

9. The Mariana trench is located in the floor of the Pacific Ocean at a depth of about 11 000 m below the surface of the water. The density of seawater is 1025 kg/m^3 . **(a)** If an underwater vehicle were to explore such a depth, what force would the water exert on the vehicle's observation window (radius = 0.10 m)? **(b)** For comparison, determine the weight of a jetliner whose mass is $1.2 \times 10^5 \text{ kg}$.

$$F = (\Delta P)A = (P_{\text{outside}} - P_{\text{inside}})A$$

We will assume inside is 1 atm or $1.01 \times 10^5 \text{ N/m}^2$

$$P_{\text{outside}} = \rho g d = (1025 \text{ kg/m}^3)(9.80 \text{ m/s}^2)(11\,000 \text{ m}) = 1.105 \times 10^8 \text{ N/m}^2$$

$$F = (P_{\text{outside}} - P_{\text{inside}})A = (P_{\text{outside}} - P_{\text{inside}})\pi R^2$$

$$F = (P_{\text{outside}} - P_{\text{inside}})\pi R^2 = (1.105 \times 10^8 \text{ N/m}^2 - 1.01 \times 10^5 \text{ N/m}^2)\pi(0.10 \text{ m})^2$$

$$F = (1.104 \times 10^8 \text{ N/m}^2)(3.1416 \times 10^{-2} \text{ m}^2) = 3.468 \times 10^6 \text{ N}$$

$$W = mg = (1.2 \times 10^5 \text{ kg})(9.80 \text{ m/s}^2) = 1.176 \times 10^6 \text{ N}$$

$F = 3.5 \times 10^6 \text{ N}$ $W = 1.2 \times 10^6 \text{ N}$
--

Dr. Donovan's Classes
Page

Dr. Donovan's PH 201
Homework Page

NMU Physics
Department Web Page

NMU Main Page

Please send any comments or questions about this page to ddonovan@nmu.edu

This page last updated on November 20, 2021