

**Density and Pressure - 2017**

1. 9702/11/M/J/17/14

A metal block has a mass of 750 g. 60% of the mass is magnesium and the remainder is copper.

The density of magnesium is  $1.7 \text{ g cm}^{-3}$ .

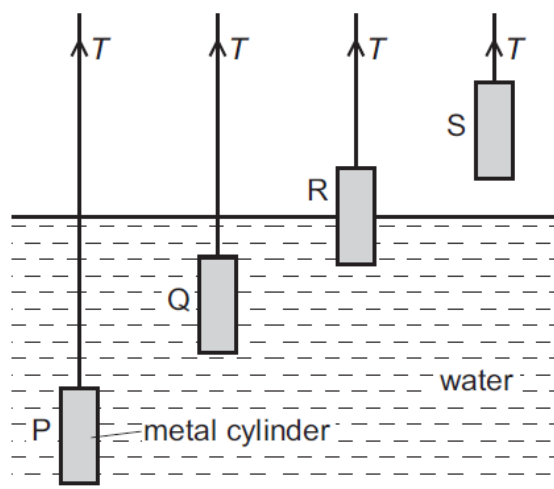
The density of copper is  $9.0 \text{ g cm}^{-3}$ .

What is the density of the block?

- A  $2.5 \text{ g cm}^{-3}$       B  $4.6 \text{ g cm}^{-3}$       C  $5.4 \text{ g cm}^{-3}$       D  $10.7 \text{ g cm}^{-3}$

2. 9702/12/M/J/17/10

A metal cylinder is suspended vertically in equilibrium by a cord. The diagram shows the cylinder in four different positions P, Q, R and S.



Which statement explains the variation of the tension  $T$  in the cord?

- A At P and at Q, the tension  $T$  in the cord is the same because the difference in pressure between the top and bottom of the cylinder is the same.
- B At Q, the tension  $T$  in the cord is less than at P because, at smaller depth, liquid pressure is smaller.
- C At R, the tension  $T$  in the cord is less than at P because atmospheric pressure is less than water pressure.
- D At S, the tension  $T$  in the cord is greater than at P because atmospheric pressure at S exerts no force on the top or bottom of the cylinder.

3. 9702/12/M/J/17/13

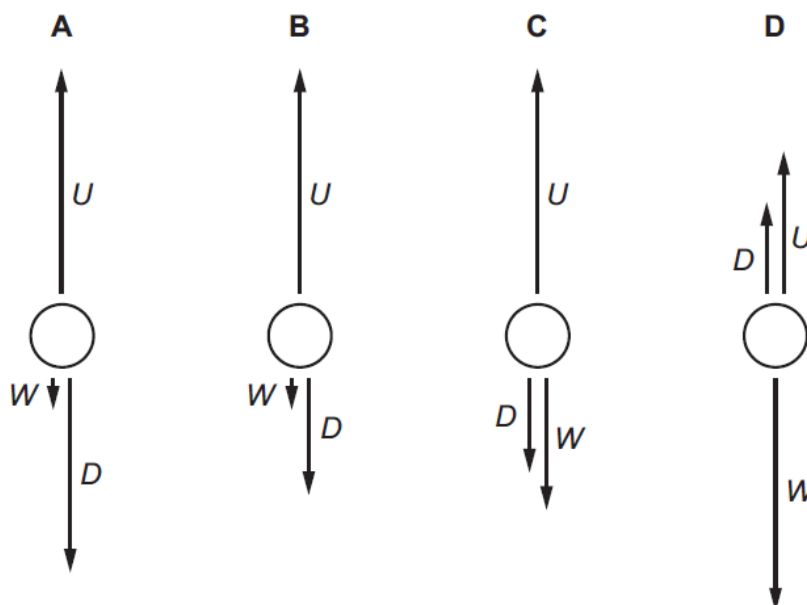
What are the SI base units of the quantity  $\frac{\text{pressure}}{\text{density}}$  ?

