

Pressure

Pressure tells us whether a **force** is **focused** or **spread out** over an **area**.

When you push a **drawing pin** with your thumb, the **small area** of the point has a very **high pressure**. This enables it to go into the wall. The flat bit you push has a **larger area**. The **force** is more **spread out**. There is **less pressure** which is why it doesn't go into your thumb.

1 Do you want a high or low pressure? How did you decide?

(a) Cat's claws when it climbs a tree

(b) Standing on soft snow when you don't want to sink in

(c) A tractor's wheels in a muddy field

(d) Scissor blades cutting paper

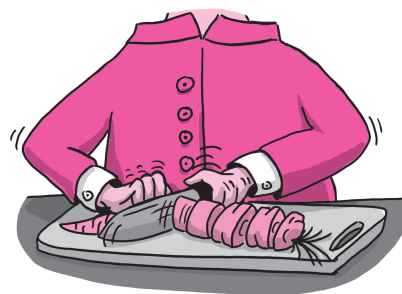


2 Fill in the gaps to complete the explanation:

A bar of chocolate has six chunks joined with thinner pieces of chocolate. When you try to bend the bar, the _____ is greatest where the bar is _____. This helps you break off one chunk of chocolate at a time.

3 A chef is chopping carrots with a sharp knife. Complete the table to compare the force, pressure and area of the knife handle with its blade. Choose from the words **larger**, **smaller** and **equal**.

	On handle compared to blade edge,
Area	area is
Pressure	pressure is
Force	force is



A pressure of 30 N/cm^2 means that there is a force of **30 N** on each **square centimetre**.

4 A chair leg makes a pressure of 10 N/cm^2 on the floor.

(a) Complete the sentence: The force on 1 cm^2 of the floor is newtons.

(b) Work out the force on 6 cm^2 of floor using an equation.

$$\begin{array}{ccccc}
 \text{force (N)} & = & \text{pressure (N/cm}^2\text{)} & \times & \text{area (cm}^2\text{)} \\
 \text{[]} & = & \text{[10]} & \times & \text{[6]}
 \end{array}$$

(c) Work out the force on the floor due to one 16 cm^2 chair leg using an equation.

$$\begin{array}{ccccc} \text{force (N)} & = & \text{pressure (N/cm}^2\text{)} & \times & \text{area (cm}^2\text{)} \\ \boxed{} & = & \boxed{10} & \times & \boxed{16} \end{array}$$

(d) Work out the force for the total 64 cm^2 area of the chair legs.

5 Calculate the force on these areas if the pressure is 20 N/cm^2 .

(a) 2 cm^2

(c) 30 cm^2

(b) 4 cm^2

(d) 0.04 cm^2

6 A 200 N force is spread over a 40 cm^2 area.

(a) Force on $1 \text{ cm}^2 = \boxed{} \div \boxed{} = \boxed{}$ newtons

(b) Complete the sentence: The pressure (in N/cm^2) is $\boxed{}$.

(c) A 100 N force is applied over 25 cm^2 . Work out the pressure using an equation.

$$\begin{array}{ccccc} \text{force (N)} & = & \text{pressure (N/cm}^2\text{)} & \times & \text{area (cm}^2\text{)} \\ \boxed{100} & = & \boxed{} & \times & \boxed{25} \end{array}$$

(d) Work out the pressure if 80 N is applied over an area of 20 cm^2 .

(e) Work out the pressure when a 30 N TV sits on a base with an area of 600 cm^2 .

7 Calculate the pressure for these forces and areas.

(a) 60 N over 3 cm^2 ,

(b) 20 N over 0.2 cm^2 ,

8 A pump compresses air in a football to a pressure of 10 N/cm^2 .

(a) What is the force on 1 cm^2 ?

(b) The total force on the football is $15\,000 \text{ N}$. How many 10 N forces is this?

(c) What is the area of the football? Count the 10 N forces (each on 1 cm^2).

(d) Work out the area for a 90 N total force using an equation.

$$\begin{array}{ccccc} \text{force (N)} & = & \text{pressure (N/cm}^2\text{)} & \times & \text{area (cm}^2\text{)} \\ \boxed{90} & = & \boxed{10} & \times & \boxed{} \end{array}$$

(e) Work out the area for a force of 600 N.

9 A force is 300 N. Calculate the area to make these pressures.

(a) 150 N/cm²

(c) 15 N/cm²

(b) 30 N/cm²

(d) 600 N/cm²

10 Complete the word equations using **force**, **pressure** and **area**.

(a) force =

(b) pressure =

(c) area =

11 Rewrite your word equations using symbols.

F is the force, P is the pressure and A is the area.

(a) $F =$

(b) $P =$

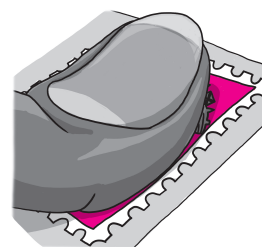
(c) $A =$

12 Use your understanding of pressure, or the formulae, to calculate

(a) the pressure when a 48 N force squeezes a 1.2 cm² stamp,

(b) the force when a 20 N/cm² pressure fluid pushes a 5 cm² piston,

(c) the area if a 900 N force makes a 90 N/cm² pressure.



Areas can also be measured in square metres. $1 \text{ m}^2 = 100 \text{ cm} \times 100 \text{ cm} = 10\,000 \text{ cm}^2$.

A pressure of 50 000 N/m² can also be written as 50 000 Pa (pascals) or 50 kPa (kilopascals).

13 A van with weight 25 000 N is supported by tyres with total area 0.25 m². Calculate the

(a) pressure in kPa,

(b) area in cm²,

(c) pressure in N/cm².