Pressure

Question Paper

Level	O Level
Subject	Physics
Exam Board	Cambridge International Examinations
Unit	Newtonian Mechanics
Topic	Pressure
Booklet	Question Paper

Time Allowed: **79 minutes**

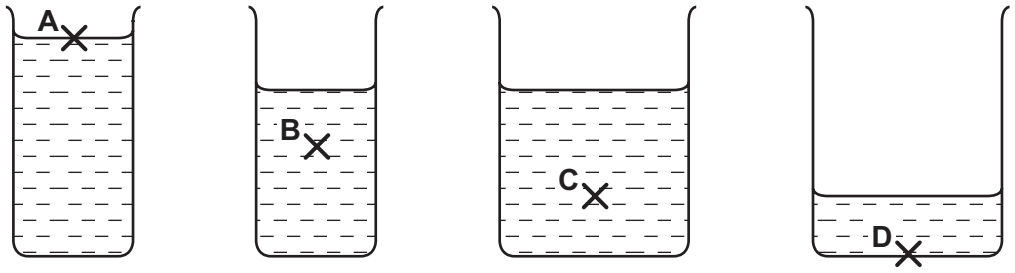
Score: **/66**

Percentage: **/100**

Grade Boundaries:

1 Four beakers contain the same liquid.

At which point is the pressure the greatest?



2 Water of depth 10 m exerts a pressure equal to atmospheric pressure.

An air bubble rises to the surface of a lake which is 20 m deep. When the bubble reaches the surface, its volume is 6.0 cm^3.

What is the volume of the air bubble at the bottom of the lake?

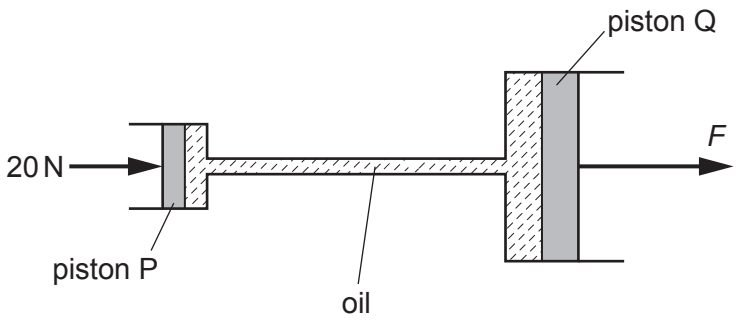
A 2.0 cm^3 **B** 3.0 cm^3 **C** 12 cm^3 **D** 18 cm^3

3 A block of weight W rests on a side of area A. The gravitational field strength is g.

What is the pressure exerted on the ground due to the block?

A WA **B** $\frac{W}{A}$ **C** $\frac{WA}{g}$ **D** $\frac{W}{g}$

4 The diagram shows a simple model of the braking system of a car. A force of 20 N is applied to piston P. As a result, there is a force *F* on piston Q.



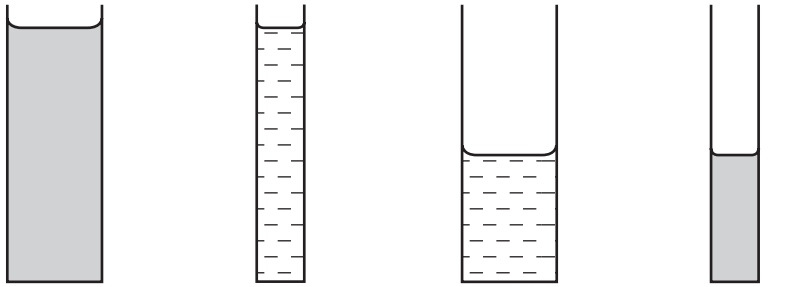
Piston P has an area of 5.0 cm^2 and piston Q has an area of 25 cm^2.

What is the force *F*?

A 4.0 N **B** 20 N **C** 100 N **D** 500 N

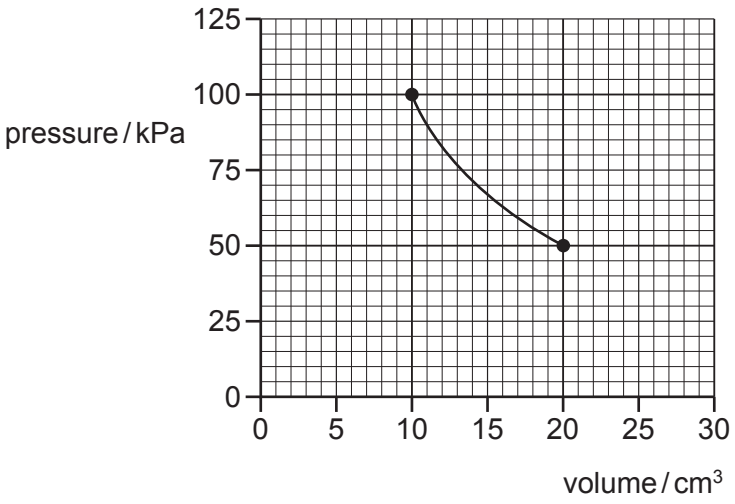
5 The diagrams show liquids in containers.

Which column of liquid exerts the greatest pressure on the base of its container?



	A	B	C	D
density of liquid	0.8 g / cm^3	1.0 g / cm^3	1.0 g / cm^3	0.8 g / cm^3

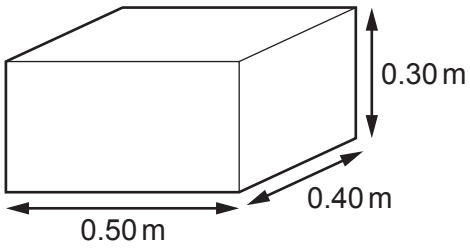
6 The graph shows how the pressure of a fixed mass of gas varies with volume at constant temperature.



What is the volume of the gas when the pressure is 25 kPa?

A 2.5 cm^3 **B** 10 cm^3 **C** 30 cm^3 **D** 40 cm^3

7 A block of weight 900 N has rectangular faces. The diagram shows the lengths of the sides.

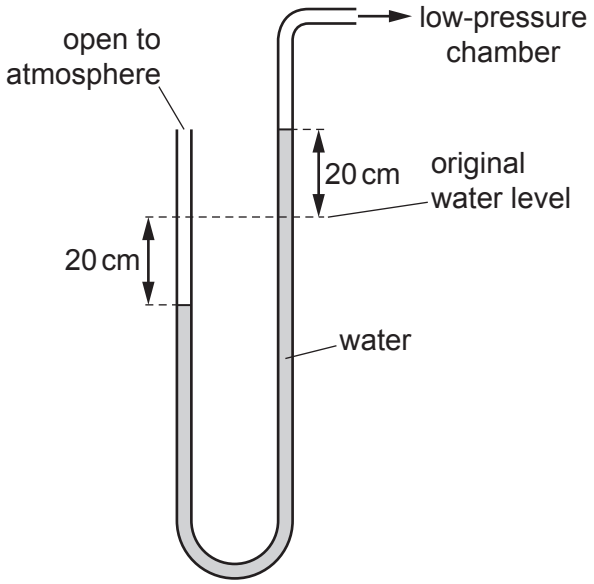


The block can rest on any of its faces.

What is the minimum pressure that the block can exert on the ground when resting on one of its faces?

A 900 Pa **B** 4500 Pa **C** 6000 Pa **D** 7500 Pa

8 A U-tube containing water is used as a manometer.



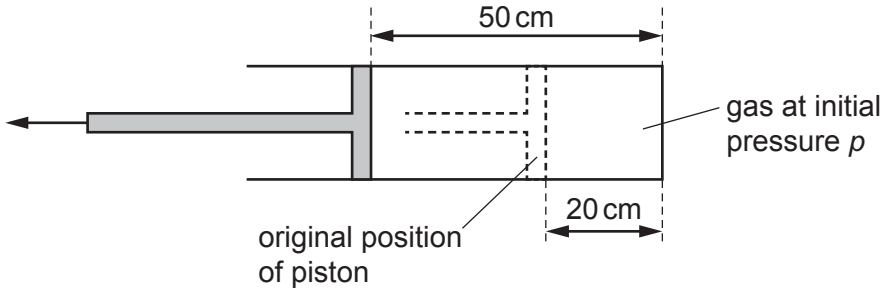
When one end of the manometer is connected to a low-pressure chamber, both water levels in the manometer change by 20 cm. The gravitational field strength g is 10 N / kg.

