1. Motion, forces and energy

1.8 Pressure

Paper 1 and 2

Question Paper

Paper 1

Questions are applicable for both core and extended candidates

1 In which position does a person exert least pressure on the ground?

A kneeling on the ground

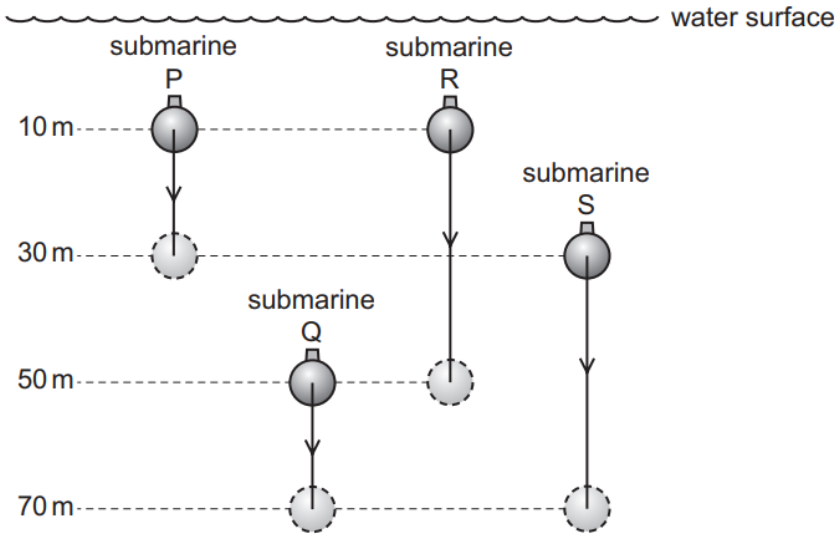
B lying flat on the ground

C sitting on the ground

D standing on the ground

2 Four identical submarines, P, Q, R and S, are lowered from one depth to another in water of a constant density.

The initial and final depths of each submarine are shown.

