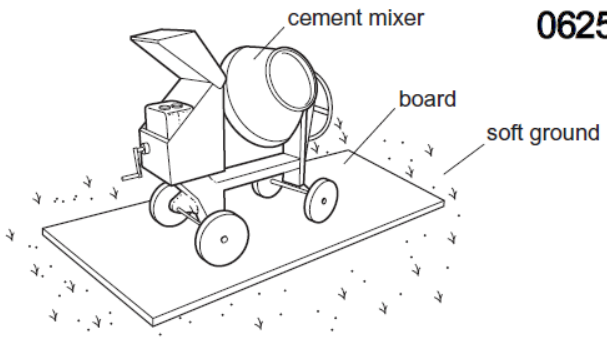
Pressure

Definition: Pressure is defined as force per unit area

Formula: $P=\frac{F}{A}$

Units: N/m^2 or Pascal.

12 To prevent a cement mixer sinking into soft ground, the mixer is placed on a large flat board.



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Why does this prevent the mixer sinking?

A The large area decreases the pressure on the ground.

B The large area increases the pressure on the ground.

C The large area decreases the weight on the ground.

D The large area increases the weight on the ground.

Here, the large area decreases the pressure on the ground. This is because the mass of the mixer does not change and hence nor does its weight. Ans: A

Pressure exerted by solids can be found using the formula :$P=\frac{F}{A}$

Numerical:

(c) The area of the piston is $5.5 \times 10^{-3} m^2$ ($0.0055 m^2$). M/J/15-P32-Q2

Calculate the force exerted by the gas on the piston when the pressure is 800 kPa.

SOLUTION:

Pressure=$\frac{F}{A}$

It is important to convert 800kPa to 800 000Pa .Then substitute in the formula $\Rightarrow$ F=$P\ x\ A = 800000\ x\ 0.0055$ ==4400N

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6 **(a)** A man squeezes a pin between his thumb and finger, as shown in Fig. 6.1.

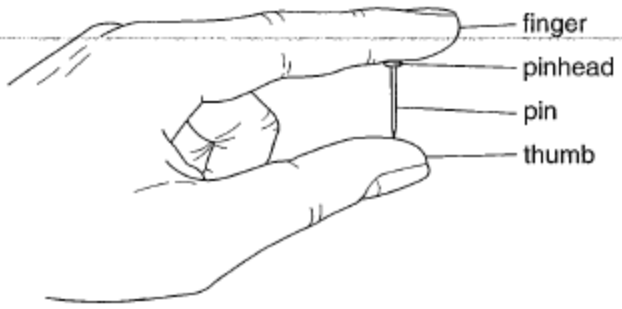


Fig. 6.1

The finger exerts a force of 84 N on the pinhead.

The pinhead has an area of $6.0 \times 10^{-5}\,m^2$.

(i) Calculate the pressure exerted by the finger on the pinhead.

$P = F/A$

$= 84/6 \times 10^{-5}$

$= 1.4 \times 10^{6}$

(ii) State the value of the force exerted by the pin on the thumb.

84n

(b) The density of the water in a swimming pool is $1000\,kg/m^3$. The pool is 3 m deep.

(i) Calculate the pressure of the water at the bottom of the pool.

$P = hpg$

$= 3 \times 1000 \times 10$

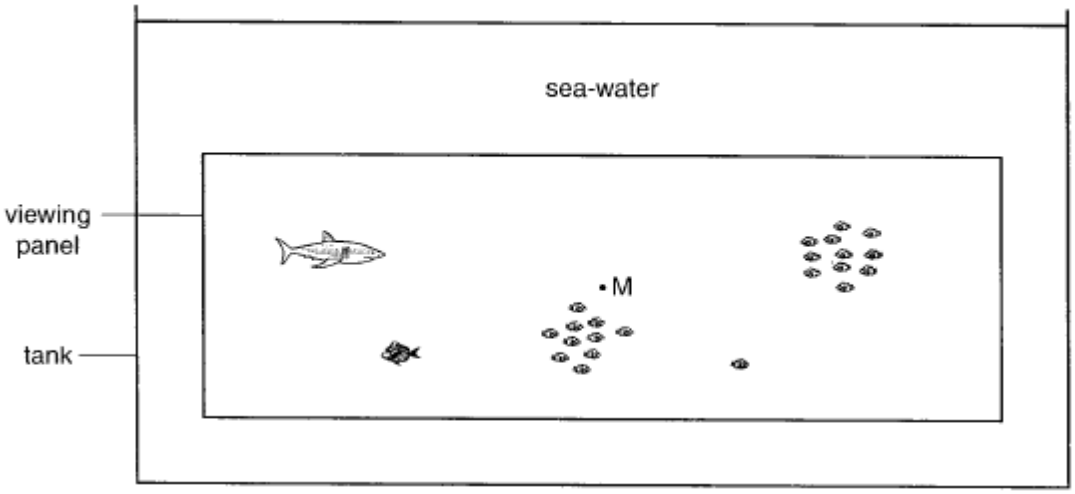
3×10^{4}

(ii) Another pool has the same depth of water but has twice the area.

