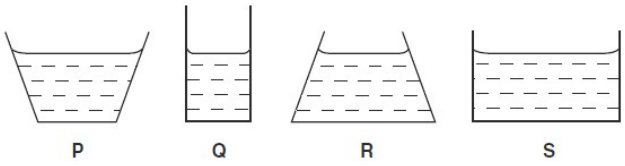
Pressure – Consolidated Practice 1

1. The diagrams show, to the same scale, the vertical sections of a set of circular vessels each containing the same depth of water. Which one of the following statements is correct?



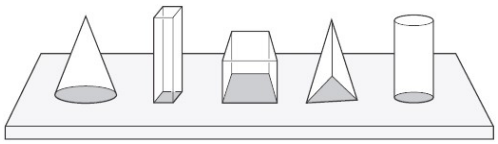
A The water exerts the greatest pressure on the base of vessel **P**.

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

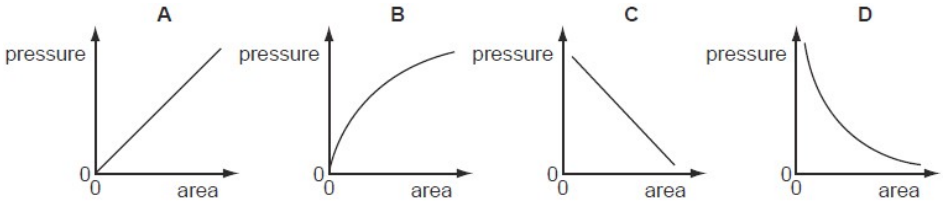
C The water exerts the same force on the base of each vessel.

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

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

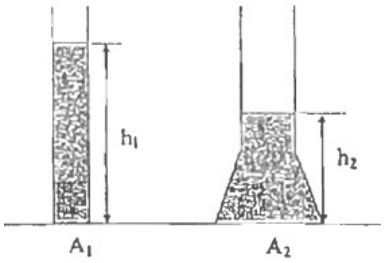


A graph is plotted to show the relationship between the pressure exerted on the table and the base area of the block. Which graph shows this relationship?



( )

3. Water is contained in a container of base area $\mathbf{A_1}$ up to height $\mathbf{h_1}$. Water is also contained in a second container of bigger base area $\mathbf{A_2}$, but up to a smaller height $\mathbf{h_2}$. The pressure exerted on base $\mathbf{A_1}$ is $\mathbf{P_1}$ while that exerted on base $\mathbf{A_2}$ is $\mathbf{P_2}$.



Which of the following statements is correct?

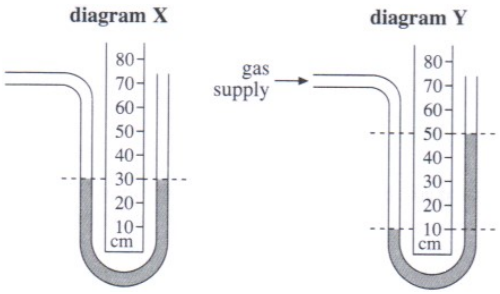
A It is possible that $\mathbf{P_1} = \mathbf{P_2}$ since $\mathbf{A_2} > \mathbf{A_1}$ and $\mathbf{h_1} > \mathbf{h_2}$

B $\mathbf{P_1} < \mathbf{P_2}$ because $\mathbf{A_2} > \mathbf{A_1}$

C $\mathbf{P_1} > \mathbf{P_2}$ because $\mathbf{A_2} > \mathbf{A_1}$

D $\mathbf{P_1} > \mathbf{P_2}$ since $\mathbf{h_1} > \mathbf{h_2}$ ( )

4. Diagram **X** shows a water manometer before it is connected to a gas supply. Diagram **Y** shows the manometer when it is connected to a gas supply.



What is the excess pressure of the gas supply above atmospheric pressure?

