

entropy [23 marks]

1. A block of ice at 0°C is placed on a surface and allowed to melt completely to give water at 0°C . During this process the entropy of the [1 mark]
- A. molecules in the block has decreased.
 - B. surroundings has increased.
 - C. universe has increased.
 - D. universe has decreased.
2. Which of the following can be deduced from the second law of thermodynamics? [1 mark]
- A. Thermal energy cannot spontaneously transfer from a low temperature region to a high temperature region.
 - B. Thermal energy cannot spontaneously transfer from a high temperature region to a low temperature region.
 - C. The entropy of an isolated system always decreases with time.
 - D. The entropy of an isolated system is the measure of the internal energy of the system.
3. Which process will increase the entropy of the local surroundings? [1 mark]
- A. The melting of a block of ice
 - B. Evaporation of water vapour
 - C. The isothermal expansion of a gas
 - D. The adiabatic expansion of a gas

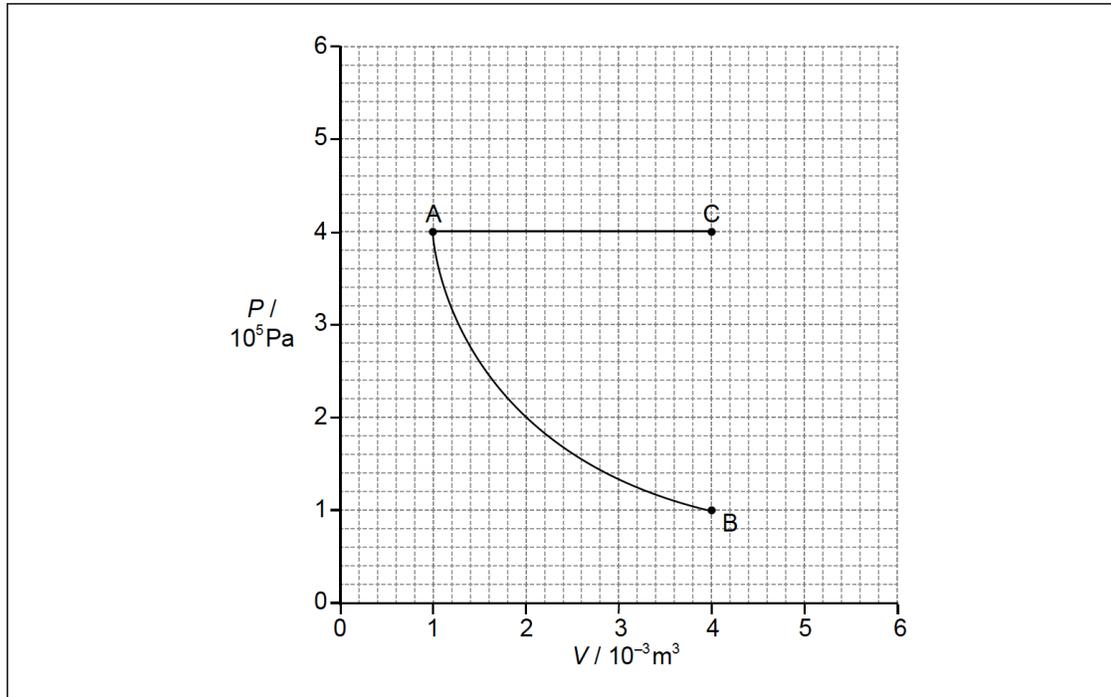
4. A piece of ice melts at constant temperature. Which of the following gives the correct change in the entropy of the water molecules and that of the surroundings? [1 mark]

	entropy of water molecules	entropy of surroundings
A.	increases	decreases
B.	decreases	decreases
C.	increases	increases
D.	decreases	increases

5. Which of the following correctly describes the entropy changes of the water molecules [1 mark] and the universe when a sample of water freezes?

	Water molecules	Universe
A.	increases	increases
B.	decreases	increases
C.	increases	decreases
D.	decreases	decreases

A fixed mass of an ideal monatomic gas undergoes an isothermal change from A to B as shown.



The temperature at A is 350 K. An identical mass of the same ideal monatomic gas undergoes an isobaric change from A to C.