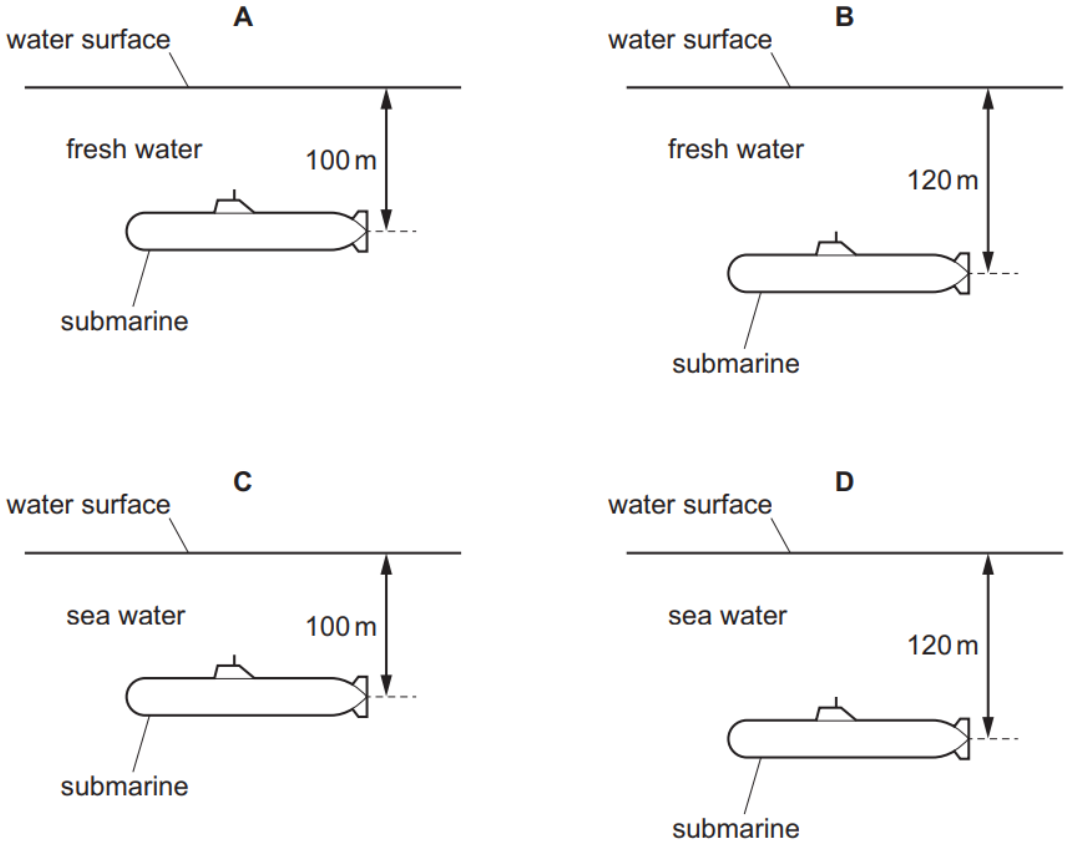


Which row is correct for the difference in pressure from the initial to the final depth of each submarine?

	least change in pressure	greatest change in pressure
A	submarines P and Q	submarines R and S
B	submarines P and Q	submarine R only
C	submarine P only	submarines R and S
D	submarine P only	submarine R only

3 Four submarines are submerged. The density of fresh water is 1000 kg / m^3 and the density of sea water is 1020 kg / m^3.

Which submarine experiences the greatest pressure due to the water?



4 When a diver swims down from the surface of the water to a depth of 10 m, the pressure experienced increases from 100 000 N / m^2 to 200 000 N / m^2.

Which statement explains this increase in pressure?

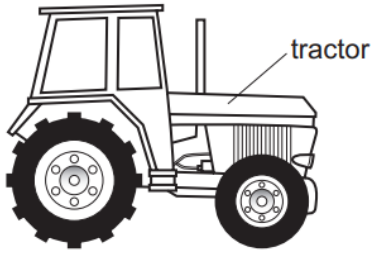
A The density of the water increases with depth.

B The gravitational field strength increases with depth.

C The weight of water above the diver increases with depth.

D Water cannot be compressed.

5 Tractors have large tyres. These help to prevent the wheels from sinking into soft ground.



Which statement explains this?

A Larger tyres exert a greater force on the ground.

B Larger tyres exert a greater pressure on the ground.

C Larger tyres exert a smaller force on the ground.

D Larger tyres exert a smaller pressure on the ground.

6 A woman has a weight of 600 N. She stands on a horizontal floor. The area of her feet in contact with the floor is $0.050\,m^2$.

What is the pressure she exerts on the floor?

A $1.2 \times 10^3\,N/m^2$

B $2.4 \times 10^3\,N/m^2$

C $1.2 \times 10^4\,N/m^2$

D $2.4 \times 10^4\,N/m^2$

7 A rectangular marble block has dimensions 1 m by 1 m by 5 m and weighs 125 000 N.

The marble block is stored with the long side resting on the ground, as in diagram 1.

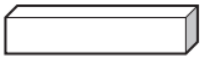


diagram 1

diagram 2

What is the change in the pressure on the ground due to the block when the block is stored as in diagram 2 rather than diagram 1?

A a decrease of 25 000 N/m^2

B an increase of 100 000 N/m^2

C an increase of 125 000 N/m^2

D no change

8 A pressure gauge is lowered into the sea. Measurements of the pressure and depth are taken as the pressure gauge is lowered.

Which statement describes how and why the pressure changes as the gauge is lowered?

A The density of the sea water decreases so the pressure increases.

B The depth of the gauge below the surface of the sea increases so the pressure increases.

C The height of the gauge above the sea bed decreases so the pressure decreases.

D The temperature of the sea water decreases so the pressure decreases.

9 Liquid of mass 92 kg is contained in a rectangular tank.

The area of the base of the tank is 0.23 m^2.

What is the pressure exerted by the liquid on the base of the tank?