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

How far below atmospheric pressure is the pressure in this chamber?

A 2000 Pa **B** 4000 Pa **C** 200 000 Pa **D** 400 000 Pa

9 A gas is trapped inside a cylinder by a movable piston. The length of the gas column is 20 cm and the pressure inside the cylinder is p.

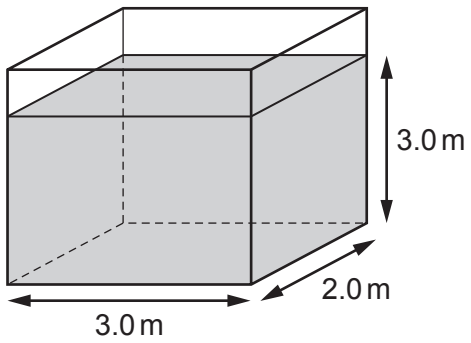


The piston is pulled out a distance of 30 cm, so that the length of the gas column is now 50 cm. The temperature of the gas does not change.

What is the new pressure of the gas?

A 0.40 p **B** 0.60 p **C** 1.5 p **D** 2.5 p

10 The base of a rectangular storage tank is 2.0 m by 3.0 m. The tank is filled with paraffin to a depth of 3.0 m.

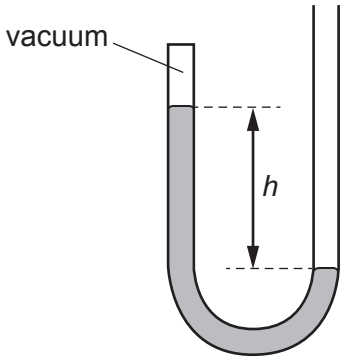


The density of paraffin is 800 kg / m^3 and the gravitational field strength is 10 N / kg.

What is the pressure at the bottom of the tank due to the paraffin?

A 2400 Pa **B** 14 400 Pa **C** 24 000 Pa **D** 144 000 Pa

11 The diagram shows a manometer containing mercury that is sealed at one end.



What happens to the distance *h* when the manometer is taken to the top of a mountain?

A It decreases, because atmospheric pressure decreases with height.

B It decreases, because atmospheric pressure increases with height.

C It increases, because atmospheric pressure decreases with height.

D It increases, because atmospheric pressure increases with height.

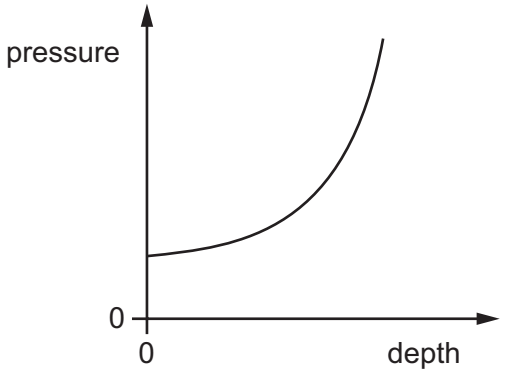
12 A gas occupies a volume of 2.0 m^3 in a cylinder at a pressure of 240 kPa. A piston compresses the gas until the volume is 0.50 m^3, the temperature remaining constant.

What is the new pressure of the gas?

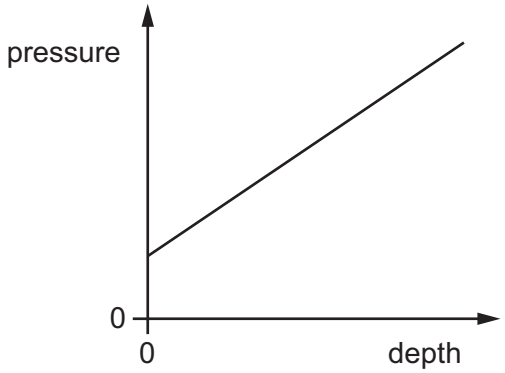
A 60 kPa **B** 240 kPa **C** 480 kPa **D** 960 kPa

13 Which graph shows the total external pressure acting on a submarine at different depths below the surface of the sea?

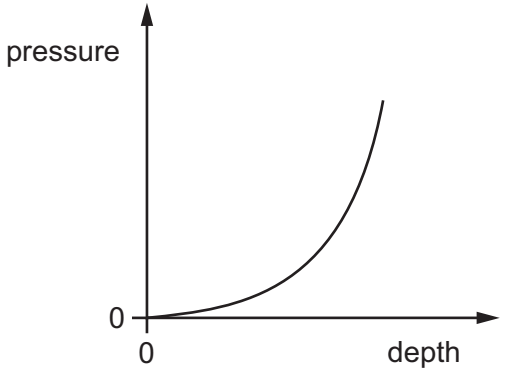
A



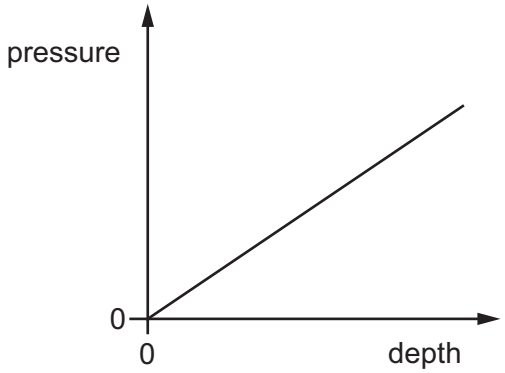
B



C



D

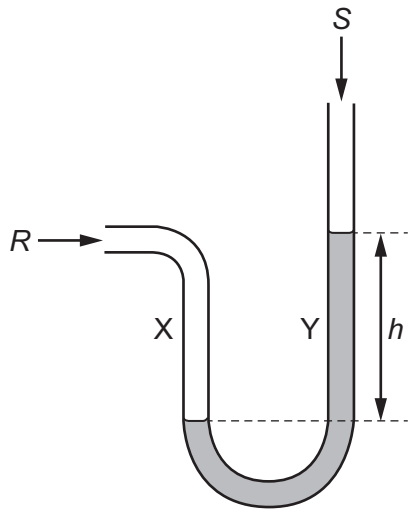


14 Objects of different weights are placed on a rigid, horizontal surface.

Which row shows the correct pressure acting on the surface?

	weight / N	area in contact / m^2	pressure / Pa
A	10	0.1	1
B	20	0.2	0.01
C	30	0.1	300
D	40	0.2	8

15 The diagram shows a simple manometer that contains a liquid.



Side X is connected to a gas supply of pressure *R*.
Side Y is open to the atmosphere at pressure *S*.

Which pressure is the length *h* used to measure?

A *R*

B *S*

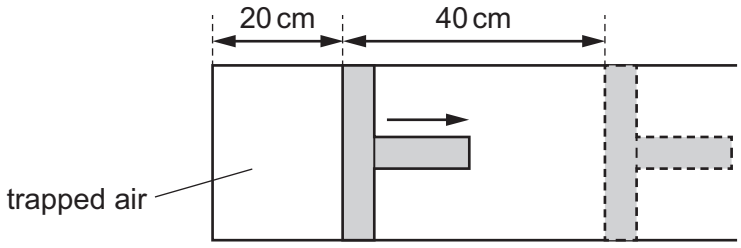
C *R* – *S*

D *R* + *S*

16 Air is trapped in a cylinder by a piston. The pressure of the air is p and the length of the air column is 20 cm.

The piston is moved outwards until the length of the air column has increased by 40 cm.

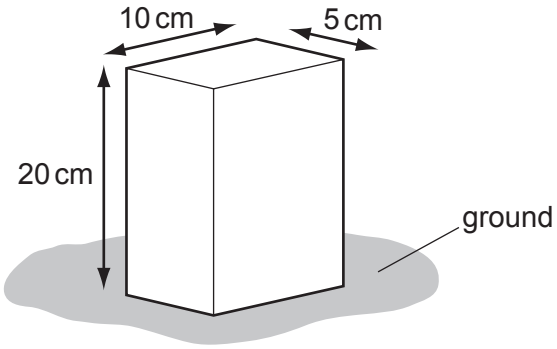
The temperature of the air remains constant.



