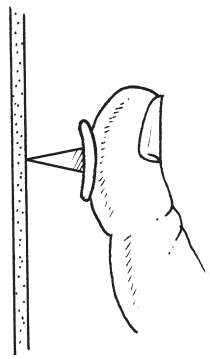
9L Summary Sheets

Pressure and moments

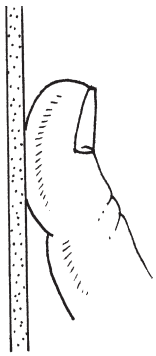
Pressure on solids

A



The thumb is putting a force onto the head of the pin. The force is transferred to the point of the pin. This is a very small area, so there is a very large **pressure** on the board, and the pin goes in.

B



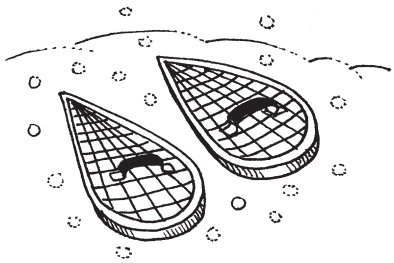
The thumb is putting a force on the board. The area of the thumb is much larger than the area of the pin point, so there is only a small pressure on the board. The thumb does not go into the board.

Examples of a small area giving a large pressure:

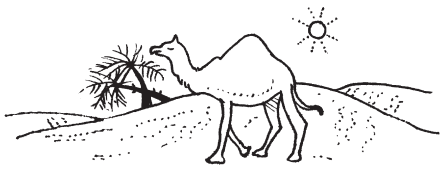
Sharp knife.

Ice skates.

Examples of a large area giving a small pressure:



Snow shoes.



Camel on sand.

We can work out the pressure on something by using this formula:

pressure = force ÷ area

Pressure can be measured in:

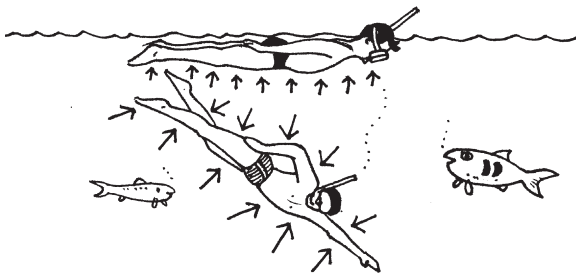
- newtons per square metre (N/m^2)
- newtons per square centimetre (N/cm^2)
- pascals (Pa).

$1\,Pa = 1\,N/m^2$

Pressure in liquids and gases

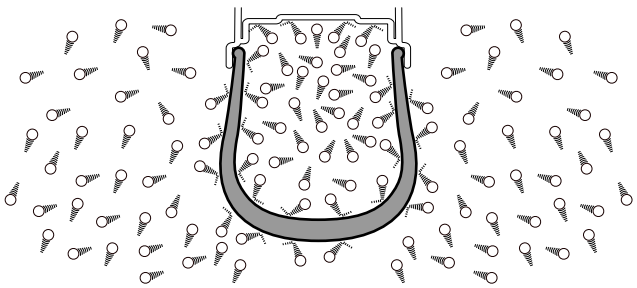
Both gases and liquids are **fluids**. Fluids can flow. Pressure in fluids acts in all directions. The particles in fluids are moving all the time and hitting the walls of containers or other things they come into contact with. The force of the collisions causes pressure which acts in all directions.

The swimmer is floating because pressure in the water provides a force called **upthrust**, which balances the force of **gravity**. As you go deeper into the sea, pressure increases because there is more water above you pressing down. Dams are made with thicker walls at the bottom to withstand the pressure.



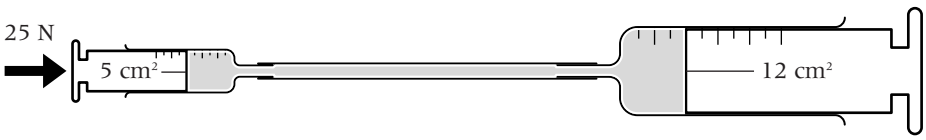
Uses of pressure in liquids and gases

Gases can be **compressed**. The pressure in a compressed gas is higher because there are more molecules moving around and hitting the walls of the container. **Pneumatic** tyres contain compressed air and this keeps the tyre inflated and helps to soften a bumpy ride.



Liquids cannot be compressed. Liquids are used in **hydraulic systems** which can be used to increase the size of a force. Hydraulics are used in car braking systems.

Example



Pressure = force ÷ area

The pressure on the water is $\frac{25\,\text{N}}{5\,\text{cm}^2}$.

This is $5\,\text{N/cm}^2$.

The area at the end of the other syringe is $12\,\text{cm}^2$.

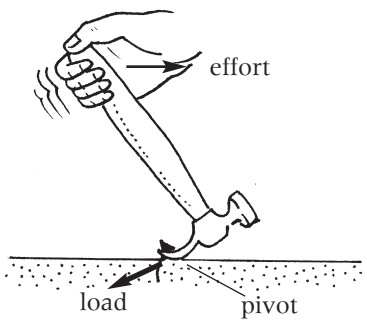
Force = pressure × area

The output force is $5\,\text{N/cm}^2 \times 12\,\text{cm}^2 = 60\,\text{N}$.

Levers

Forces can be used to turn objects around **pivots**. A pivot is also known as a **fulcrum**.

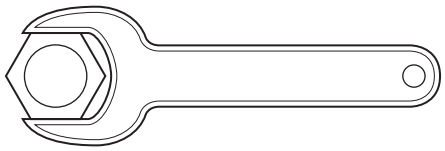
Levers work by magnifying the force that is put in or the distance it moves.



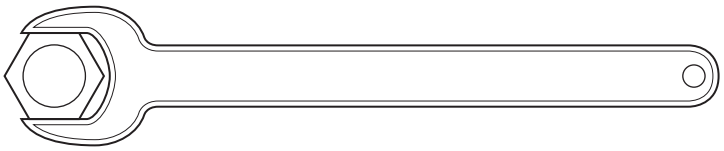
*The hammer is acting as a **force multiplier**.*

Moments

A **turning force** is called a **moment**. Moments are measured in newton centimetres (N cm) or newton metres (N m).



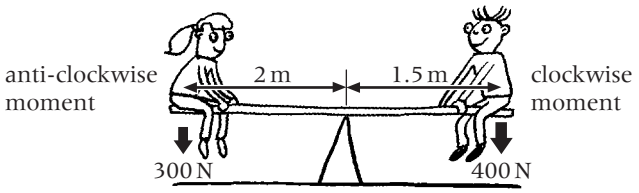
Small moment.



Big moment.

The longer the distance the greater the moment. It is easier to turn the long spanner than the short one.

When an object is balanced, the anticlockwise moment = the clockwise moment.



In the example above:

the anticlockwise moment = 300 N × 2 m
= 600 N m

the clockwise moment = 400 N × 1.5 m
= 600 N m

The clockwise and anticlockwise moments are the same, so the seesaw is **balanced** or **in equilibrium**.

Cranes use the principle of moments. The moment from the load is balanced by the moment from the concrete blocks to stop the crane toppling over.