Pressure

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

When you push a **drawing pin** into a wall with your thumb, the small area of the point has a very high pressure. The point goes 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.

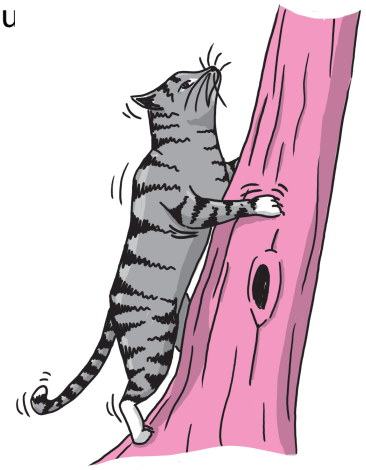
1 Do these situations need high or low pressure? How did you

(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

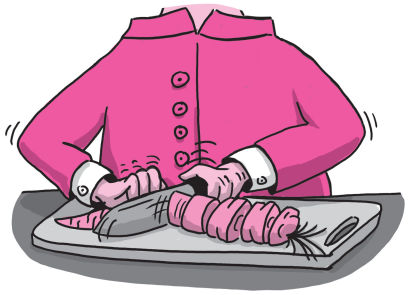
(d) Scissor blades cutting paper



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 puts 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.

force (N)	=	pressure (N/cm^2)	×	area (cm^2)
☐	=	10	×	6

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

force (N)	=	pressure (N/cm^2)	×	area (cm^2)
	=	10	×	16

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

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

(a) 2 cm^2

(b) 4 cm^2

(c) 30 cm^2

(d) 0.04 cm^2

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

(a) Force on 1 cm^2 = ____ ÷ ____ = ____ newtons

(b) Complete the sentence: The pressure (in N/cm^2) is ____.

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

force (N)	=	pressure (N/cm^2)	×	area (cm^2)
100	=		×	25

(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.

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7 Calculate the pressure for these forces and areas.

(a) 60 N over 3 cm^2,

(b) 20 N over 0.2 cm^2,

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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 outwards force on the whole football is $15\,000$ N. How many 10 N forces is this?

(c) What is the area of the football? (Each 10 N force acts on 1 cm^2.)

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

force (N)	$=$	pressure (N/cm^2)	$\times$	area (cm^2)
90	$=$	10	$\times$	

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

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

(a) 150 N/cm^2 (c) 15 N/cm^2

(b) 30 N/cm^2 (d) 600 N/cm^2

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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) $A =$

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

(a) the pressure when a 48 N force squeezes a 1.2 cm^2 stamp,

(b) the force when a 20 N/cm^2 pressure fluid pushes a 5 cm^2 piston,

(c) the area if a 900 N force makes a 90 N/cm^2 pressure.

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

A pressure of $50\,000$ N/m^2 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 m^2. Calculate the

(a) pressure in kPa, (b) area in cm^2, (c) pressure in N/cm^2.