What is the new air pressure?

A $\frac{p}{2}$ **B** $\frac{p}{3}$ **C** $2p$ **D** $3p$

17 A brick of weight 80 N stands upright on the ground as shown.



What is the pressure it exerts on the ground?

A $0.080\,N/cm^2$ **B** $0.40\,N/cm^2$ **C** $0.80\,N/cm^2$ **D** $1.6\,N/cm^2$

18 An airtight container holds a fixed mass of gas. Its pressure and volume are measured on four occasions when the temperature is 20 °C.

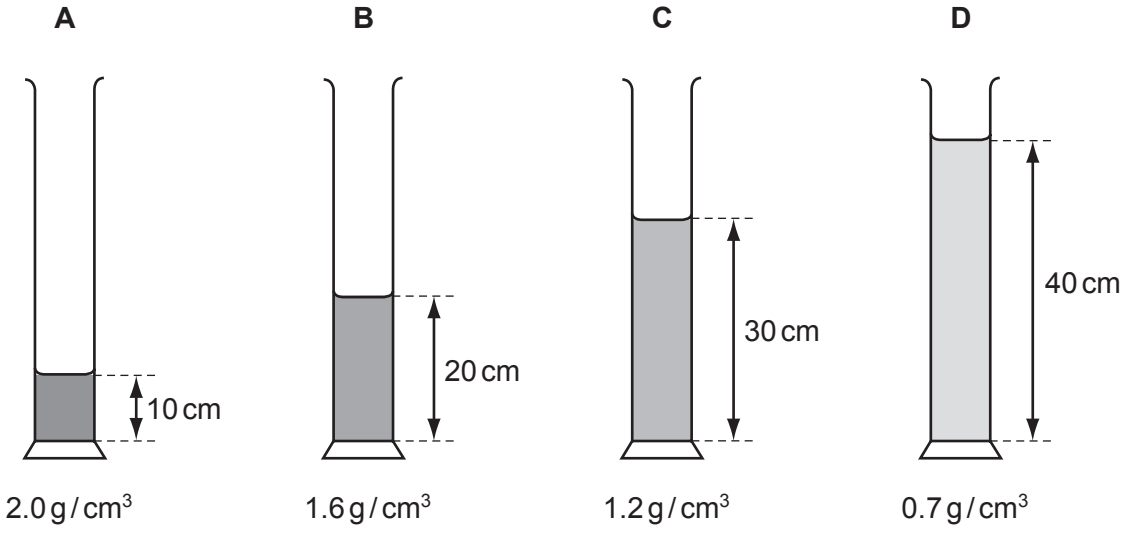
The results are shown in the table. Three sets of readings are correct.

Which set of readings is **not** correct?

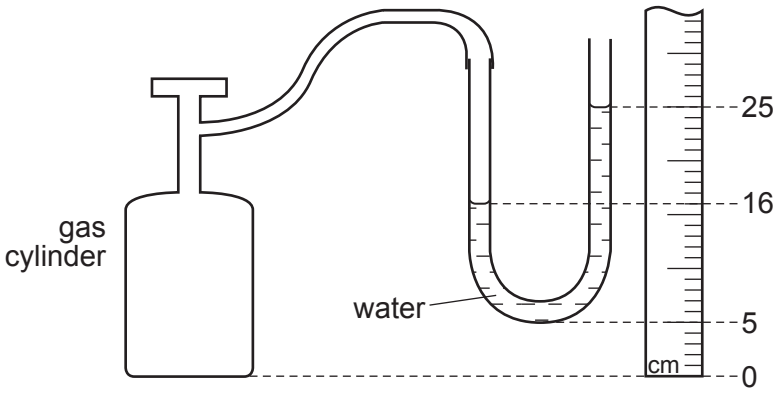
	pressure / kPa	volume / cm^3
A	120	36
B	100	48
C	80	60
D	60	80

19 Four different liquids are poured into identical measuring cylinders. The diagrams show the depths of the liquids and their densities.

Which liquid causes the largest pressure on the base of its measuring cylinder?



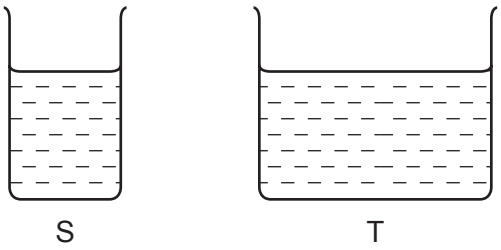
20 A manometer is attached to a gas cylinder as shown.



What is the pressure difference, in cm of water, shown by the manometer?

A 9 **B** 16 **C** 20 **D** 25

21 Two vessels S and T are filled to the same level with the same liquid. The area of the base of S is less than that of T.



Which statement is correct?

A The force on the base of S is greater than the force on the base of T.

B The force on the base of S is the same as the force on the base of T.

C The pressure on the base of S is greater than the pressure on the base of T.

D The pressure on the base of S is the same as the pressure on the base of T.

22 The conditions at the bottom and at the surface of a lake are given in the table.

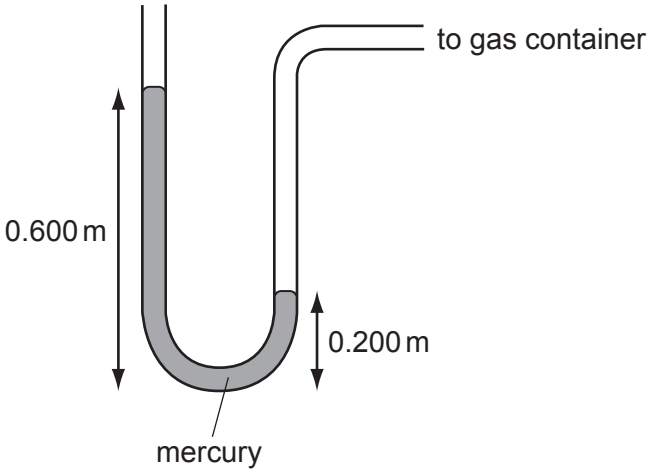
	bottom of lake	surface of lake
temperature	10 °C	10 °C
pressure	500 kPa	100 kPa

A bubble of volume 1.0 cm^3 forms at the bottom of the lake.

What is the volume of the bubble as it reaches the surface?

A 0.20 cm^3 **B** 0.25 cm^3 **C** 4.0 cm^3 **D** 5.0 cm^3

23 The diagram shows a mercury manometer connected to a gas container.

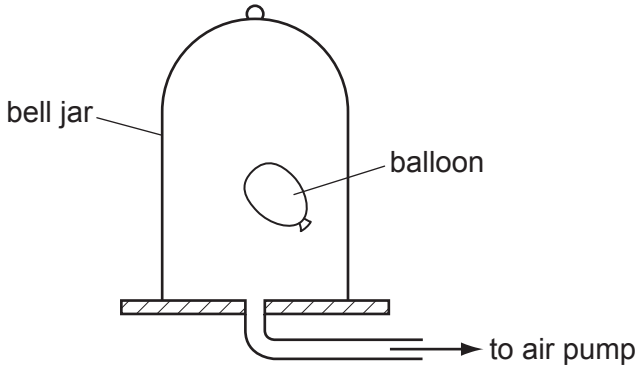


The density of mercury is 13 600 kg / m^3. The gravitational field strength *g* is 10 N / kg.

What is the pressure difference between the gas in the container and the atmosphere?

