. In fact, liquids exert pressure in all directions.

This can be demonstrated using a plastic bottle. Make several small holes at the same height around the sides of the bottle and fill it with water. When the holes are opened, water flows out through all the holes. This shows that water exerts pressure on the walls of the container.

The pressure exerted by a liquid depends on the height of the liquid column. As the height of the water column increases, the pressure at the bottom increases. This can be shown by attaching a balloon to the bottom of a pipe and gradually adding water. The balloon bulges more as the height of the water column increases.

Therefore, greater the height of the liquid column, greater is the pressure exerted by the liquid.

Ans 3. A dam holds a large quantity of water, and the water exerts pressure on the walls and floor of the dam. The pressure exerted by water increases with the height of the water column.

Therefore, the water pressure is greater near the bottom of the dam than near the top. The water also exerts a large horizontal pressure on the side walls near the bottom.

To withstand this greater pressure and provide stability, the base of a dam is made much broader and stronger than its top. The broad base helps the dam withstand the large pressure exerted by the water and supports the weight of the structure.

Ans 4. A thunderstorm develops when warm, moist air rises and strong winds are present.

The process takes place as follows:

- When land becomes hot, warm and moist air rises because it is lighter. This creates a low-pressure area.
- Cooler air from surrounding high-pressure regions moves in to replace the rising warm air.
- The rising air expands and cools at higher altitudes. The water vapour in it condenses to form water droplets and clouds.
- Strong upward and downward winds cause water droplets and ice particles to rub against and collide with one another.
- This rubbing produces electric charges in the clouds. The lighter, positively charged ice particles move towards the upper part of the cloud, while the heavier, negatively charged water droplets occupy the lower part.
- When the build-up of opposite charges becomes very large, the insulating property of air breaks down.
- A sudden flow of electric charges takes place, producing a bright flash called lightning.
- Lightning rapidly heats the surrounding air. The air expands suddenly and produces a loud sound called thunder.

A storm accompanied by lightning and thunder is called a thunderstorm.

Ans 5. Cyclones are large storms that generally form over warm ocean waters. Their formation involves the following steps:

- Warm ocean water heats the air above it. The warm, moist air rises and creates a low-pressure area.
- As the moist air rises, the water vapour condenses to form raindrops.
- During condensation, heat is released into the atmosphere. This further warms the rising air, causing it to rise even more.
- The pressure decreases further, creating a very low-pressure region.
- Air from the surrounding high-pressure regions rushes towards this low-pressure area and also begins to

rise.

- Due to the rotation of the Earth, the moving air starts to spin.
- This process continues repeatedly, resulting in a system of high-speed winds, clouds, and rain revolving around a very low-pressure centre. This system is called a cyclone.

The central region of the cyclone is called the eye. It has the lowest pressure and relatively calm winds, while the region around it experiences very strong winds and heavy rainfall.

When a cyclone moves over land, its supply of warm, moist air from the ocean is cut off, so it gradually loses its strength.

Ans 6. Cyclones can cause severe destruction to life, property, crops, and infrastructure. Their major effects include:

- Very strong winds can damage or destroy houses, trees, roads, and other structures.
- Strong winds can push ocean water towards the shore, creating a storm surge that can flood coastal areas.
- Heavy rainfall can cause rivers to overflow and may trigger landslides.
- Seawater entering coastal areas can contaminate drinking water sources.
- Salt from seawater can make soil less fertile and damage farmland and crops.
- Fallen trees and debris can block roads and make rescue operations difficult.
- Power outages can disrupt communication, emergency services, and daily life.

Precautions during a cyclone:

- Stay updated with weather reports, alerts, and warnings issued by the India Meteorological Department (IMD).
- People living in cyclone-prone areas should keep an emergency kit ready with essential items.
- Follow official instructions and move quickly to a designated cyclone shelter when advised.
- Avoid going outside during the cyclone and stay away from damaged electrical wires and flooded areas.
- Weather-monitoring satellites help track cyclones and predict their paths, allowing authorities and communities to prepare and reduce loss of life and property.

Thus, early warnings, proper preparedness, timely evacuation, and cyclone shelters play an important role in reducing the harmful effects of cyclones.