A 10 cm water

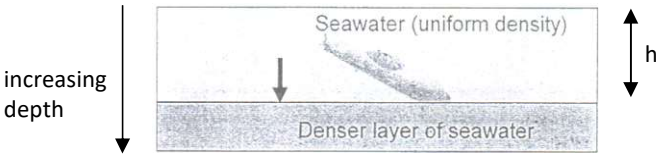
B 20 cm water

C 40 cm water

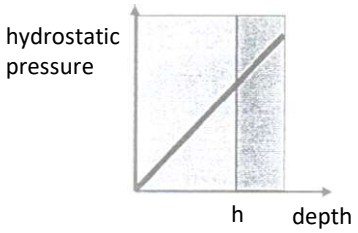
D 50 cm water ( )

5. The figure shows a submarine diving in seawater.

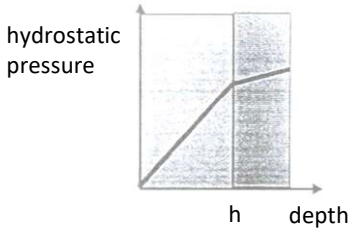
How does the hydrostatic (water) pressure change as it dives?



A



B



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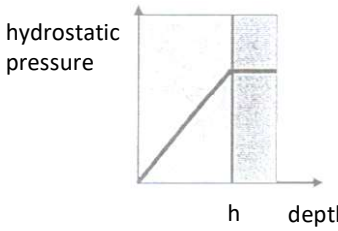

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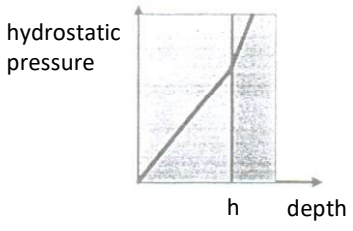

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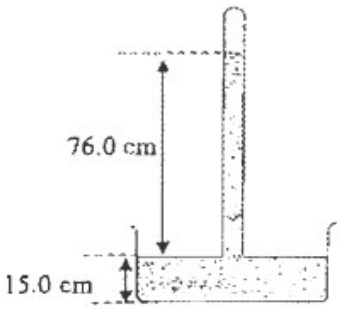
6. The diagram on the right shows a simple mercury barometer.



If the base area of the trough is 2.0×10^{-3} m^2, find the force exerted on the base of the barometer. (Density of mercury = 13 600 kg/m^3)

A 2.1×10^2 N

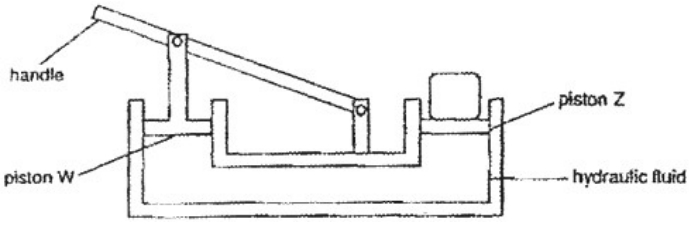
B 2.5×10^2 N

C 5.2×10^2 N

D 6.2×10^2 N

( )

7. The figure below shows a simple hydraulic jack.



Which change will result in the heaviest load being lifted with the same force applied at the handle?