A 27 200 Pa **B** 40 800 Pa **C** 54 400 Pa **D** 81 600 Pa

24 A partially-inflated balloon is placed inside a bell jar. The bell jar is connected to an air pump.

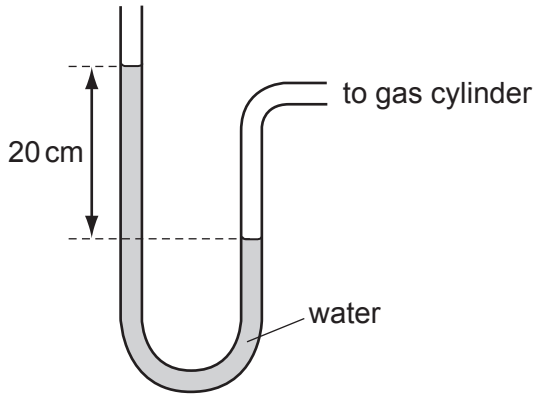


The air pump is switched on and air is removed from the bell jar.

What happens to the pressure and to the volume of the gas inside the balloon?

	pressure	volume
A	decreases	decreases
B	decreases	increases
C	increases	decreases
D	increases	increases

25 The pressure of a gas in a cylinder is found using a water manometer.

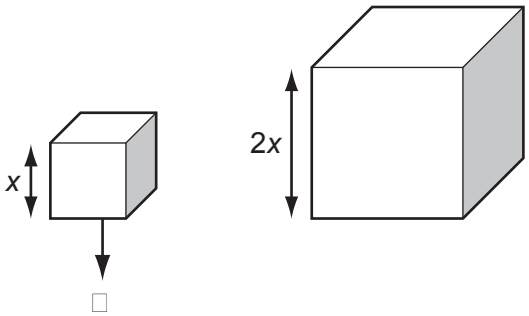


The density of water is 1000 kg / m^3 and the gravitational field strength g is 10 N / kg.

What is the pressure, above atmospheric pressure, of the gas in the cylinder?

A 200 Pa **B** 2000 Pa **C** 20 000 Pa **D** 200 000 Pa

26 The diagram shows two cubes made from the same material. One cube has sides that are twice as long as the sides of the other cube.



The weight of the small cube is *W*.

What is the weight of the larger cube?

A 2*W** **B** 4*W** **C** 8*W** **D** 16*W*

27 A garden table weighs 40 N and has a top surface of area 2 m^2. It is raining and the rain produces a pressure of 4 N / m^2 on the table.

What is the force exerted by the table on the ground?

A 20 N **B** 32 N **C** 42 N **D** 48 N

28 Four syringes contain air at atmospheric pressure.

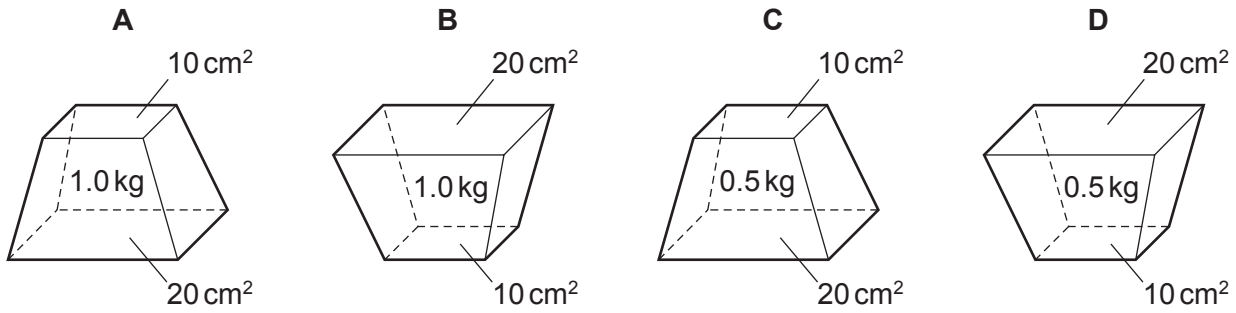
The air in all four syringes is slowly compressed. The results are given in the table.

Which syringe shows the smallest pressure change?

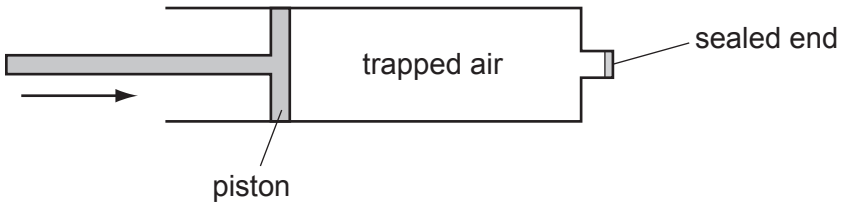
	volume before compression / cm^3	volume after compression / cm^3
A	50	10
B	100	50
C	400	25
D	400	100

29 Four solid blocks with flat surfaces are placed on some soft plasticine, in the positions shown.

Which block sinks the deepest into the plasticine?



30 The end of a bicycle pump is sealed.



The temperature of the air does not change as the piston is pushed in. The final volume of trapped air is $\frac{1}{4}$ of the original volume.

How does the pressure of the trapped air change?

A It decreases to $\frac{1}{4}$ of the original value.

B It decreases to $\frac{3}{4}$ of the original value.

C It increases to 3 times the original value.

D It increases to 4 times the original value.

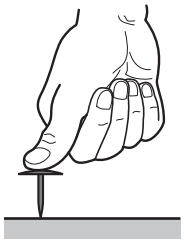
31 The **same** downward force is applied to four objects resting on a horizontal surface.

Which exerts the greatest pressure on the surface?

A

car wheel

B



drawing pin

C

table fork

D

stiletto heel

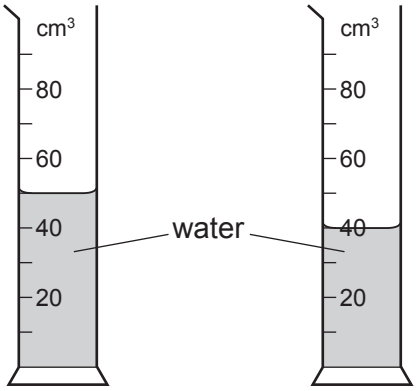
32 Four identical measuring cylinders contain liquid.

Two contain water of density 1000 kg / m^3.

Two contain paraffin of density 800 kg / m^3.

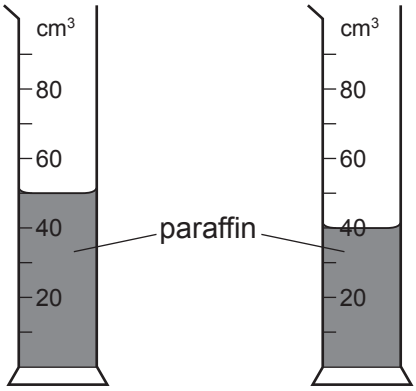
Which cylinder has the **least** pressure exerted on its base by the liquid it contains?

A



B

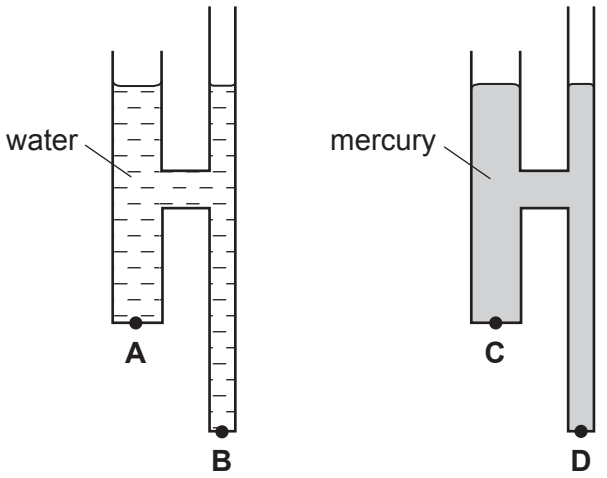
C



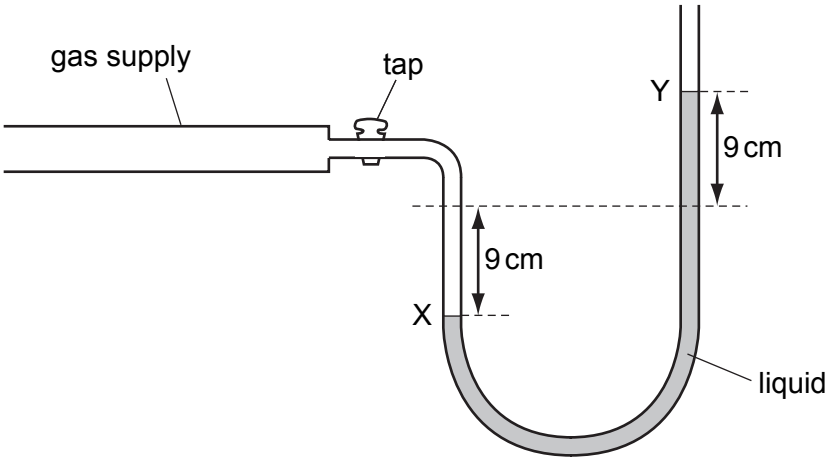
D

33 The diagram shows two identical pieces of apparatus. One is filled with water and the other is filled with mercury. Water is less dense than mercury.

