1.26. A certain object weighs 300 N at the earth's surface. Determine the mass of the object (in kilograms) and its weight (in newtons) when located on a planet with an acceleration of gravity equal to 4.0 ft/s².

1.47. One type of capillary-tube viscometer is shown in Video V1.5 and in Fig. P1.47. For this device the liquid to be tested is drawn into the tube to a level above the top etched line. The time is then obtained for the liquid to drain to the bottom etched line. The kinematic viscosity, \( \nu \), in m²/s is then obtained from the equation \( \nu = KR^4t \) where \( K \) is a constant, \( R \) is the radius of the capillary tube in mm, and \( t \) is the drain time in seconds. When glycerin at 20 °C is used as a calibration fluid in a particular viscometer, the drain time is 1430 s. When a liquid having a density of 970 kg/m³ is tested in the same viscometer the drain time is 900 s. What is the dynamic viscosity of this liquid?

1.63 A 25-mm-diameter shaft is pulled through a cylindrical bearing as shown in Fig. P1.63. The lubricant that fills the 0.3-mm gap between the shaft and bearing is an oil having a kinematic viscosity of \( 8.0 \times 10^{-4} \) m²/s and a specific gravity of 0.91. Determine the force \( P \) required to pull the shaft at a velocity of 3 m/s. Assume the velocity distribution in the gap is linear.

1.65 A layer of water flows down an inclined fixed surface with the velocity profile shown in Fig. P1.65. Determine the magnitude and direction of the shearing stress that the water exerts on the fixed surface for \( U = 2 \) m/s and \( h = 0.1 \) m.
1.69 A pivot bearing used on the shaft of an electrical instrument is shown in Fig. P1.69. An oil with a viscosity of $\mu = 0.010$ lb.s/ft$^2$ fills the 0.001-in. gap between the rotating shaft and the stationary base. Determine the frictional torque on the shaft when it rotates at 5,000 rpm.

![Diagram of pivot bearing and oil film](image)

2.21 Bourdon gages (see Video V2.3 and Fig. 2.13) are commonly used to measure pressure. When such a gage is attached to the closed water tank of Fig. P2.21 the gage reads 5 psi. What is the absolute air pressure in the tank? Assume standard atmospheric pressure of 14.7 psi.

![Diagram of Bourdon gage and water tank](image)
2.35 The cylindrical tank with hemispherical ends shown in Fig. P2.35 contains a volatile liquid and its vapor. The liquid density is 800 kg/m³, and its vapor density is negligible. The pressure in the vapor is 120 kPa (abs), and the atmospheric pressure is 101 kPa (abs). Determine: (a) the gage pressure reading on the pressure gage; and (b) the height, \( h \), of the mercury manometer.

2.42 Determine the pressure of the water in pipe \( A \) shown in Fig. P2.42 if the gage pressure of the air in the tank is 2 psi.

2.58 A structure is attached to the ocean floor as shown in Fig. P2.58. A 2-m-diameter hatch is located in an inclined wall and hinged on one edge. Determine the minimum air pressure, \( p_1 \), within the container that will open the hatch. Neglect the weight of the hatch and friction in the hinge.
2.61 A homogeneous, 4-ft-wide, 8-ft-long rectangular gate weighing 800 lb is held in place by a horizontal flexible cable as shown in Fig. P2.61. Water acts against the gate which is hinged at point A. Friction in the hinge is negligible. Determine the tension in the cable.

2.72 A rectangular gate that is 2 m wide is located in the vertical wall of a tank containing water as shown in Fig. P2.72. It is desired to have the gate open automatically when the depth of water above the top of the gate reaches 10 m. (a) At what distance, \( d \), should the frictionless horizontal shaft be located? (b) What is the magnitude of the force on the gate when it opens?

2.84 The 18-ft-long gate of Fig. P2.84 is a quarter circle and is hinged at H. Determine the horizontal force, \( P \), required to hold the gate in place. Neglect friction at the hinge and the weight of the gate.
2.88 The homogeneous gate shown in Fig. P2.88 consists of one quarter of a circular cylinder and is used to maintain a water depth of 4 m. That is, when the water depth exceeds 4 m, the gate opens slightly and lets the water flow under it. Determine the weight of the gate per meter of length.

![Diagram of homogeneous gate](image)

2.104 A 1-m-diameter cylindrical mass, $M$, is connected to a 2-m-wide rectangular gate as shown in Fig. P2.104. The gate is to open when the water level, $h$, drops below 2.5 m. Determine the required value for $M$. Neglect friction at the gate hinge and the pulley.

![Diagram of gate and cylindrical mass](image)