

74. The work (the “area under the curve”) for process 1 is  $4p_iV_i$ , so that  $U_b - U_a = Q_1 - W_1 = 6p_iV_i$  by the First Law of Thermodynamics.

(a) Path 2 involves more work than path 1 (note the triangle in the figure of area  $\frac{1}{2}(4V_i)(p_i/2) = p_iV_i$ ). With  $W_2 = 4p_iV_i + p_iV_i = 5p_iV_i$ , we obtain

$$Q_2 = W_2 + U_b - U_a = 5p_iV_i + 6p_iV_i = 11p_iV_i \quad .$$

(b) Path 3 starts at  $a$  and ends at  $b$  so that  $\Delta U = U_b - U_a = 6p_iV_i$ .