Chapter 12
In a complete sentence be able to define pressure as force per unit area. \( P = \frac{F}{A} \)
Be able to state the units of pressure as Pascal, Pa, or \( \text{N} / \text{m}^2 \), in SI units and as \( \text{lb} / \text{ft}^2 \) in English units.
Be able to determine the direction of the force exerted on a surface by a pressure as in the direction perpendicular to the surface.
Be able to solve simple problems involving pressure, force and area.
Be able to determine the change in the pressure in a fluid with a change in the vertical position \( y \). \( \Delta P = \rho \Delta y \)
Be able to solve simple problems relating the change in pressure \( \Delta P \), the density \( \rho \), the acceleration of gravity \( g \), and the change in vertical position \( \Delta y \).
Be able to calculate the pressure at a point \( y \) below the surface of a liquid when the top is at atmospheric pressure \( P_o \).
\( P = P_o + \rho g y \) where \( P_o = 101,300 \text{ Pa} = 14.7 \text{ lb} / \text{in}^2 \) is the pressure of the atmosphere at sea level.
Be able to explain why pressure does not depend on the shape of the container.
Be able to explain what buoyant force is and how it comes about. Increased pressure on the bottom of an object pushes up on it with a greater force than the pressure at the top of the object that is immersed in a fluid.
Be able to state Archimedes’ Principle - An upward buoyant force acts upward on a body in a fluid that is equal to the weight of the fluid displaced by the body.
Be able to solve simple problems relating the buoyant force, the density of the fluid, the acceleration of gravity and the volume of fluid displaced. \( F_B = \rho g V \)
Be able to explain how a metal boat is able to float in water.
Be able to compare the volume of fluid displaced when an object is floating as compared to the volume of fluid displaced when it is immersed. i.e. metal on a barge compared to metal in the water.
Be able to state Pascal’s Principle - A change in pressure applied at any point in a fluid is transmitted equally and undiminished in all directions.
Be able to explain how a hydraulic jack works.
Be able to determine the ideal mechanical advantage of a hydraulic jack. \( \text{IMA} = \frac{A_{\text{out}}}{A_{\text{in}}} \)
Be able to solve simple problems with hydraulic jacks relating the output force \( F_{\text{out}} \), the input force \( F_{\text{in}} \), the output area \( A_{\text{out}} \) and the input area \( A_{\text{in}} \) assuming a 100% efficient machine.
Be able to describe and explain surface tension and give simple examples of the phenomenon.
Be able to explain what is meant by adhesion and cohesion.
Be able to explain capillary action in terms of adhesion and cohesion.