

**Mark scheme for Support Worksheet – Topic 3,  
Worksheet 3**

- 1 The work done is the area under the curve; i.e.  
$$W = \frac{(6.0 + 3.0) \times 10^6}{2} \times (8.0 - 2.0) \times 10^{-4} = 2700 \text{ J} \quad [2]$$
- 2 From  $\frac{p_1 V_1}{n_1 T_1} = \frac{p_2 V_2}{n_2 T_2}$  and cancelling out terms that remain constant we see that  
$$\frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2} \text{ i.e. } \frac{6.0 \times 10^6 \times 2.0 \times 10^{-4}}{600} = \frac{3.0 \times 10^6 \times 8.0 \times 10^{-4}}{T_2} \Rightarrow T_2 = 1200 \text{ K} \quad [1]$$
- 3  $Q = \Delta U + W$  and  $W > 0$  (gas expands) and  $\Delta U > 0$  (temperature increases); so  $Q > 0$  so heat is provided. [2]
- 4 The entropy of the universe always increases. [1]
- 5 **a** Energy is removed from the water; and so its entropy decreases. [2]
- b** The energy removed from the water is deposited in the surroundings increasing the entropy of the surroundings; by an amount that is bigger than the decrease of the water. [2]