Answer on Question #72490-Physics-Mechanics-Relativity

The surface pressure on Venus is 92.00 atm, and the acceleration due to gravity there is 0.894 g. In a future exploratory mission, an upright cylindrical tank of benzene is sealed at the top but still pressurized at 92.00 atm just above the benzene. The tank has a diameter of 1.57 m , and the benzene column is 11.90 m tall. Ignore any effects due to the very high temperature on Venus.

What total force is exerted on the inside surface of the bottom of the tank?

Express your answer using four significant figures.

Solution

The pressure on the surface of the bottom of the tank is

$$p = p_o + \rho g h.$$

The total force is exerted on the inside surface of the bottom of the tank is

$$F = pA = \frac{\pi d^2}{4} p = \frac{\pi d^2}{4} (p_o + \rho g h)$$

$$F = \frac{\pi 1.57^2}{4} \left(92.00 \cdot 101325 + 876.5(0.894 \cdot 9.81)(11.90)\right) = 18.22\ MN.$$

Answer: 18.22 MN.