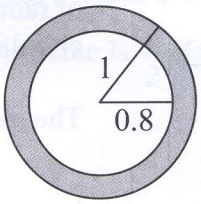
9. (a) State the Principle of Archimedes.

2010

A buoy in the form of a hollow spherical shell of external radius 1 m and internal radius 0.8 m floats in water with 61% of its volume immersed.



Find the density of the material of the shell.

Principle of Archimedes — 5

$$B = \rho V g$$

$$= 1000\left\{\frac{61}{100}\left(\frac{4}{3}\pi(1)^3\right)\right\}g \quad \text{— 5}$$

$$= 610\left(\frac{4}{3}\pi\right)g$$

$$W = \rho V g$$

$$= \rho\left\{\frac{4}{3}\pi(1)^3 - \frac{4}{3}\pi(0.8)^3\right\}g \quad \text{— 5}$$

$$= 0.488\rho\left(\frac{4}{3}\pi\right)g$$

$$W = B$$

$$0.488\rho\left(\frac{4}{3}\pi\right)g = 610\left(\frac{4}{3}\pi\right)g \quad \text{— 5}$$

$$\rho = \frac{610}{0.488} = 1250 \text{ kg m}^{-3} \quad \text{— 5}$$

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