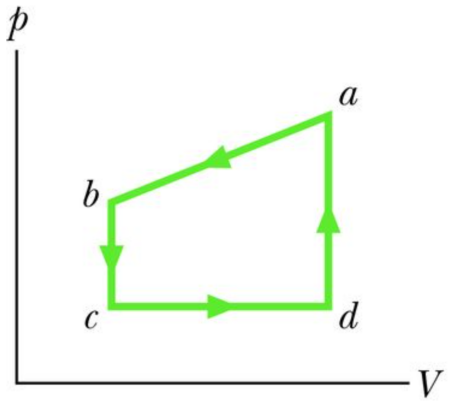
General Physics B1 - Homework Set 5

Due on 01/03/2023, 5:00PM sharp. Please hand in your homework via eLearn.

1 points for each problem. Total:5 points

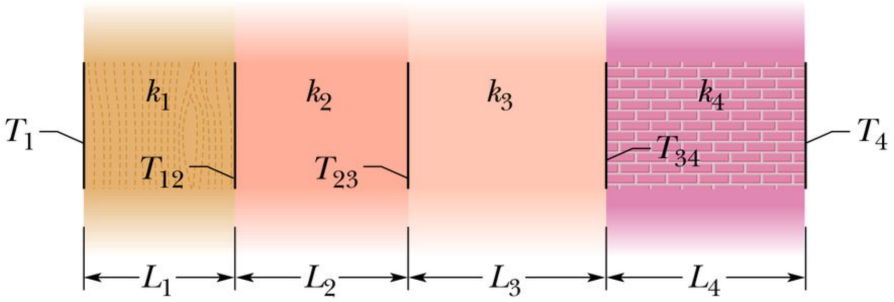
1. The First Law of Thermodynamics

The bottom figure represents a closed cycle for a gas (the figure is not drawn to scale). The change in the internal energy of the gas as it moves from a to c along the path abc is -200 J. As it moves from c to d, 180 J must be transferred to it as heat. An additional transfer of 80 J to it as heat is needed as it moves from d to a. How much work is done on the gas as it moves from c to d?



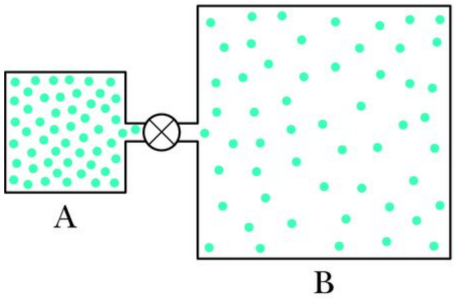
2. Thermal Conduction of Multilayer Insulation

As in the figure, a wall consisting of four layers, with thermal conductivities k1 = 0.060 W/m·K, k3 = 0.040 W/m·K, and k4 = 0.12 W/m·K (k2 is not known). The layer thicknesses are L1 = 1.5 cm, L3 = 2.8 cm, and L4 = 3.5 cm (L2 is not known). The known temperatures are T1 = 30°C, T12 = 25°C, and T4 = -10°C. Energy transfer through the wall is steady. What is interface temperature T34?



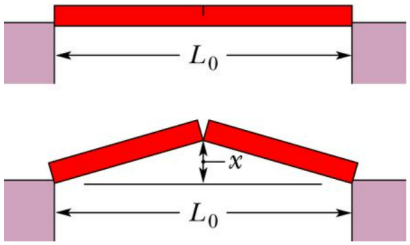
3.Ideal Gas

Container A in the following figure holds an ideal gas at a pressure of 5.0×10^5 Pa and a temperature of 300 K. It is connected by a thin tube (and a closed valve) to container B, with four times the volume of A. Container B holds the same ideal gas at a pressure of 1.0×10^5 Pa and a temperature of 400 K. The valve is opened to allow the pressures to equalize, but the temperature of each container is maintained. What then is the pressure?



4. Thermal expansion

As a result of a temperature rise of 32 C°, a bar with a crack at its center buckles upward as shown in the following figure. The fixed distance L0 is 3.77 m and the coefficient of linear expansion of the bar is 25 × 10-6/C°. Find the rise x of the center.



5. The Adiabatic and Isothermal Expansion of an Ideal Gas

The following figure, shows two paths that may be taken by a gas from an initial point i to a final point f. Path 1 consists of an isothermal expansion (work is 50 J in magnitude), an adiabatic expansion (work is 40 J in magnitude), an isothermal compression (work is 30 J in magnitude), and then an adiabatic compression (work is 25 J in magnitude). What is the change in the internal energy of the gas if the gas goes from point i to point f along path 2?