At which point is the liquid pressure greatest?



34 The diagram shows the levels X and Y in a liquid manometer with the gas tap open.



What is the pressure of the gas supply?

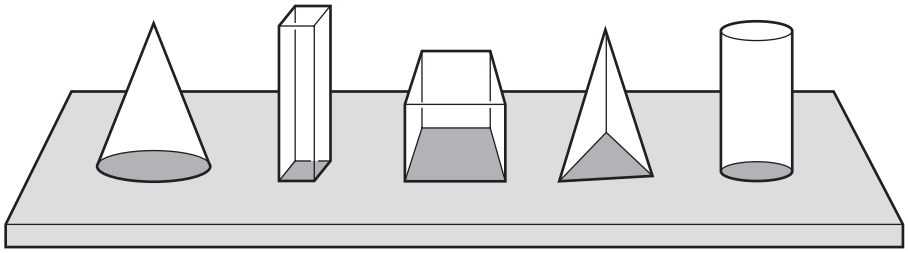
A 18 cm of liquid below atmospheric pressure

B 9 cm of liquid below atmospheric pressure

C 9 cm of liquid above atmospheric pressure

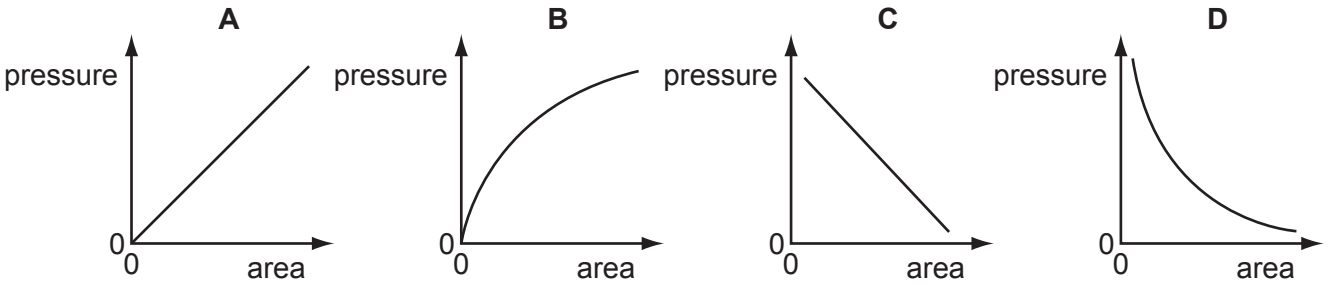
D 18 cm of liquid above atmospheric pressure

35 Five blocks have the same mass but different base areas. They all rest on a horizontal table.

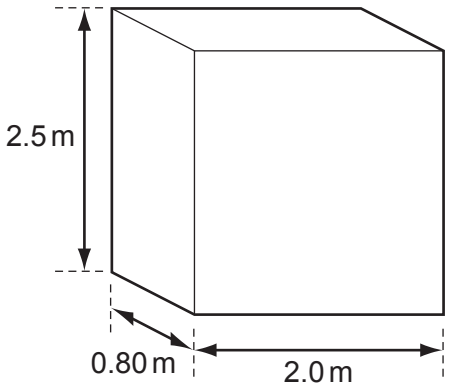


A graph is plotted to show the relationship between the pressure exerted on the table and the base area of the block.

Which graph shows this relationship?



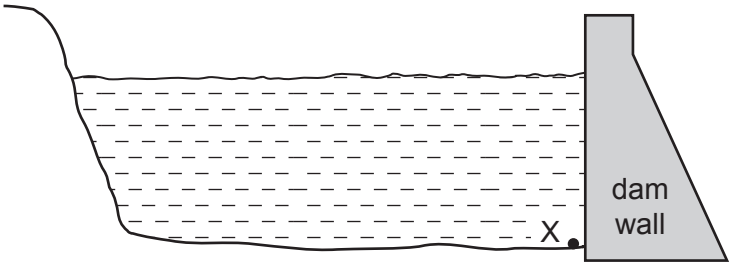
36 The base for a statue rests on level ground. It is made from stone and is 2.0 m long, 2.5 m high and 0.80 m wide. It has a weight of 96 000 N.



What is the pressure that the base exerts on the ground?

A 19 kPa **B** 24 kPa **C** 48 kPa **D** 60 kPa

37 An engineer designs a dam wall for a reservoir.



Which factor determines the pressure at X?

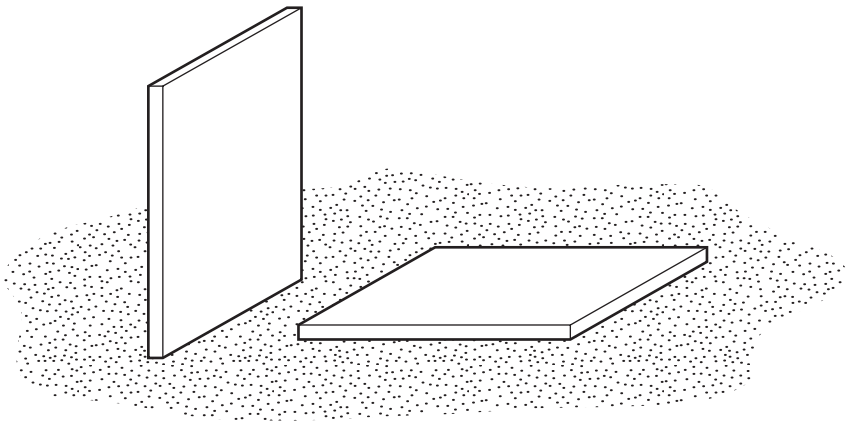
A the depth of the water in the reservoir

B the surface area of the reservoir

C the length of the reservoir

D the thickness of the dam wall

38 A builder leaves two identical, heavy, stone tiles resting on soft earth. One is vertical and the other is horizontal.

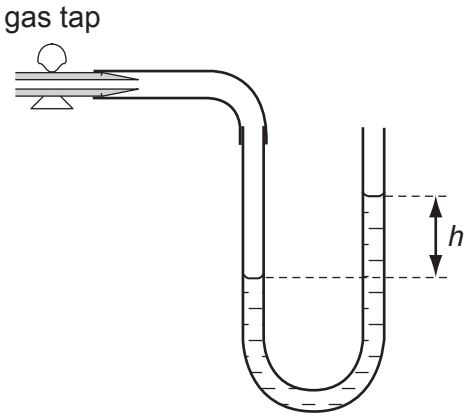


After a few hours, the vertical tile has started to sink into the soft earth, but the horizontal one has not.

Which row correctly compares the forces and the pressures that the tiles exert on the earth?

	forces	pressures
A	different	different
B	different	same
C	same	different
D	same	same

39 A water manometer is connected to a gas supply. One end of the manometer is open to the atmosphere.



Which statement about the pressure of the gas supply is true?

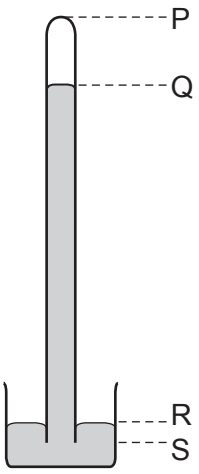
A The pressure is *h* cm of water.

B The pressure is *h* cm of water below atmospheric pressure.

C The pressure is the same as atmospheric pressure.

D The pressure is *h* cm of water above atmospheric pressure.

