$\rho = \frac{m}{V}\left[\frac{kg}{m^3}\right]; \rho_{Al} = 2{,}700\frac{kg}{m^3}$ if $m = 10\,kg$ $V = ?$

$r = ?$

15. SOLVE The volume of the sphere is:

Brou $\rho = \frac{m}{V}$ →

$$V = \frac{m}{\rho} = \frac{(10\text{ kg})}{(2700\text{ kg/m}^3)} = 3.7 \times 10^{-3}\text{ m}^3$$

From the formula for the volume of sphere we can then calculate its radius:

$$V = \tfrac{4\pi}{3}r^3$$

$$r = \sqrt[3]{\frac{3V}{4\pi}} = 9.6\text{ cm}$$

The correct answer is (d).

REFLECT We could probably have gotten the correct answer with a simple estimate. A 10-cm cube of aluminum has a volume of 1 L and would weigh 2.7 kg. A sphere with a 10 cm radius contains approximate four 10-cm cubes, or approximate 10 kg.

$V_{H_2O} = ?$ to have the mass of 1L gasoline

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28.ORGANIZE AND PLAN With the density of gasoline from Table 10.1 we can calculate the mass of 1 L of gasoline. Then, with the density of water we can calculate the volume of water with this mass.

Known: $V_{\text{gasoline}} = 1\text{ L}$; $\rho_{\text{gasoline}} = 680\text{ kg/m}^3$; $\rho_{\text{water}} = 1000\text{ kg/m}^3$. → 10^{-3} m^3

$\rho = \frac{m}{V} \rightarrow m = \rho \cdot V$

SOLVE The mass of 1.0 L of gasoline is:

$\rho = \frac{m}{V}$ →

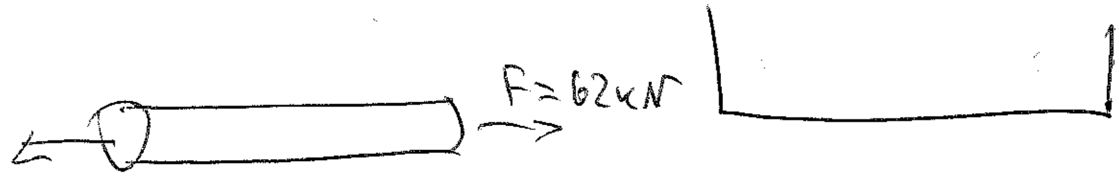
$$m = V_{\text{gasoline}}\rho_{\text{gasoline}} = (1\text{ L})(680\text{ kg/m}^3) = 0.7\text{ kg}$$

The volume of 0.7 kg of water is:

$\rho = \frac{m}{V}$ →

$$V_{\text{water}} = \frac{m}{\rho_{\text{water}}} = \frac{(0.7\text{ kg})}{(1000\text{ kg/m}^3)} = 0.7\text{ L}$$

REFLECT Gasoline floats on top of water. This can make it difficult to extinguish a gasoline fire.



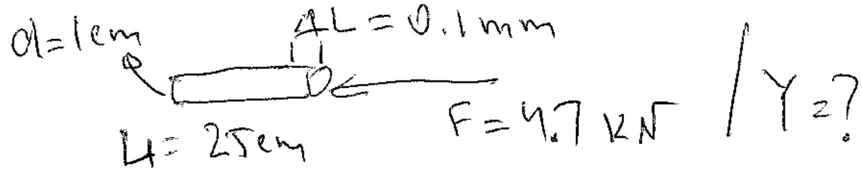
$R = 9.5\,mm$ | stress = ?

$L = 81\,cm$ | $\Delta L = ?$ $Y = 2.10^{11}\,N/m^2 \rightarrow$ steel

$$\text{stress} = \frac{F}{A} = \frac{F}{\pi r^2} = \frac{6.2 \times 10^4\,N}{\pi\,(9.5 \times 10^{-3}\,m)^2} = 2.2 \times 10^8\,N/m^2$$

$$\Delta L = \frac{(F/A) \cdot L}{Y} = 0.89\,mm \quad ; \quad \frac{F}{A} = \frac{\Delta L}{L} \cdot Y$$

$$\frac{\Delta L}{L} = 0.11\,\%$$



16. **SOLVE** Equation 10.1 relates stress and strain:

$$\frac{F}{A} = Y\frac{\Delta L}{L}$$

Rewrite this equation to calculate the Young's modulus:

$$Y = \frac{F}{A}\frac{L}{\Delta L} = \frac{F}{\frac{\pi}{4}d^2}\frac{L}{\Delta L} = \frac{(4.7\ \text{kN})}{\frac{\pi}{4}(1.0\ \text{cm})^2}\frac{(25\ \text{cm})}{(0.10\ \text{mm})} = 15\times10^{10}\ \text{N/m}^2$$

$1K = 10^3$

$1cm = 10^{-2}m$

$1mm = 10^{-3}m$