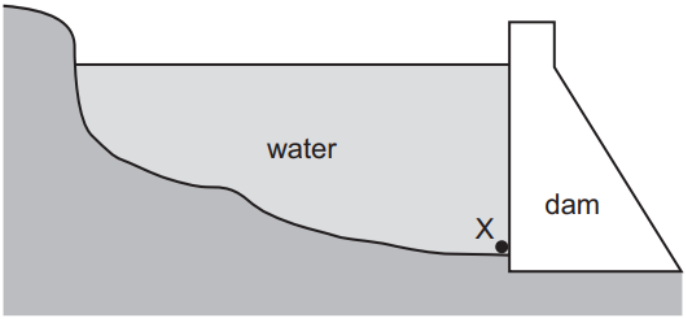
A 2.5×10^{-4} N/m^2

B 2.5×10^{-3} N/m^2

C 400 N/m^2

D 4000 N/m^2

10 The diagram shows a deep reservoir formed by a dam.



On what does the pressure at X depend?

A the depth of the water at X

B the length of the reservoir

C the surface area of the water

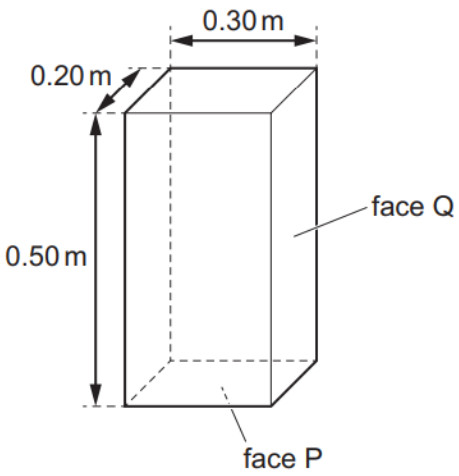
D the thickness of the dam wall

11 The table shows the weights and base areas of four metal blocks.

Which block exerts the greatest pressure on its base?

	weight / N	area of base / m^2
A	3 000	0.20
B	10 000	0.50
C	16 000	2.0
D	20 000	1.5

12 The box shown has a weight of 15 N.



The box is resting on a horizontal surface with face P in contact with the surface.

What is the change in pressure on the surface if the box falls over onto face Q?

A $0.0040\,m^2/N$ **B** $0.0067\,m^2/N$ **C** $100\,N/m^2$ **D** $250\,N/m^2$

13 A book has a mass of 400 g.

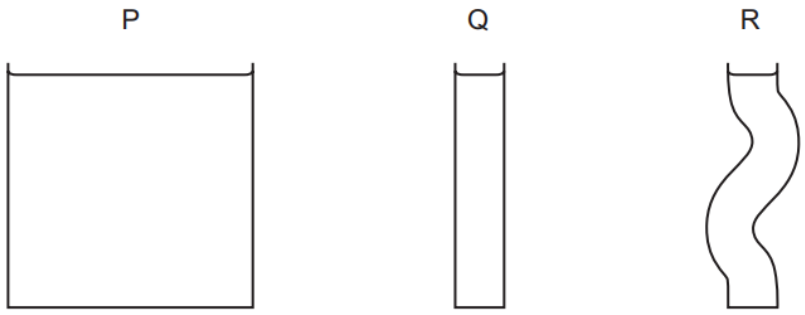
The surface of the book in contact with a table has dimensions $0.10\,m \times 0.20\,m$.

The gravitational field strength g is $10\,N/kg$.

What is the pressure exerted on the table due to the book?

A $0.08\,N/m^2$ **B** $8.0\,N/m^2$ **C** $20\,N/m^2$ **D** $200\,N/m^2$

14 The diagrams show three containers, P, Q and R.



Each container contains the same liquid.

The depth of the liquid is the same in each container.

Which statement about the pressure of the liquid at the bottom of the container is correct?

A The pressure of the liquid at the base of P is greatest.

B The pressure of the liquid at the base of Q is greatest.

C The pressure of the liquid at the base of R is greatest.

D The pressures of the liquid at the bases of P, Q and R are the same.

15 A man who weighs 540 N stands with both feet on the ground. The area of contact between one foot and the ground is $0.015\,m^2$.

What is the pressure exerted on the floor by the man?