- A  $\text{s}^{-2}$                       B  $\text{kg}^2 \text{s}^{-2}$                       C  $\text{kg}^2 \text{m}^2 \text{s}^{-2}$                       D  $\text{m}^2 \text{s}^{-2}$

4. 9702/13/M/J/17/12

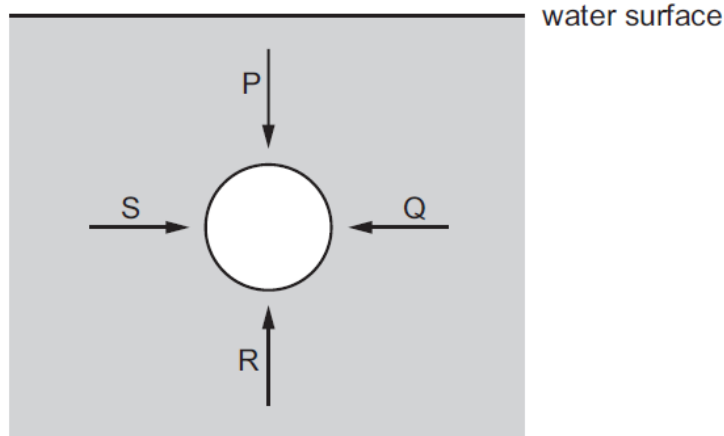
An air bubble is rising through a liquid at a constant speed. The forces on it are the upthrust  $U$ , the viscous drag  $D$  and its weight  $W$ .

Which diagram shows the directions and relative sizes of the forces?



5. 9702/13/M/J/17/13

The diagram represents a sphere under water. P, Q, R and S are forces acting on the sphere due to the pressure of the water.



Each force acts perpendicularly to the sphere's surface. P and R act in opposite directions vertically. Q and S act in opposite directions horizontally.

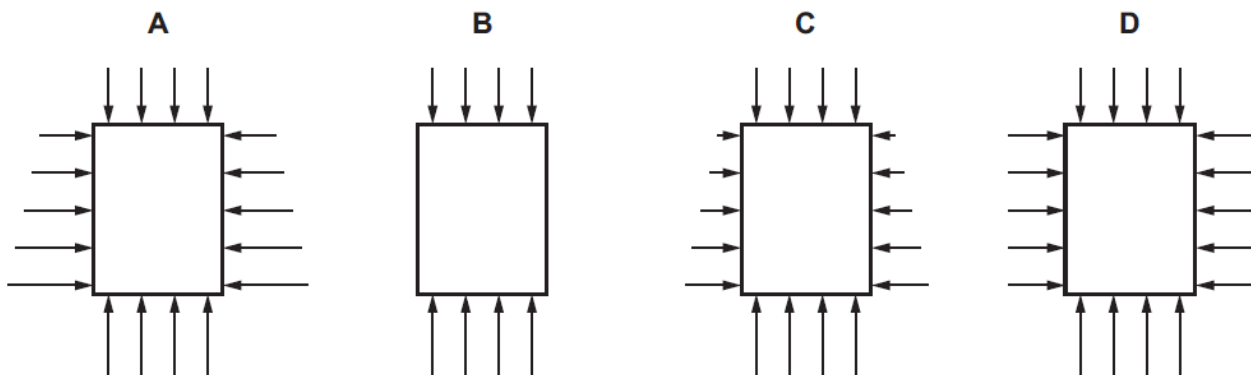
Which information about the magnitudes of the forces is correct?

- A  $P < R$  and  $S = Q$
- B  $P > R$  and  $S = Q$
- C  $P = R$  and  $S = Q$  and  $P < S$
- D  $P = R$  and  $S = Q$  and  $P = S$

6. 9702/11/O/N/17/12

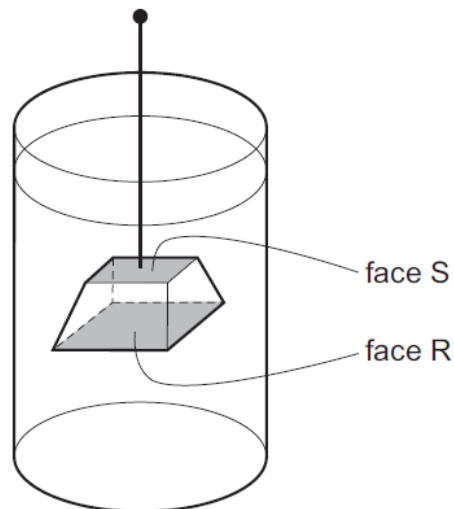
A block is submerged vertically in a liquid. The four diagrams show, to scale, the forces exerted by the liquid on the block.

Which diagram correctly shows a possible situation as viewed from the side?



7. 9702/12/O/N/17/11

The diagram shows a block of copper suspended in water.



The block experiences an upthrust from the water.

Which statement is the basis of an explanation for this upthrust?

- A Copper is more dense than water.
- B The area of face R is greater than the area of face S.
- C The density of water increases with depth.
- D The pressure of water increases with depth.

