

## BoxSand Thermodynamics Ideal Gas Quantitative Problems

*Thermodynamics.Ideal-Gas.QP.BS.1:* An ideal gas at a temperature of  $19.2^{\circ}\text{C}$  and a pressure of  $6.72 \times 10^5 \text{ Pa}$  occupies a volume of  $3.41 \text{ m}^3$ . a) How many moles of gas are present? b) If the volume is increased to  $5.27 \text{ m}^3$  and the temperature is increased to  $32.5^{\circ}\text{C}$ , what will the pressure of the gas be?

*Thermodynamics.Ideal-Gas.QP.BS.2:* A boat's diesel engine has a piston that compresses air at  $299\text{K}$  to a volume that is one-tenth of the original volume and 36 times the original pressure. What is the temperature of the air after the compression?

*Thermodynamics.Ideal-Gas.QP.BS.3:* Two thermally insulated pipes are connected by a valve that is initially closed. Each pipe contains helium gas. The first, smaller pipe has the following conditions:  $P_1 = 4.0 \times 10^5 \text{ Pa}$ ,  $T_1 = 200\text{K}$  and  $V_1 = 2.2 \text{ m}^3$ . The second, larger pipe has the following conditions:  $P_2 = 1.0 \times 10^5 \text{ Pa}$ ,  $T_2 = 520\text{K}$  and  $V_2 = 6.0 \text{ m}^3$ . When the valve is open, the contents of the two pipes mix, and the pressure becomes constant throughout. a) What is the final temperature? Ignore any change in temperature of the pipes themselves. (*Hint: the heat gained by the gas in one pipe is equal to the heat lost in the other*). b) What is the final pressure?