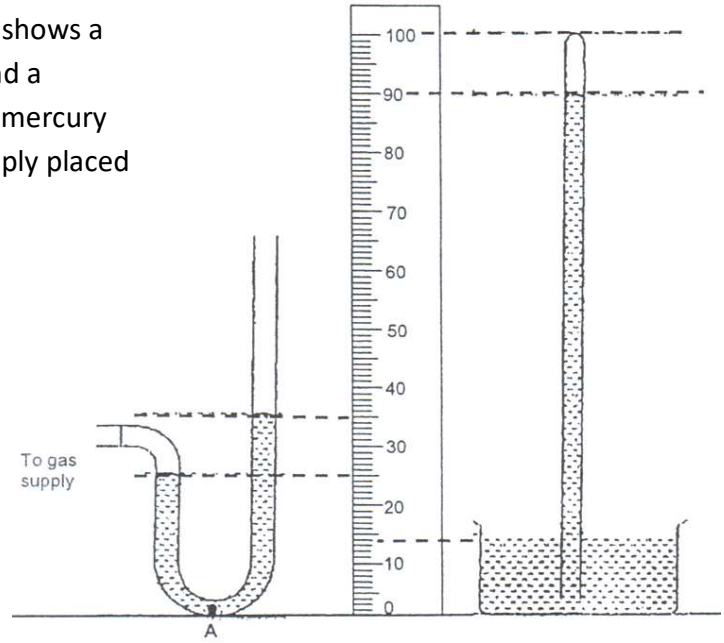
	Diameter of W	Diameter of Z
A	Doubled	Halved
B	No change	Halved
C	No change	Doubled
D	Halved	Doubled

( )

8. A barometer is carried from the 1st floor to the 20th floor of a building. Why does the reading on the barometer fall?

A Air pressure has increased.
B Temperature has increased.
C Gravity has decreased.
D There is less air above the barometer. ( )

9. The figure on the right shows a mercuny barometer and a manometer filled with mercury connected to a gas supply placed next to a meter rule.



(a) Determine the atmospheric pressure indicated by the mercury barometer in cm Hg.[1]

(b) Determine the gas pressure in cm Hg. [1]

(c) Calculate the pressure at **A** in Pa. (Density of mercury = 13 600 kg m^{-3}) [3]

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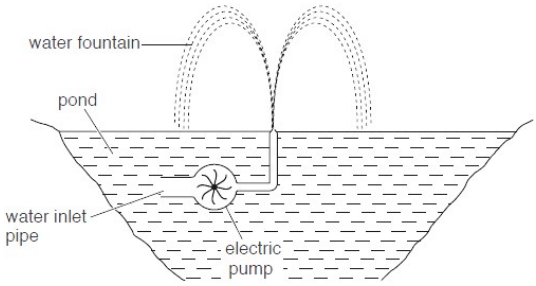
10. A garden pond contains a small fountain. An electric pump in the water causes the water to rise above the surface of the pond, as shown in the figure.



(a) The pressure of the water in the pond increases with depth.

(i) Explain what is meant by *pressure*. [1]

(ii) Explain why the pressure below the surface of the water increases with depth. [2]

(iii) State the unit of pressure. [1]

(b) Describe the energy changes that occur within the pump. [3]

(c) A volume of 0.78 m^3 of water passes through the pump in one hour. The density of water is 1000 kg / m^3.

(i) Calculate the mass of water that passes through the pump in one hour. [2]

(ii) The water rises 1.5 m. The gravitational field strength g is 10 N / kg.

Calculate the useful work done in one hour raising the water to the top of the fountain. [2]

(iii) Calculate the minimum power output of the pump. [2]

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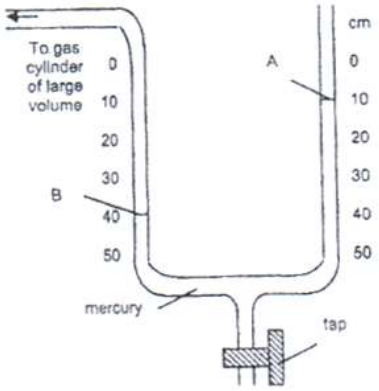
11. The figure shows a U-tube manometer connected to a gas cylinder of large volume. The atmospheric pressure is 76 cm of mercury.



(a) What is the pressure at point **A** and point **B** in the right and left tube respectively? [2]

(b) The tap is opened and mercury ran out until the level in the left tube drops to the 50 cm mark.

Assume that the pressure in the gas cylinder remains constant, what is the new position of the level in the right tube? [1]

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12. Figure A shows a hand-operated hydraulic press.