40 A long tube full of mercury is inverted in a small dish of mercury.

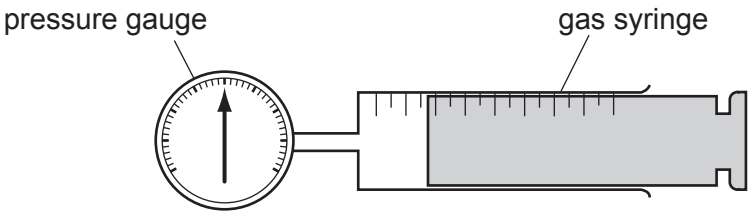


The mercury level in the tube falls, leaving a vacuum at the top.

When the atmospheric pressure falls, which length decreases?

A PQ **B** PS **C** QR **D** RS

41 Some gas is trapped in a large syringe by a piston. The atmospheric pressure is 100 kPa.



The pressure gauge indicates that the gas pressure is 200 kPa above atmospheric pressure. The piston moves outwards and the volume of the trapped gas doubles. The temperature remains constant.

What is the new gas pressure?

A 100 kPa **B** 150 kPa **C** 200 kPa **D** 400 kPa

42 Which statement about the pressure in a column of liquid is correct?

A It acts only vertically downwards.

B It increases if the column width increases.

C It increases with depth in the column.

D It is uniform throughout the column.

43 An airtight container holds a fixed quantity of gas. Its pressure and volume are measured on four occasions when the temperature is 20 °C.

The results are shown in the table.

Which set of readings is **incorrect**?

	pressure / kPa	volume / cm^3
A	120	36
B	100	48
C	80	60
D	60	80

44 Some air is trapped inside a small balloon. The average kinetic energy of the air molecules in the balloon is increased.

What remains the same?

A the density of the air in the balloon

B the mass of the air in the balloon

C the temperature of the air in the balloon

D the volume of the air in the balloon

45 A crane lifts a weight of 1000 N through a vertical height of 30 m.

It uses 60 000 J of energy.

What is the efficiency of the crane?

A 20 % **B** 30 % **C** 40 % **D** 50 %

46 A rock climber of weight 600 N climbs up a rock face of vertical height 300 m in 3600 s.

What is the average power she generates against gravity during this time?

A 0.020 W **B** 50 W **C** 1800 W **D** 7200 W

47 Using an electric kettle, 100 g of water at 100 °C is converted into steam at 100 °C in 300 seconds.

The specific latent heat of steam is 2250 J / g.

What is the average electrical power used?

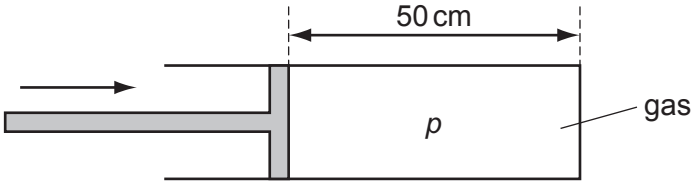
A $\frac{2250}{300 \times 100}$ W

B $\frac{100 \times 2250}{300}$ W

C $\frac{300 \times 2250}{100}$ W

D $100 \times 300 \times 2250$ W

48 A gas is trapped inside a cylinder by a movable piston. The length of the gas column is 50 cm and the pressure inside the cylinder is p.



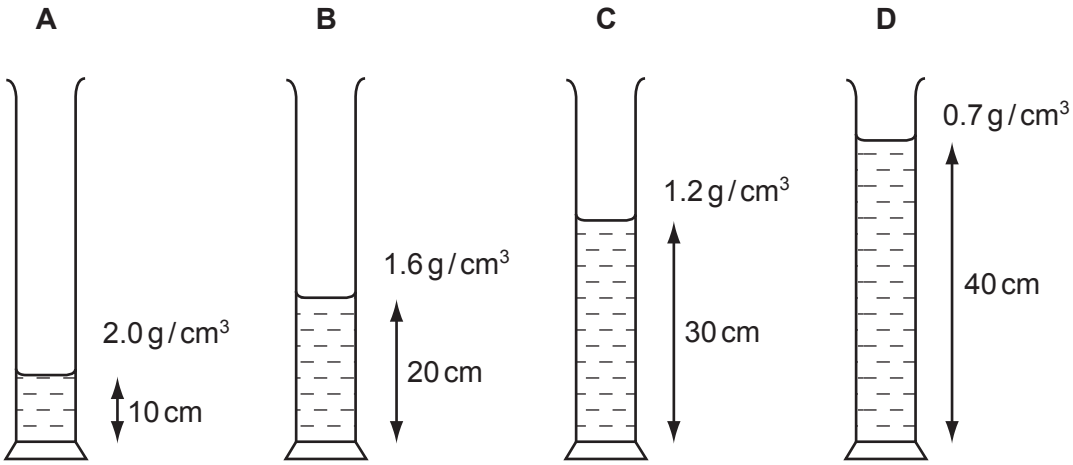
The piston is pushed in a distance of 30 cm, so that the length of the gas column is now 20 cm. The temperature of the gas does not change.

What is the new pressure of the gas?

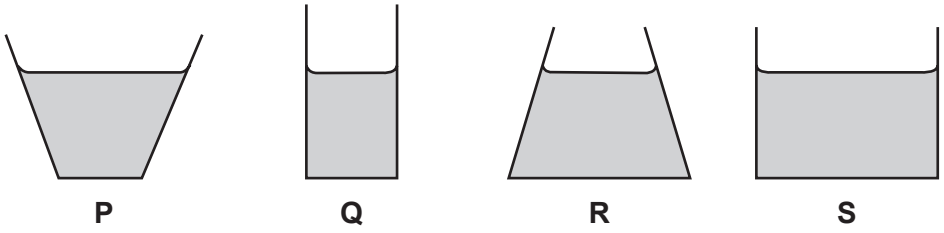
A 0.4 p **B** 0.6 p **C** 1.5 p **D** 2.5 p

49 Four different liquids are poured into identical measuring cylinders. The diagrams show the depths of the liquids and their densities.

Which liquid causes the largest pressure on the base of its measuring cylinder?



50 The diagrams show, to the same scale, the vertical sections of a set of circular vessels. Each vessel contains the same depth of water.



Which of the following statements is correct?

A The water exerts the greatest pressure on the base of vessel **P**.

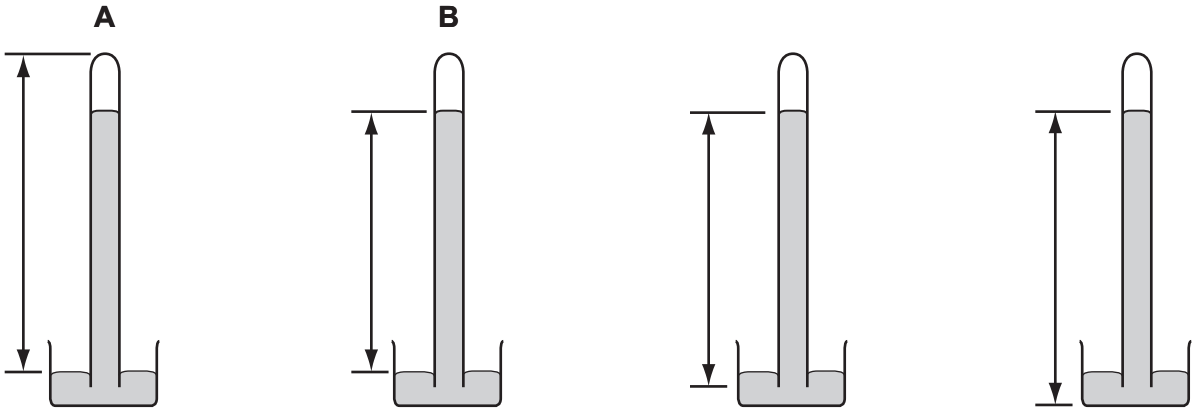
B The water exerts the greatest pressure on the base of vessel **S**.

C The water exerts the same force on the base of each vessel.

