Chapter 17 Problem 36 †

Given
$V_1 = 8.0\ L$
$T_1 = 20\ °C = 293\ K$
$P_1 = 1\ atm$
$P_2 = 0.65\ atm$
$T_2 = -10\ °C = 263\ K$

Solution
Find the volume at the new altitude.

Notice that the temperatures are converted into absolute temperature (kelvin scale). Begin with the ideal gas law.

$$PV = nRT$$

Assuming there is no loss of gas.

$$\frac{PV}{T} = nR = \text{constant}$$

Therefore,

$$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$$

Solving for the final volume gives

$$V_2 = \frac{P_1V_1T_2}{P_2T_1}$$

$$V_2 = \frac{(1\ atm)(8.0\ L)(263\ K)}{(0.65\ atm)(293\ K)} = 11.0\ L$$

†Problem from Essential University Physics, Wolfson