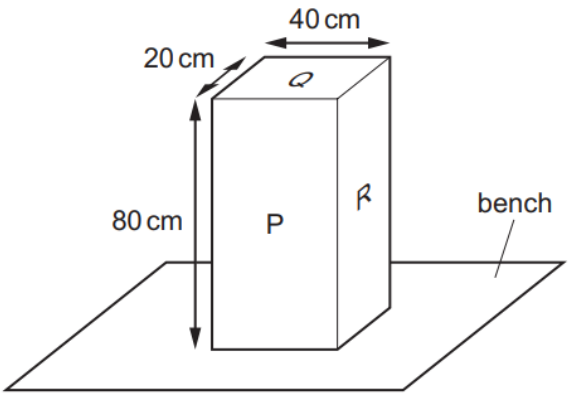
A $1800\,N/m^2$

B $3600\,N/m^2$

C $18\,000\,N/m^2$

D $36\,000\,N/m^2$

16 The diagram shows a solid block resting on a bench. The dimensions of the block are shown.



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

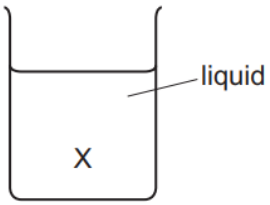
A P

B Q

C R

D P, Q and R produce the same pressure

17 A beaker contains a liquid.



On what does the liquid pressure at position X depend?

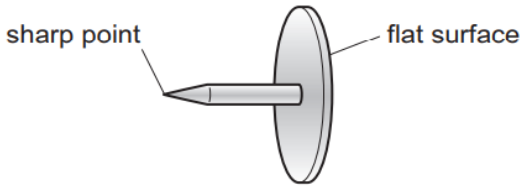
A both the density of the liquid and the depth of X below the surface

B both the surface area of the liquid and the depth of X below the surface

C both the surface area of the liquid and the volume of the liquid

D the depth of X below the surface only

18 A drawing pin (thumb tack) has a sharp point at one end and a flat surface at the other end.



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 on the flat surface?

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

19 The table shows four forces. Each force acts on a different surface.

Which row shows the **least** pressure?

	size of the force / N	area of the surface / m^2
A	0.30	0.040
B	10	2.0
C	60	15
D	1200	40

20 A metal block of weight *W* rests on a table. In order to calculate the pressure that the block exerts on the table, one other quantity must be known.

What is the other quantity?

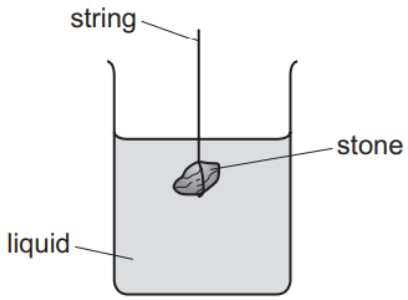
A the area of contact between the block and the table

B the density of the block

C the mass of the block

D the volume of the block

21 The diagram shows a stone suspended on a string under the surface of a liquid. The stone experiences a pressure caused by the liquid.



What would increase the pressure on the stone?

A decreasing the surface area of the stone

B increasing the mass of the stone

C lowering the stone deeper into the liquid

D using a liquid with a lower density

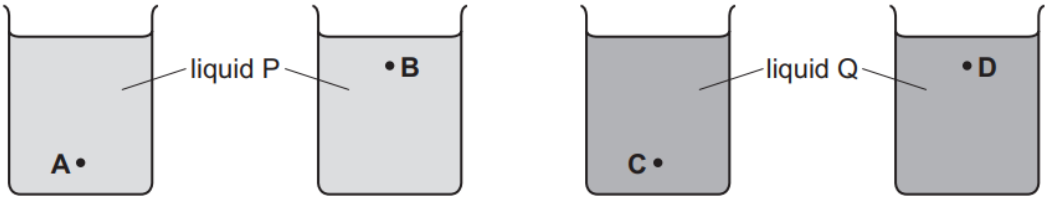
22 A metal has a density of $8.0\,g/cm^3$. A solid cube of mass 1.0 kg is made from this metal.

How long is each side of the cube?

A 0.50 cm **B** 2.0 cm **C** 5.0 cm **D** 42 cm

23 Four identical beakers are filled with equal volumes of liquids P or Q, as shown. Liquid P is more dense than liquid Q.

At which point is the pressure the least?



Paper 2

Questions are applicable for both core and extended candidates unless indicated in the question

24 An elephant of weight 45 000 N stands with all four feet on the floor.

The average pressure on the floor due to the elephant foot in contact with it is 34 000 Pa.