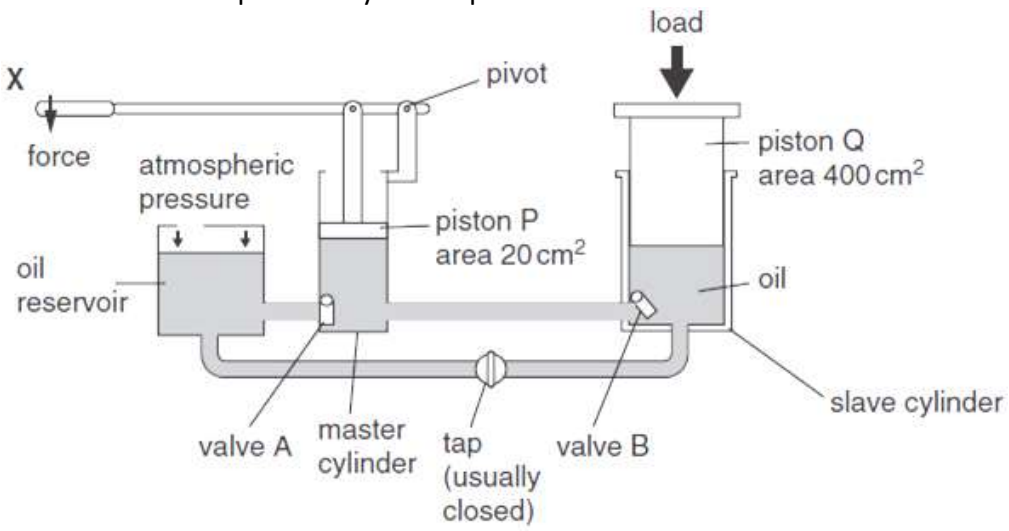

Figure A

A force is applied downwards at **X** as shown. Piston Q rises in the slave cylinder. The area of piston P is 20 cm^2 and the area of piston Q is 400 cm^2.

(a) Explain, in detail, how pushing **X** downwards causes piston Q to rise. State clearly what happens to valve A and to valve B. [5]

(b) Piston P exerts a downward force of 300 N on the oil. [5]

(i) Calculate the pressure, in N /cm^2, exerted by piston P on the oil.

(ii) State the value of the pressure in the slave cylinder.

(iii) Calculate the force exerted by the oil on piston Q.

(c) Piston P moves down 5 cm. [2]

(i) Calculate the volume of oil that moves out of the master cylinder.

(ii) Calculate the distance that piston Q rises.

(d) After **X** in Figure A is pushed down, it is lifted up again.

State what happens, as **X** is lifted, to valve A, to valve B and to the piston Q. [2]

(e) State why oil, not air, is used in the hydraulic press. [1]

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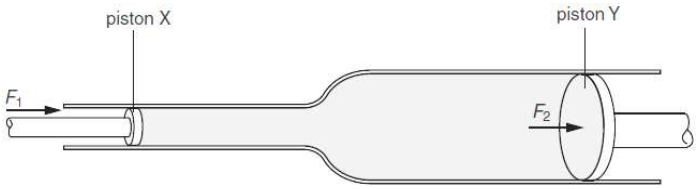
13. The figure represents part of the hydraulic braking system of a car.



The force F_1 of the driver's foot on the brake pedal moves piston X. The space between pistons X and Y is filled with oil which cannot be compressed. The force F_2 exerted by the oil moves piston Y. This force is applied to the brake mechanism in the wheels of the car.

The area of cross-section of piston X is 4.8 cm^2.

(a) The force F_1 is 90 N. Calculate the pressure exerted on the oil by piston X. [2]

(b) The pressure on piston Y is the same as the pressure applied by piston X. Explain why the force F_2 is greater than the force F_1. [1]

(c) Piston Y moves a smaller distance than piston X. Explain why. [2]

(d) Suggest why the braking system does not work properly if the oil contains bubbles of air. [2]

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