- 6a. (i) Calculate the temperature at C. [6 marks]
- (ii) Calculate the change in internal energy for AC.
- (iii) Determine the energy supplied to the gas during the change AC.
- (iv) On the graph, draw a line to represent an adiabatic expansion from A to a state of volume $4.0 \times 10^{-3} \text{m}^3$ (point D).

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- 6b. (i) State the change in entropy of a gas for the adiabatic expansion from A to D. [4 marks]
- (ii) Explain, with reference to the concept of disorder, why the entropy of the gas is greater at C than B.

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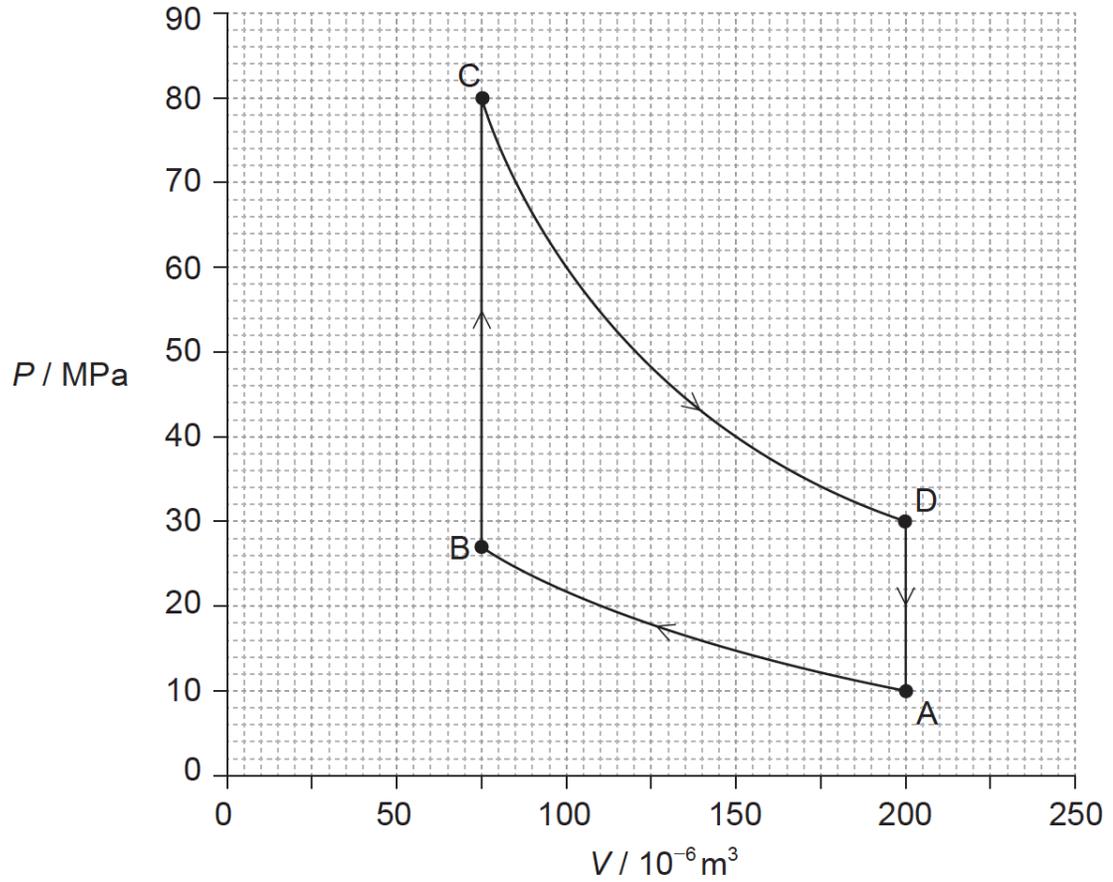
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This question is about an ideal gas cycle.

The P - V diagram shows a cycle ABCDA for a fixed mass of an ideal gas.



7a. Estimate the total work done in the cycle.

[3 marks]

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7b. The change **AB** is isothermal and occurs at a temperature of 420K. Calculate the number of moles of gas.

[3 marks]

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7c. Identify and explain the change, if any, in the entropy of the gas when it has completed [2 marks] one cycle.

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