What is the area of each foot of the elephant?

A 0.19 m^2 **B** 0.33 m^2 **C** 0.76 m^2 **D** 1.3 m^2

25 Some altimeters use the change in air pressure to measure height. **(extended only)**

If the pressure is 100 kPa at sea level on a particular day, what will the pressure be at the top of an 830 m hill?

(Take the density of air to be constant at 1.3 kg / m^3.)

A 1.1 kPa **B** 11 kPa **C** 89 kPa **D** 110 kPa

26 The equation $\Delta p = \rho g \Delta h$ can be used for a liquid. **(extended only)**

What is the meaning of the term ρ?

A pressure due to the liquid

B density of the liquid

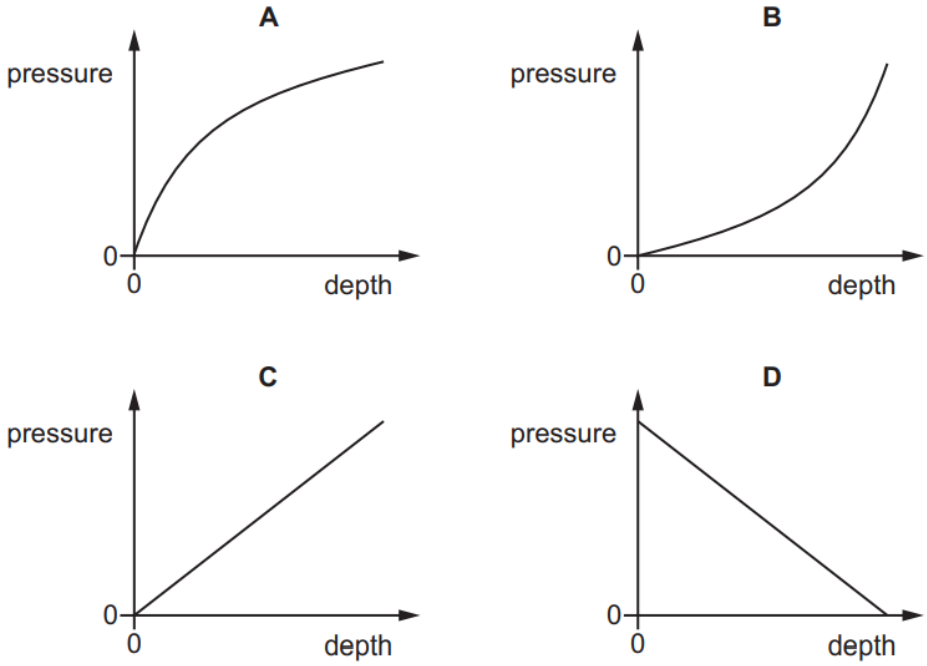
C total pressure due to the liquid and the air above the liquid

D density of an object placed in the liquid

27 The water in a swimming pool exerts a pressure at the bottom of the pool.

Which graph shows the relationship between the pressure exerted by the water and the depth of water in the pool?

(Assume the density of water is constant.)

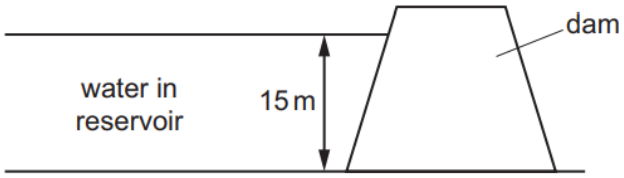


28 An object is a depth h below the surface of a liquid. The pressure due to the liquid at this depth is p. The gravitational field strength is g.

What is the density ρ of the liquid? **(extended only)**

A $\rho = pgh$ **B** $\rho = \frac{pg}{h}$ **C** $\rho = \frac{ph}{g}$ **D** $\rho = \frac{p}{hg}$

29 A dam holds water in a reservoir. The height of the water in the reservoir is 15 m. **(extended only)**



The density of water is 1000 kg / m^3.

What is the pressure due to the water at the bottom of the dam?