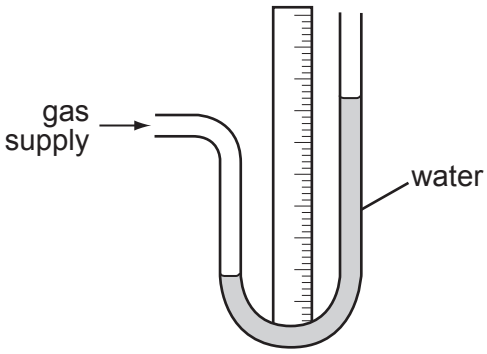
D The water exerts the same pressure on the base of each vessel.

51 The diagrams show a simple mercury barometer.

Which diagram shows the distance to be measured to find atmospheric pressure?

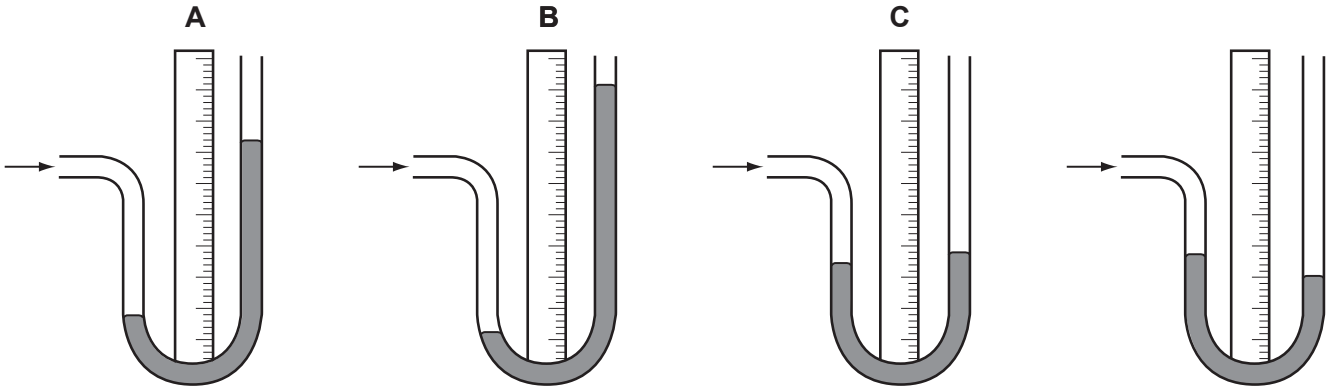


52 A water manometer is connected to a gas supply. The diagram shows the water levels.

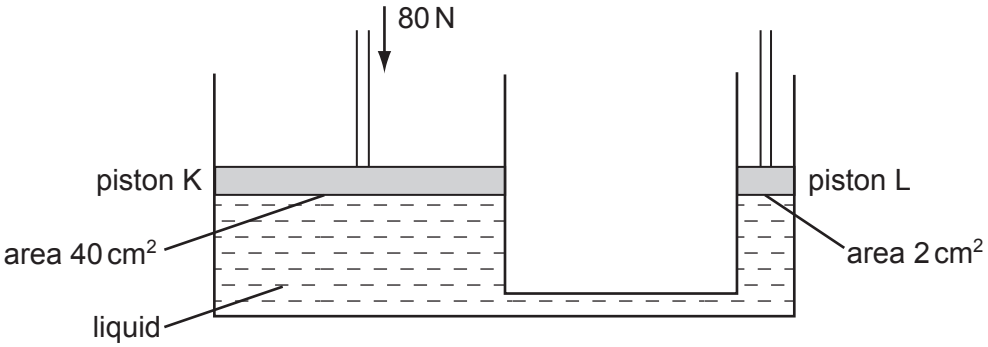


The water is replaced by mercury, which is more dense than water.

Which diagram shows the mercury levels when the manometer is connected to the same gas supply?



53 The system shown in the diagram contains a liquid.



A downward force of 80 N is exerted on piston K.

What will be the upward force exerted by the liquid on piston L?

A 1 N

B 4 N

C 80 N

D 1600 N

54 What does **not** affect the pressure at a point beneath the surface of a liquid?

A area of the liquid surface

B density of the liquid

C depth of the point below the surface

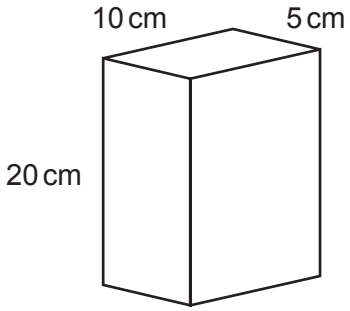
D strength of the gravitational field

55 A small table weighing 40 N stands on four legs, each having an area of 0.001 m^2.

What is the pressure of the table on the floor?

A 400 N / m^2 **B** 1000 N / m^2 **C** 10 000 N / m^2 **D** 40 000 N / m^2

56 A brick of weight 80 N stands upright on the ground as shown.



What is the pressure it exerts on the ground?

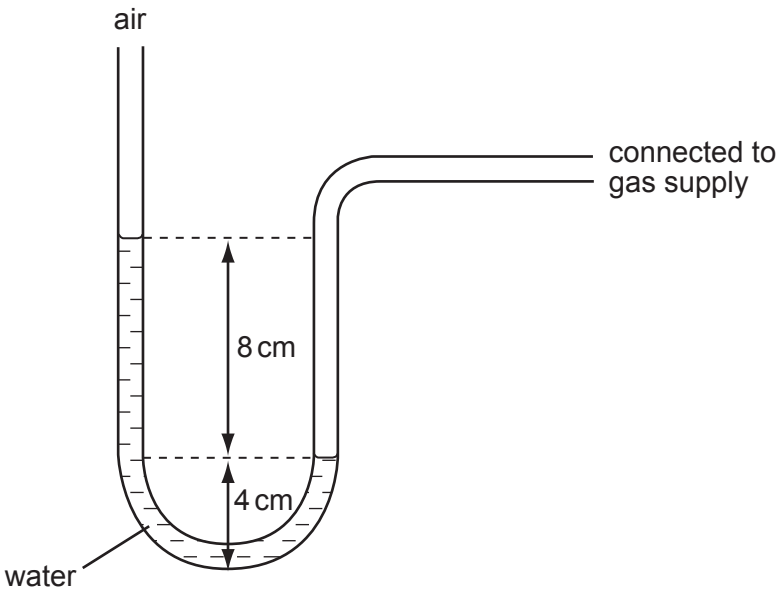
A $\frac{80}{20 \times 10}$ N / cm^2

B $\frac{20 \times 10}{80}$ N / cm^2

C $\frac{80}{10 \times 5}$ N / cm^2

D $\frac{10 \times 5}{80}$ N / cm^2

57 A manometer is connected to a gas supply.



Pressure can be measured in cm of water.

What is the pressure of the gas?

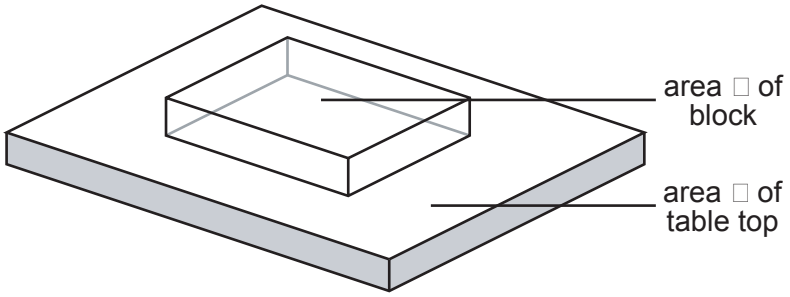
A 8 cm of water more than atmospheric pressure

B 12 cm of water more than atmospheric pressure

C 8 cm of water less than atmospheric pressure

D 12 cm of water less than atmospheric pressure

58 The diagram shows a glass block resting on a table top.



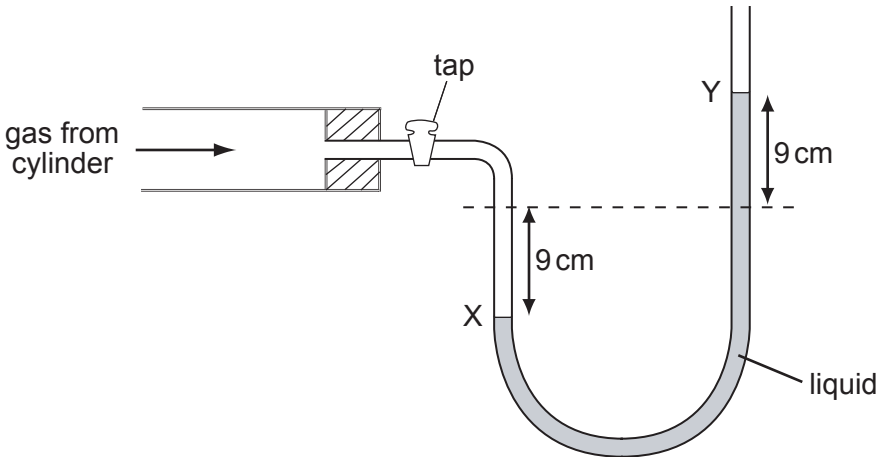
The area of the block in contact with the table is *X* and the area of the table top is *Y*.