8. 9702/11/O/N/17/15

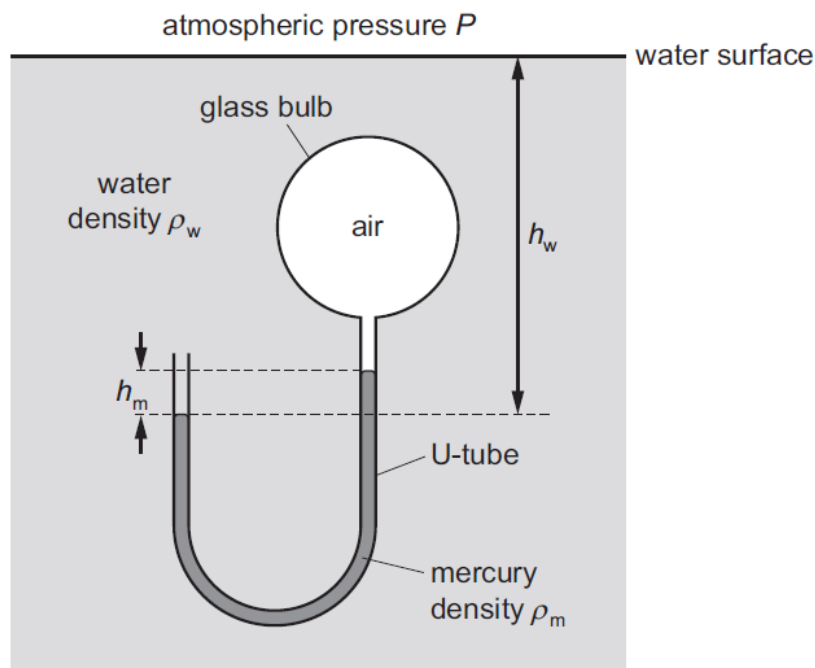
The derivation of the pressure equation  $\Delta p = \rho g \Delta h$  uses a number of relationships between quantities.

Which relationship is **not** used in the derivation of this equation?

- A density =  $\frac{\text{mass}}{\text{volume}}$
- B potential energy = mass  $\times$  acceleration of free fall  $\times$  height
- C pressure =  $\frac{\text{force}}{\text{area}}$
- D weight = mass  $\times$  acceleration of free fall

9. 9702/12/O/N/17/15

Air is trapped inside a glass bulb which is immersed in water and attached to a U-tube containing mercury. The densities of water and mercury are  $\rho_w$  and  $\rho_m$  respectively. The surface of the water is open to the atmosphere where atmospheric pressure is  $P$ .



The acceleration of free fall is  $g$ .

What is the pressure of the air in the glass bulb?

- A  $P + g\rho_w h_w + g\rho_m h_m$
- B  $P + g\rho_w h_w - g\rho_m h_m$
- C  $g\rho_w h_w + g\rho_m h_m$
- D  $g\rho_w h_w - g\rho_m h_m$

10. 9702/13/O/N/17/14

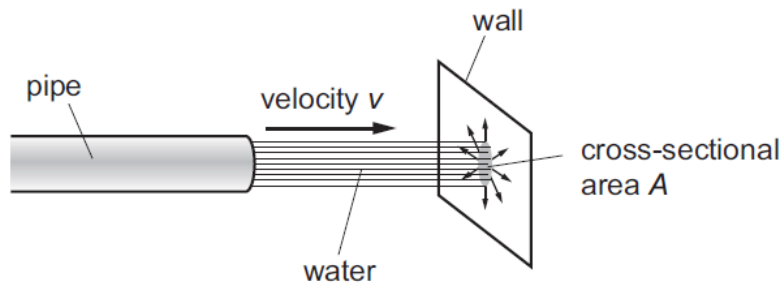
A thin horizontal plate of area  $0.036 \text{ m}^2$  is beneath the surface of a liquid of density  $930 \text{ kg m}^{-3}$ . The force on one side of the plate due to the pressure of the liquid is  $290 \text{ N}$ .

What is the depth of the plate beneath the surface of the liquid?

- A 0.88 m
- B 1.1 m
- C 1.8 m
- D 8.7 m

11. 9702/12/F/M/17/9

Water flows out of a pipe and hits a wall.



When the jet of water hits the wall, it has horizontal velocity  $v$  and cross-sectional area  $A$ .

The density of the water is  $\rho$ . The water does not rebound from the wall.

What is the force exerted on the wall by the water?

A  $\frac{\rho v}{A}$

B  $\frac{\rho v^2}{A}$

C  $\rho Av$

D  $\rho Av^2$

12. 9702/12/F/M/17/15

Which force is caused only by a pressure difference?

A friction

B upthrust

C viscous force

D weight