

4. Forces, density and pressure

Starter Quiz · 课前小测

A-Level Physics

Name: _____ Score: _____

1. A force of 20 N acts at a perpendicular distance of 0.50 m from a pivot. What is the moment?

_____ N · m

2. Select **both** conditions a body must meet to be in equilibrium.

- ☐ The resultant force is zero
- ☐ The resultant moment is zero
- ☐ The object is at its centre of gravity
- ☐ The object is not moving at all

Tick every correct option.

3. A block has mass 5.0 kg and volume 0.0020 m³. What is its density?

_____ kg/m³

4. Why is a door handle placed far from the hinges?

- ☐ A larger distance gives a larger moment for the same push
- ☐ It uses a larger force
- ☐ It makes the door heavier
- ☐ It has no effect on the turning

5. A body with zero resultant force must be in equilibrium.

- ☐ True
- ☐ False

6. Pressure is the force per unit _____ (acting at right angles to the surface).

7. Only the part of a force perpendicular to the arm contributes to the turning.

- ☐ True
- ☐ False

8. At balance, the total clockwise moment equals the total _____ moment.

9. The extra pressure at a depth in a liquid depends on:

- ☐ the density of the liquid and the depth
- ☐ the shape of the container
- ☐ the area of the surface at the top

- ☐ the total volume of liquid

10. Select **all** the features of a couple.

- ☐ The two forces are equal in size
- ☐ They point in opposite directions
- ☐ Their lines of action are a distance apart
- ☐ The resultant force is zero
- ☐ They point in the same direction

Tick every correct option.

A-Level Physics

1. **10 N · m**

$$M = F \times d = 20 \times 0.50 = 10 \text{ N} \cdot \text{m}.$$

2. **The resultant force is zero; The resultant moment is zero**

Equilibrium = zero resultant force **and** zero resultant moment. A body can be in equilibrium while moving at constant velocity.

3. **2500 kg/m³**

$$\rho = \frac{m}{V} = \frac{5.0}{0.0020} = 2500 \frac{\text{kg}}{\text{m}^3}.$$

4. **A larger distance gives a larger moment for the same push**

Moment = $F \times d$. A bigger d means a bigger turning effect for the same force, so the door opens more easily.

5. **False**

Not necessarily — a couple gives zero resultant force but still turns the body. You also need zero resultant moment.

6. **area**

$$p = \frac{F}{A}, \text{ measured in Pa} = \frac{\text{N}}{\text{m}^2}.$$

7. **True**

Yes — that is why $M = Fr \sin \theta$: $\sin \theta$ picks out the perpendicular part of the force.

8. **anticlockwise**

That is the principle of moments — the two turning effects cancel about any chosen point.

9. **the density of the liquid and the depth**

$\Delta p = \rho g \Delta h$ — only density and depth matter; the container shape does not.

10. **The two forces are equal in size; They point in opposite directions; Their lines of action are a distance apart; The resultant force is zero**

A couple is equal, opposite forces a distance apart, giving zero resultant force but a pure turning effect. Same-direction forces are not a couple.