A 6.8 Pa **B** 1500 Pa **C** 15 000 Pa **D** 150 000 Pa

30 The density of sea water is 1030 kg / m^3. **(extended only)**

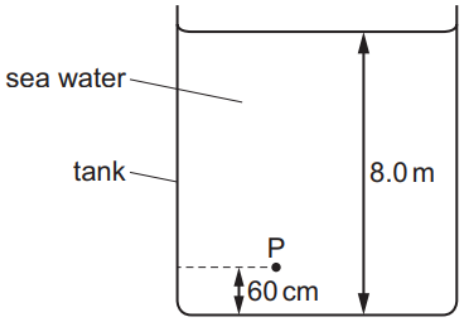
The gravitational field strength on the Earth is 9.8 N / kg.

Atmospheric pressure is 101 000 Pa.

At which depth in sea water is the total pressure due to the atmosphere and the water equal to 513 000 Pa?

A 40.8 m **B** 50.8 m **C** 400 m **D** 498 m

31 The diagram shows a tank containing sea water. **(extended only)**



NOT TO SCALE

The density of the sea water is 1020 kg / m^3.

What is the pressure at point P relative to atmospheric pressure?

A 7400 Pa above atmospheric pressure

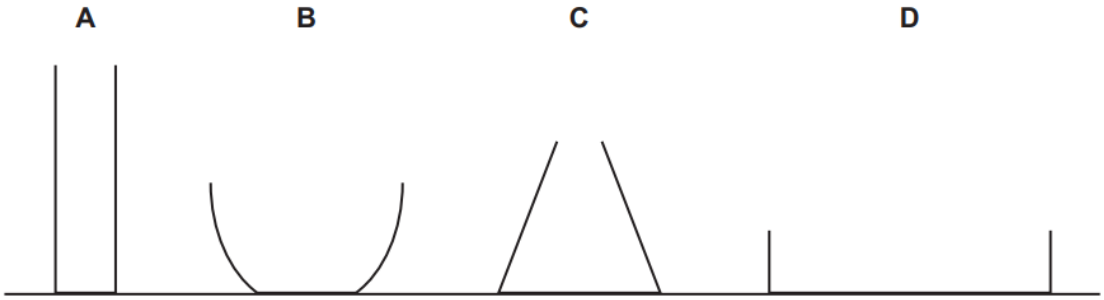
B 7500 Pa above atmospheric pressure

C 75 000 Pa above atmospheric pressure

D 82 000 Pa above atmospheric pressure

32 Four containers are filled to the top with the same liquid. The base of each container is circular.

Which container has the greatest pressure exerted by the liquid at its base?



33 Which equation can be used to calculate the pressure at a depth h beneath the surface of a liquid? **(extended only)**

A $p = \frac{h}{\rho g}$ **B** $p = \frac{h\rho}{g}$ **C** $p = h\rho g$ **D** $p = \frac{1}{h\rho g}$

34 A research submarine is at a depth of 10 000 m below the surface of the sea. **(extended only)**

The average density of the water above the submarine is 1030 kg / m^3.

The atmospheric pressure at the surface of the sea is 103 000 Pa.

How many times greater is the pressure due to the sea water than the atmospheric pressure?

A 10 **B** 100 **C** 1000 **D** 100 000

35 The pressure due to the liquid on an object immersed in that liquid is 4500 Pa.

The density of the liquid is 900 kg / m^3.

What is the depth of the object below the surface of the liquid? **(extended only)**

A 0.5 cm **B** 2.0 cm **C** 50 cm **D** 200 cm

36 An object is 60 cm below the surface of a liquid. The pressure due to the liquid at this depth is 9000 Pa.

What is the density of the liquid? **(extended only)**

A 15 kg / m^3 **B** 540 kg / m^3 **C** 1500 kg / m^3 **D** 54 000 kg / m^3

37 An object is 20 cm below the surface of a liquid. The density of the liquid is 1200 kg / m^3.

What is the pressure on the object due to the liquid? **(extended only)**

A 600 Pa **B** 2400 Pa **C** 60 000 Pa **D** 240 000 Pa

38 The density of mercury is 13 600 kg / m^3. **(extended only)**

What is the pressure at the bottom of a column of mercury that has a height of 75.0 cm?

A 1.02×10^4 Pa

B 1.02×10^5 Pa

C 1.02×10^6 Pa

D 1.02×10^7 Pa