THE STRIVING

MUSLIM ACADEMY

Islamic and Academic Education

YEARS 7 TO 9 · SCIENCE

Pressure and balanced forces

Pressure as force over area, why it grows with depth, what balanced forces actually look like, and moments.

WHAT IS INSIDE

- Pressure, defined in terms of weight
- Balanced forces, and what they look like
- The lever arm, and your own forearm
- Pressure, balance and turning
- How each one is answered

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1 sets · a hint on every question

Written for a parent teaching at home. No training assumed, and nothing else to buy.

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Pressure, defined in terms of weight

Read this, then answer the questions on it.



PRESSURE, DEFINED IN TERMS OF WEIGHT

Pressure is force spread over an area: the same force on a smaller area gives a greater pressure. That is why a drawing pin goes in and a thumb does not.

In a fluid the force doing the pressing is the weight of the fluid above, which is why the OpenStax objective is to define pressure in terms of weight and then explain its variation with depth.

So pressure in a fluid increases with depth, because there is more fluid above to be supported. It is completely independent of the width and length of the container, so two vessels of different shape filled to the same height have the same pressure at the bottom.

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The lever arm, and your own forearm

Read this, then answer the questions on it.



THE LEVER ARM, AND YOUR OWN FOREARM

A force applied at a distance from a pivot has a turning effect, and what counts is the perpendicular lever arm: the distance from the pivot measured at right angles to the force.

OpenStax works this out on a forearm holding a book, treating it as an approximately equivalent mechanical system and calling the schematic a good approximation for the forearm. The muscle pulls close to the elbow, so its lever arm is short, while the book sits far out at the hand with a long one. A short lever arm has to supply a large force to balance a small one acting far away.

The source applies the same reasoning to the muscles of the back, which have a small effective perpendicular lever arm, and to a bicycle seat. Nothing about the force changes; the lever arm does.

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How each one is answered

Mark it together. Where a question asks for a list, the order does not matter.



PRESSURE, BALANCE AND TURNING

1. Explain why a drawing pin goes into a board and your thumb does not, with the same push.

1. Pressure is the force divided by the area it acts on.
2. The pin's point has a tiny area, so the same force gives a very large pressure.
3. Your thumb spreads the same force over a much larger area, so the pressure is small.

Answer: **because the pin has a tiny area, so the same force gives a much larger pressure**

2. In a fluid, what is doing the pressing, and what happens to the pressure as you go deeper?

1. The force comes from the weight of the fluid above.
2. Deeper means more fluid above to be supported, so the pressure increases with depth.

Answer: **the weight of the fluid above, and the pressure increases with depth**

3. A falling object reaches a steady speed. Say what the forces are doing and why the speed stops changing.

1. Weight acts down and the upward force from the air acts up.
2. The upward force grows with speed until it equals the weight, and then the net force is zero.
3. No net force means no acceleration, so the velocity stops changing and the fall continues at that speed.

Answer: **weight and the upward force from the air become equal, so the net force is zero and the velocity stops changing**

4. Hold a book in your hand with your elbow bent. The muscle pulls close to the elbow and the book is far out at your hand. Explain why the muscle must pull hard.

1. The turning effect is the force times the perpendicular lever arm.
2. The muscle's lever arm is short and the book's is long.
3. To balance a small force acting far out, a short lever arm must supply a much larger one.

Answer: **because its lever arm is short, so it needs a large force to balance the book acting far out**

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SAMPLE PAGES

You have read a few pages. The pack is longer.

What you are holding is a short sample, taken from different parts of the pack so that you can see how a week is planned and what a child is actually asked to do, before you decide.

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Our Islamic Education classes are free. These packs are part of what pays the teachers who teach them.