

FM 10 Pressure winds, storm and cyclone

1. A student performs an experiment on atmospheric pressure using identical glasses and cardboard sheets:

- **Scenario A:** Glass filled **completely** with water, covered with cardboard, and inverted. The card stays in place and water does not fall.
- **Scenario B:** Glass filled **halfway** with water, covered with cardboard, and inverted. The card immediately drops and water spills.

Choose the correct option for each sub-question:

(i) What forces are acting on the card in Scenario B? (1 Mark)

- A) Only the downward weight of the water.
- B) Downward weight of water + downward air pressure inside + upward atmospheric pressure.
- C) Downward weight of water + upward atmospheric pressure only.
- D) Downward air pressure inside + upward atmospheric pressure only.

(ii) Why does the card stay attached in Scenario A but fall in Scenario B? (1 Mark)

- A) In Scenario A, upward atmospheric pressure is greater than the downward weight of water; in Scenario B, internal air pressure adds to the weight of water, overcoming external atmospheric pressure.
- B) Water becomes sticky when filled completely to the brim.
- C) The card absorbs more water in Scenario B, making it heavier.
- D) Atmospheric pressure disappears when air is trapped inside the glass.

(iii) What will happen if a small pinhole is made at the sealed bottom of the glass in Scenario A? (1 Mark)

- A) Nothing, the card will remain stuck because the hole is too small.
- B) The water will freeze instantly inside the glass.
- C) Air will enter through the hole, equalizing internal and external pressure, causing the card and water to fall.
- D) Water will rise upward through the hole.

(iv) What is the primary reason for removing air bubbles before inverting the glass? (1 Mark)

- A) Air bubbles make the water heavier.
- B) Trapped air exerts downward pressure from inside, reducing the effectiveness of external atmospheric pressure.
- C) Air bubbles dissolve the cardboard piece.
- D) Trapped air cools down the water rapidly.

(v) If Scenario A is repeated using a glass twice as tall (fully filled), will the card still hold? (1 Mark)

- A) No, because twice the water is too heavy for atmospheric pressure to support.
- B) Yes, because atmospheric pressure is strong enough to support a column of water up to approximately 10\text{ meters} high.
- C) No, because taller glasses reduce atmospheric pressure.
- D) Yes, but only if the glass is made of plastic instead of glass.

2. Rearrange the following jumbled steps (A to E) into the correct chronological sequence to explain how the calm, low-pressure "eye" at the center of a tropical cyclone forms. (1)

Jumbled Steps:

Step A: Warm, moist air over warm ocean water heats up, becomes lighter, and rapidly rises upward, creating a strong low-pressure zone at the surface.

Step B: Strong winds swirl violently around this central region, but the extreme centrifugal force and sinking air keep the very center clear, dry, and calm—forming the eye of the cyclone.

Step C: Surrounding cool air rushes in toward the low-pressure center, but the Coriolis effect (due to Earth's rotation) forces this incoming air to spin in a spiral path.

Step D: As the spiraling air rapidly spins faster and ascends into the upper atmosphere, a small portion of cool air at the top is forced to sink directly back down into the central core.

Step E: The sinking air in the core warms up and dries out, suppressing cloud formation in the middle while giant storm walls (eyewall) form right around it.

3. A force of 200 N is applied over a flat surface of area 4 m^2 . Calculate the pressure exerted on the surface. (2)

4. A tall cylindrical bucket has three identical small holes made on its side at different heights: Hole A near the top, Hole B in the middle, and Hole C near the bottom. When the bucket is completely filled with water, which hole will spurt water out with the greatest pressure and force?

A) Hole A, because air pressure pushes down hardest at the top.

B) Hole B, because it is located at the center of gravity.

C) Hole C, because liquid pressure is highest at the greatest depth.

D) All three holes will spurt water out to the exact same distance.

5. A student places a bucket under a tap to fill it with water. As the water level inside the bucket rises from 5 cm to 25 cm , what happens to the water pressure exerted at the bottom of the bucket?

A) It remains constant because the area of the bucket stays the same.

B) It decreases because the water becomes heavier.

C) It increases because liquid pressure increases with the depth of the water column.

D) It drops to zero once the bucket is half full.