Saylor Foundation's
ME 103 Assessment 1: Guide to Responding

Instructions: Please answer each of the following questions to the best of your ability.

Questions

1. What are the important features of a property?

2. Define 1 standard atmosphere (atm) in SI unit.

3. Determine the force needed to lift up an 1 kg object.

4. A U-tube manometer filled with mercury is used to measure the pressure drop of air flow in a pipe. Estimate the pressure drop if the manometer shows a deflection of 5 mm. The density of mercury is 13.6 10^3 kg/m^3.

5. What would be the change in the temperature of 1 kg of metal at the foot of a fall from an altitude of 5000 m above ground level, assuming that no energy is lost during the fall? The specific heat of the metal is 100 kJ/kg.

6. What are the common types of pressures that one often comes across?

Solutions:

1. At a particular state of the system, a property should be finite and well-defined, irrespective of how the system was brought to the state.

2.1 atm = 1.01325 10^5 N/m^2

3. F = m x g = 1 kg x 9.8 m/s^2 = 9.8 m/s^2.

4. The pressure drop ΔP is measured by the difference in the heights of the mercury columns (deflection Δh) in the manometer as follows:
ΔP = ρ g Δh = 666 Pa.

5. During the fall, potential energy of the metal is converted to thermal energy if no energy is lost during the fall. In other words, potential energy = heat to increase temperature of the metal.
Hence, m.g.h = m.Cv. ΔT, or ΔT = g.h/Cv= 9.8 x 5000/ 100 e3 = 0.49 K. Change in temperature of metal is ~ 0.5 degree Kelvin.

6. There are four types of pressures that one often comes across: atmospheric, absolute, gauge and vacuum.