The weight of the block is *P* and the weight of the table is *Q*.

Which expression gives the pressure exerted on the table by the block?

A $\frac{P}{X}$ **B** $\frac{P}{Y}$ **C** $\frac{Q}{X}$ **D** $\frac{Q}{Y}$

59 The diagram shows the levels X and Y in a liquid manometer when the gas tap is opened.



What is the pressure of the gas in the cylinder?

A 18 cm of liquid below atmospheric pressure

B 9 cm of liquid below atmospheric pressure

C 9 cm of liquid above atmospheric pressure

D 18 cm of liquid above atmospheric pressure

60 Which would be the **least** likely to sink into soft ground?

A a loaded lorry with four wheels

B a loaded lorry with six wheels

C an empty lorry with four wheels

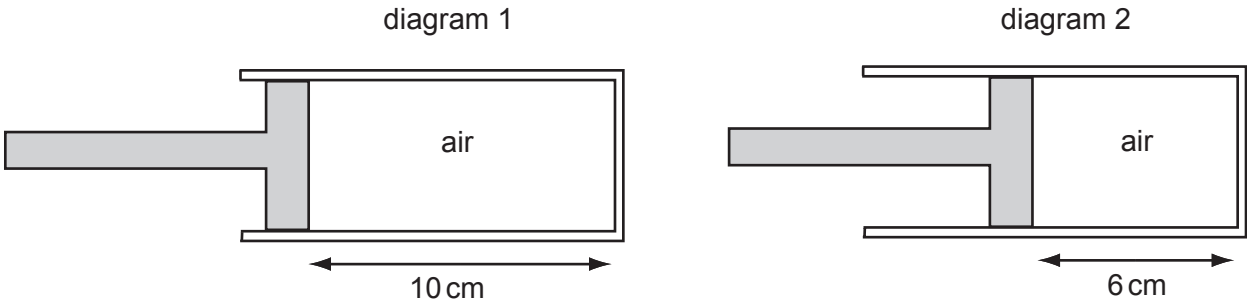
D an empty lorry with six wheels

8

61 Diagram 1 shows some air trapped in a cylinder.

Diagram 2 shows the same air after the piston has been pushed in slowly.

The air in diagram 1 is at atmospheric pressure P_A.



What is the pressure of the air in diagram 2?

A $\frac{6}{10} \times P_A$

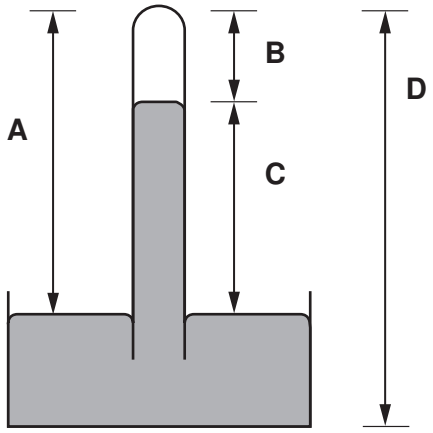
B P_A

C $\frac{10}{6} \times P_A$

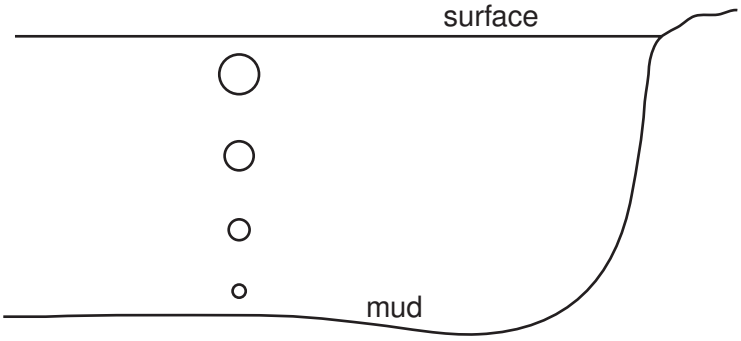
D $60 \times P_A$

62 The diagram shows a simple mercury barometer.

Which height is a measure of the atmospheric pressure?



63 Bubbles of gas, escaping from the mud at the bottom of a deep lake, rise to the surface.



As the bubbles rise they get larger.

Why is this?

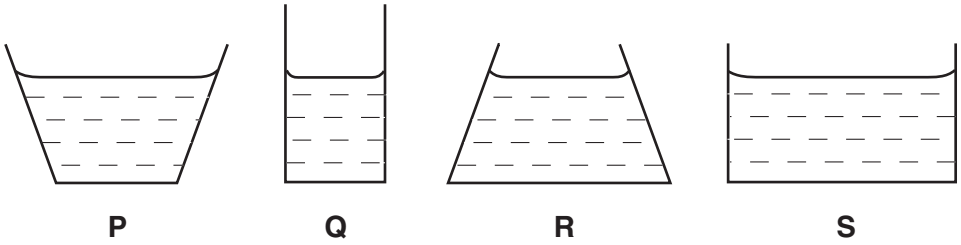
A Atmospheric pressure on the bubbles decreases.

B Atmospheric pressure on the bubbles increases.

C Water pressure on the bubbles decreases.

D Water pressure on the bubbles increases.

64 The diagrams show, to the same scale, the vertical sections of a set of circular vessels, each containing the same depth of water.



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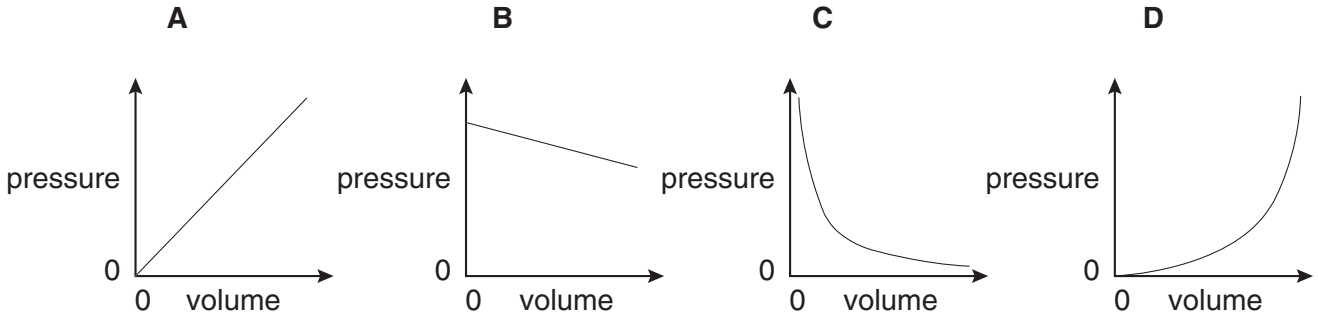
D The water exerts the same pressure on the base of each vessel.

65 Which graph shows the relationship between the pressure and volume of a fixed mass of gas at constant temperature?



66 Assuming the temperature remains constant, which combination correctly describes the volume and the shape of a gas or liquid?

	gas or liquid	volume	shape
A	gas	fixed	not fixed
B	gas	not fixed	not fixed
C	liquid	fixed	fixed
D	liquid	not fixed	fixed