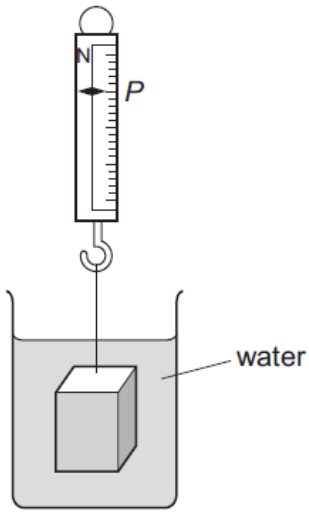
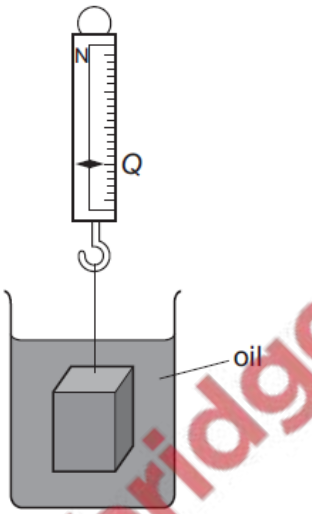
Density and Pressure – 2023 Nov AS Physics 9702

1. Nov/2023/Paper_ 9702/11/No.14

An object of weight W is suspended from a newton meter. When the object is completely immersed in water, the newton meter reads P. When the object is completely immersed in oil, the newton meter reads Q.



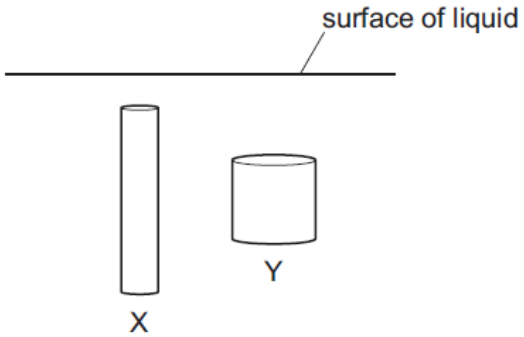


What is the ratio $\frac{\text{density of oil}}{\text{density of water}}$?

A $\frac{W-P}{Q-P}$ **B** $\frac{Q-P}{W-P}$ **C** $\frac{W-P}{W-Q}$ **D** $\frac{W-Q}{W-P}$

2. Nov/2023/Paper_ 9702/12/No.14

Two solid cylindrical objects X and Y are held fully submerged in a liquid, as shown.



The objects have the same volume. The density of the material of Y is twice the density of the material of X. Both objects are stationary.

Which statement is correct?

A The force due to the liquid acting on the top surface of X is greater than that acting on the top surface of Y.

B The pressure difference due to the liquid between the top and bottom surfaces of X is the same as that for Y.

C The upthrust acting on X is the same as the upthrust acting on Y.

D The weight of X is the same as the weight of Y.

3. Nov/2023/Paper_ 9702/13/No.14

Which expression for pressure is correct?

A force per unit area

B mass per unit area

C mass per unit volume

D weight per unit volume

4. Nov/2023/Paper_ 9702/13/No.13

Full-fat milk is made up of fat-free milk mixed with fat.

A volume of $1.000 \times 10^{-3}\,m^3$ of full-fat milk has a mass of 1.035 kg. It contains 4.00% fat by volume.

The density of fat-free milk is $1.040 \times 10^{3}\,kg\,m^{-3}$.

What is the density of fat?

A $1.25 \times 10^{2}\,kg\,m^{-3}$

B $9.15 \times 10^{2}\,kg\,m^{-3}$

C $9.28 \times 10^{2}\,kg\,m^{-3}$

D $1.16 \times 10^{3}\,kg\,m^{-3}$

5. Nov/2023/Paper_ 9702/22/No.2(a)

A high-altitude balloon is stationary in still air. A solid sphere is suspended from the balloon by a string, as shown in Fig. 2.1.

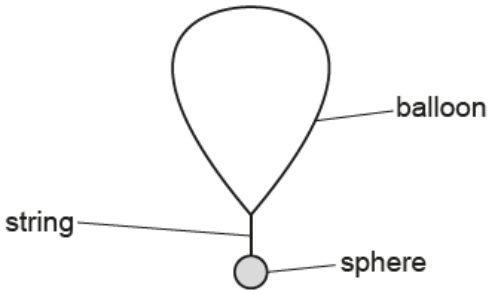


Fig. 2.1 (not to scale)

The volume of the balloon is 7.5 m^3. The total weight of the balloon, string and sphere is 65 N. The upthrust acting on the string and sphere is negligible.

(a) Calculate the density of the air surrounding the balloon.

density = ... $kg\,m^{-3}$ [2]

6. Nov/2023/Paper_ 9702/23/No.3(b)

(b) Fig. 3.1 shows an airship in flight. The airship is propelled by identical fans that can be angled to control the motion of the airship.

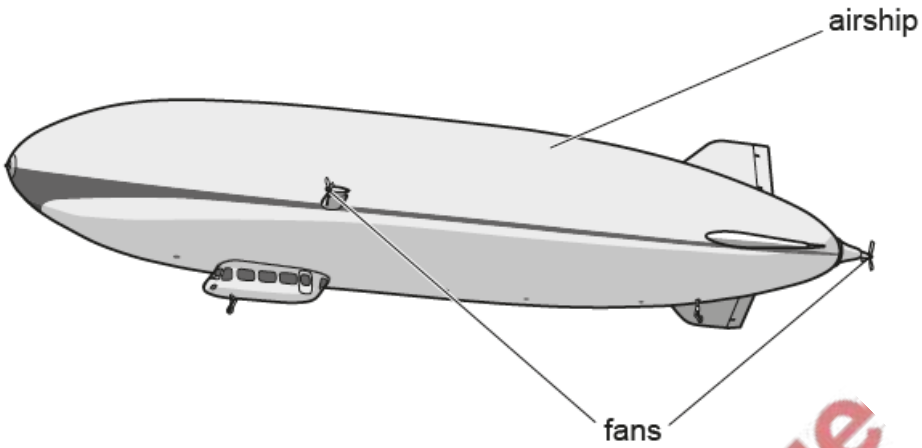


Fig. 3.1

The upthrust on the airship is 93 000 N.
The density of the surrounding air is 1.2 kg m^{-3}.

(i) Calculate the volume of air displaced by the airship.

volume = ... m^3 [1]

(ii) When fully loaded, the weight of the airship is greater than the upthrust.
To maintain horizontal flight, the fans provide a total vertical force of 3.0×10^3 N upwards on the airship.

Calculate the mass of the airship.

mass = ... kg [2]