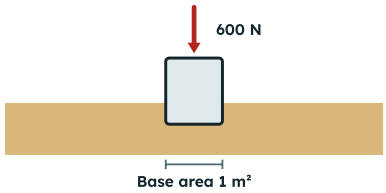
KS3 SCIENCE · PHYSICS

Pressure, moments and stretching

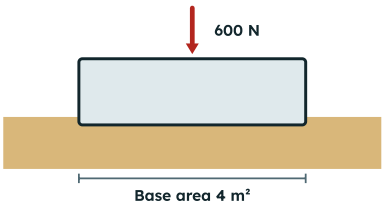
Name _____

1. Pressure on surfaces

Pressure = force ÷ area N/m² = N ÷ m²



600 N ÷ 1 m² = 600 N/m²



600 N ÷ 4 m² = 150 N/m²

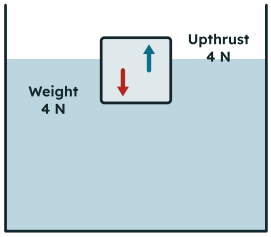
- **Pressure** is the force on each unit of area. The same force on a smaller area gives a bigger pressure.
- **Small area, big pressure:** the point of a drawing pin, the edge of a sharp knife. **Big area, small pressure:** snowshoes, wide tractor tyres.
- When a small area is measured in cm², the pressure is in N/cm².



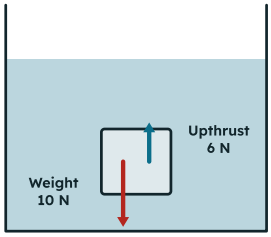
2. Pressure in liquids

- Pressure in a liquid **increases with depth**. Deeper down there is more liquid above, and its weight presses down.
- It acts in **all directions**: on a diver from above, from below and from every side.
- The particles of a liquid are always moving. They push on every surface they touch.
- A dam wall is thickest at the bottom, where the pressure of the water is biggest.

3. Floating and sinking



Floats: the upthrust equals the weight



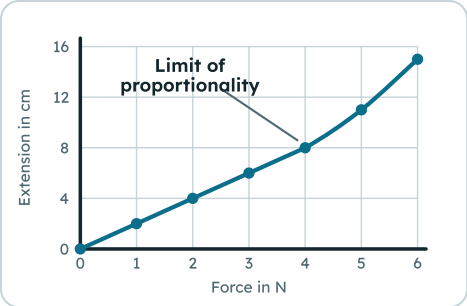
Sinks: the weight is bigger than the upthrust

- **Upthrust** is the upward push of water on an object. The bottom of the object is deeper than its top, so the water pushes up on the bottom harder than it pushes down on the top.
- An object **floats** when the upthrust balances its weight. It **sinks** when its weight is bigger than the biggest upthrust the water can give.
- A material that is **denser** than water (steel) sinks. One that is less dense (cork) floats. A steel ship floats because it is hollow.



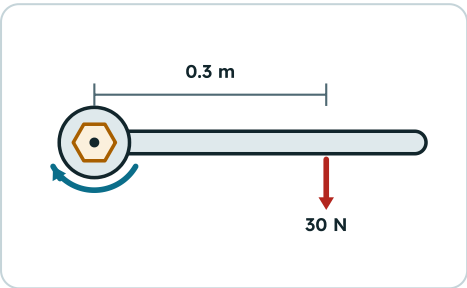
4. Atmospheric pressure

- **Atmospheric pressure** is caused by the weight of the air above. At sea level it is about 100 000 N/m².
- It pushes from all directions. The pressure inside your body pushes out just as hard.
- It is **lower higher up**: there is less air above, so less weight presses down. The air is thinner too.



5. Stretching springs

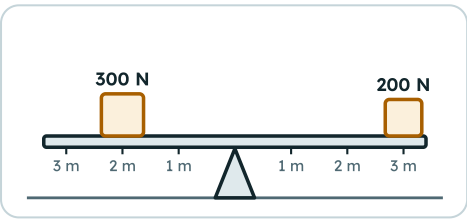
- **Extension** = stretched length − original length.
- **Hooke's law:** the extension is directly proportional to the force. Double the force gives double the extension.
- The graph of extension against force is a **straight line through the origin**.
- Past the **limit of proportionality** the line curves: extension is no longer proportional to force. A spring pulled much too far does not go back to its original length.



6. Turning forces

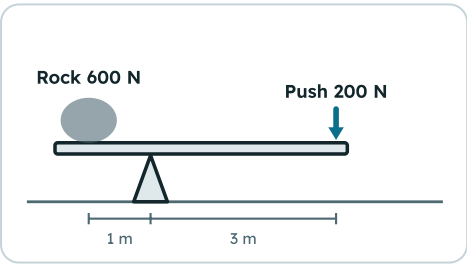
Moment = force × distance from the pivot N m = N × m

- A **moment** is the turning effect of a force. It acts clockwise or anticlockwise.
- Here: 30 N × 0.3 m = 9 N m. Pushing further from the pivot gives a bigger moment.
- A **lever** is a rigid bar that turns about a pivot: a spanner, a door handle, a see-saw.



7. Balancing

- A weight on the left of the pivot gives an **anticlockwise** moment. A weight on the right gives a **clockwise** moment.
- **It balances when the two moments are equal.** Here: 300 N × 2 m = 600 N m, and 200 N × 3 m = 600 N m.
- If they are not equal, it tips down on the side with the bigger moment.



8. Work and simple machines

Work done = force × distance moved J = N × m

- **Work** is done when a force moves something. Pushing a box 5 m with 20 N does 20 × 5 = 100 J of work.
- A **machine**, such as a lever or a ramp, lets you use a smaller force. The price is that your force moves further.
- Here a 200 N push moving 0.3 m lifts a 600 N rock by 0.1 m. Both are 60 J of work. Wheels help by cutting down friction.

Key words

Pressure: the force on each unit of area
Newton per square metre: the unit of pressure (N/m²)
Upthrust: the upward push of a liquid or a gas on an object in it
Density: how much mass is packed into each cubic centimetre
Hooke's law: the extension of a spring is proportional to the force on it
Directly proportional: doubling one quantity doubles the other: the graph is a straight line through the origin
Pivot: the point that a lever turns about
Lever: a rigid bar that turns about a pivot
Joule: the unit of work and of energy
Area: the size of a surface, in m² or cm²
Fluid: a liquid or a gas
Atmospheric pressure: the push of the air, caused by the weight of the air above
Extension: how much longer a spring gets when it is stretched
Limit of proportionality: the point past which a spring no longer follows Hooke's law
Moment: the turning effect of a force
Newton metre: the unit of a moment (N m)
Work done: the energy transferred when a force moves an object
Machine: something that makes work easier, such as a lever or a ramp

Pictures are illustrations made for this sheet, not real photographs.