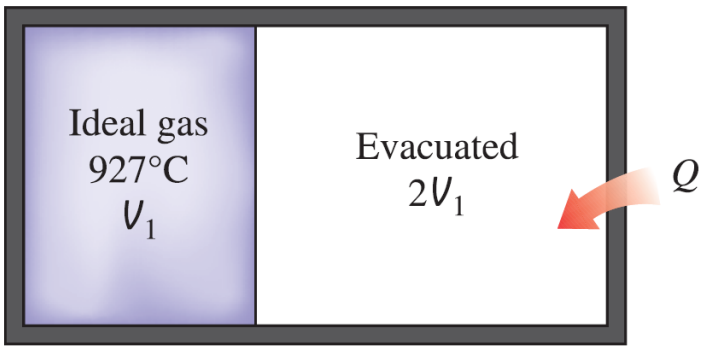
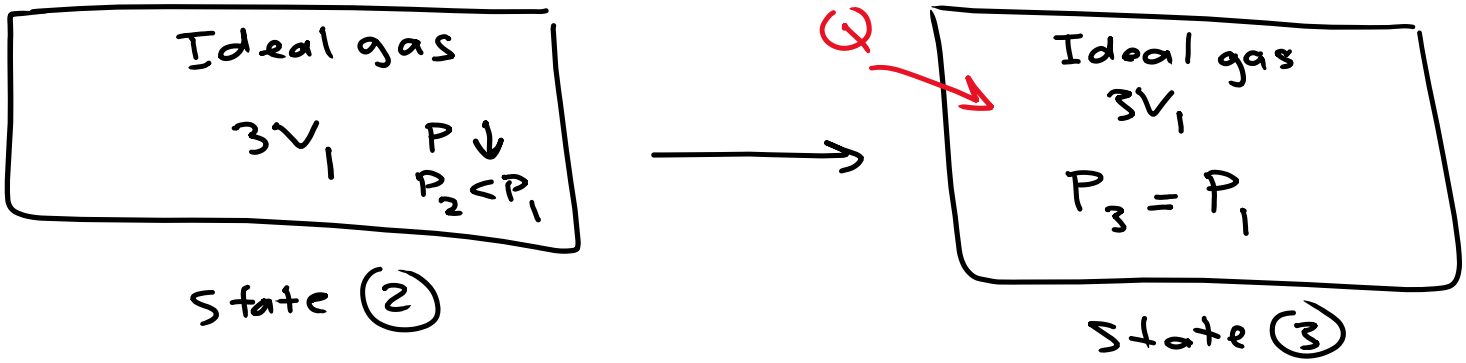
3–78 A rigid tank whose volume is unknown is divided into two parts by a partition. One side of the tank contains an ideal gas at 927°C. The other side is evacuated and has a volume twice the size of the part containing the gas. The partition is now removed and the gas expands to fill the entire tank. Heat is now transferred to the gas until the pressure equals the initial pressure. Determine the final temperature of the gas. *Answer:* 3327°C



State (1)



State (2)

State (3)

Find T_3:

Let's try to apply the ideal gas equation of state at state (3): $P_3 V_3 = m R T_3$ — (A)

Since $P_3 = P_1$, let's apply the ideal gas EOS at state (1)

$$P_1 V_1 = m R T_1 \quad \text{—— (B)}$$

Divide eqn. (A) by eqn. (B):

$$\frac{P_3 V_3}{P_1 V_1} = \frac{m R T_3}{m R T_1} \rightarrow \frac{V_3}{V_1} = \frac{T_3}{T_1}$$

$$\rightarrow \frac{3V_1}{V_1} = \frac{T_3}{T_1} \rightarrow \frac{T_3}{T_1} = 3$$

$$T_3 = 3T_1 = 3 \times (927 + 273)$$

$T_3 =$ [ ] K