State the pressure of the water at the bottom of this pool.

3×10^{4}

1 Fig. 1.1 shows a side view of a large tank in a marine visitor attraction.



The tank is 51 m long and 20 m wide. The sea-water in the tank is 11 m deep and has a density of 1030 kg/m^3.

(a) Calculate the mass of water in the tank.

$d = m/v$

$m = d \times v$

$= 1030 \times 51 \times 20 \times 11$

$= 11\,556\,600$

$= 1.2 \times 107\ kg$

(b) The pressure at point M, halfway down the large viewing panel, is 60 kPa more than atmospheric pressure.

Calculate the depth of M below the surface of the water.

$p = \rho g(\Delta)h$

$\Delta h = 60\,000 / (1030 \times 10)$

$= 5.8m$

(c) The viewing panel is 32.8 m wide and 8.3 m high.

Calculate the outward force of the water on the panel. Assume that the pressure at M is the average pressure on the whole panel.

use of $F = pA$

$= 60\,000 \times 32.8 \times 8.3$

$= 60\,000 \times 272.2$

$= 1.6 \times 10^7\ N$

Application based questions:

10 A man stands on the ground. **0625/13/M/J/13**

Which action will increase the pressure that the man exerts on the ground?

A The man slowly bends his knees.

B The man slowly lies down on the ground.

C The man slowly raises his arms.

D The man slowly raises one foot off the ground.

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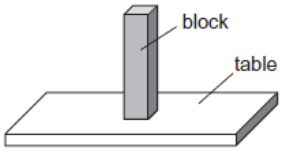
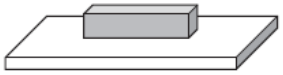
11 A block with flat, rectangular sides rests on a table. **0625/11/M/J/15**



The block is now turned so that it rests with its largest side on the table.



How has this change affected the force and the pressure exerted by the block on the table?

	force	pressure
A	decreased	decreased
B	decreased	unchanged
C	unchanged	decreased
D	unchanged	unchanged

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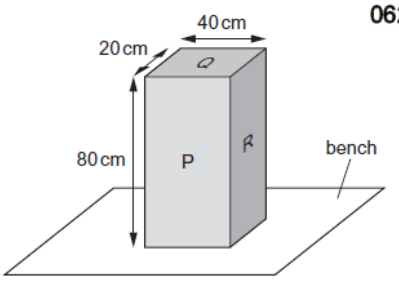
11 The diagram shows a solid block resting on a bench. The dimensions of the block are shown. **0625/13/M/J/15**



On which labelled surface should the block rest to produce the smallest pressure on the bench?

A P

B Q

C R

D any of P, Q or R

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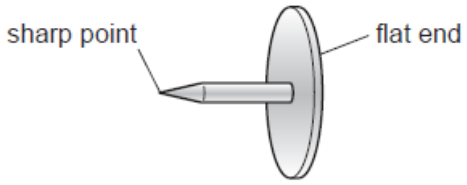
11 A drawing pin (thumb tack) has a sharp point and a flat end. **0625/12/O/N/13**



The pin is pushed into a wooden board.

How do the pressure and the force at the sharp point compare with the pressure and the force at the flat end?

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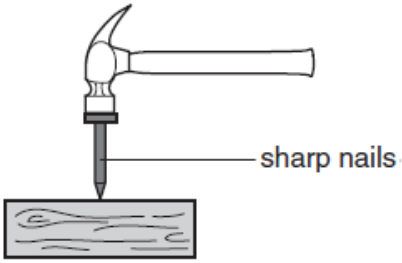
	force at the sharp point	pressure at the sharp point
A	greater than at the flat end	greater than at the flat end
B	greater than at the flat end	less than at the flat end
C	the same as at the flat end	greater than at the flat end
D	the same as at the flat end	less than at the flat end

Real life applications of solid pressure:

- **Hammering objects using a nail with the sharp tip.**



- **Placing cement mixers on flat boards in case they tend to sink**