6. (a) Isothermal means that the temperature remains constant during the process. ON a graph with temperature plotted along the vertical axis, this means that the points representing that process must lie on a horizontal line (all corresponding to a single value of T). Therefore, process AE is isothermal. This conclusion does not depend on the nature of the material (that is, AE is isothermal irrespective of this substance being a monatomic ideal gas).

   (b) Isobaric means that the pressure stays constant during the process. Knowing that this is an ideal gas, and assuming (as usual) that n stays constant during the process, then the gas law in ratio form (see Sample Problem 20-1) leads to

$$\frac{T_f}{T_i} = \frac{V_f}{V_i} = 2 \qquad \text{(see Figure 21-21)} .$$

   Consequently, we see that process AC is isobaric for this ideal gas. That it should be linear is implied by the simple proportionality between T and V shown above.

   (c) For a monatomic gas, $\gamma = 5/3$ (see the discussion in Chapter 20). Therefore,

$$T_f = T_i \left(\frac{V_i}{V_f}\right)^{\gamma-1} = T_0 \left(\frac{1}{2}\right)^{2/3} = 0.63T_0$$

   which implied process AF is adiabatic.

   (d) Since $\ln(x)$ is positive for all $x > 1$, then Eq. 21-4 makes it clear that all processes (with the possible exception of AF) have $\Delta S > 0$. We assume process AF to be reversibly adiabatic, in which case Eq. 21-1 gives $\Delta S = 0$ (since $Q = 0$ for the process, or any small portion of the process); in fact, if AF represented (in some sense) an irreversible process which generated entropy, then we would still end up with the overall conclusion that none of the processes shown are accompanied by an entropy decrease.