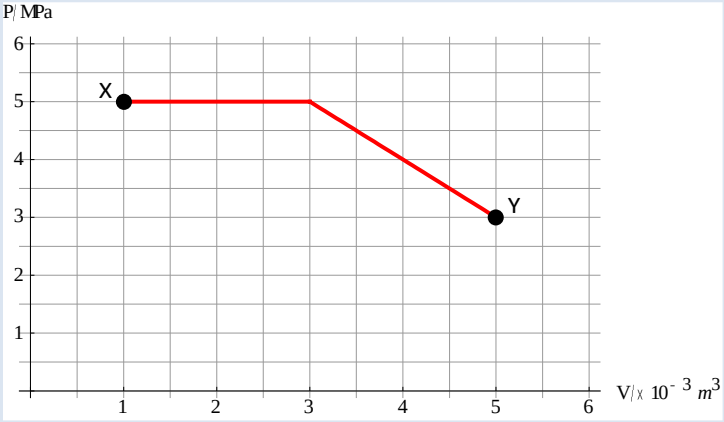
Quiz B10

Thermodynamics HL

1. A rapidly moving piston compresses a gas in an insulated container. The temperature of the gas increases. What is a microscopic and what is a macroscopic explanation of this observation?

	Microscopic	Macroscopic
A	Molecules gain kinetic energy through collisions with the piston	Work is being done by the gas
B	Molecules gain kinetic energy through collisions with the piston	Work is being done on the gas
C	Molecules gain kinetic energy because they are closer together and so the forces between them increase	Work is being done by the gas
D	Molecules gain kinetic energy because they are closer together and so the forces between them increase	Work is being done on the gas

2. The graph shows the variation with volume of an ideal gas, of the pressure of the gas.



What is the work done by the gas during the expansion from X to Y?

A 6.0 kJ **B** 18 kJ **C** 20 kJ **D** 28 kJ

3. An ideal gas expands adiabatically from a state X to a state with volume *V*. Another ideal gas expands isobarically from the same state X to a state with volume *V*.
What is correct about the work done and the change in temperature in the two processes?

	Work done	Change in temperature
A	$W_{\text{isobaric}} < W_{\text{adiabatic}}$	$\Delta T_{\text{isobaric}} < \Delta T_{\text{adiabatic}}$
B	$W_{\text{isobaric}} < W_{\text{adiabatic}}$	$\Delta T_{\text{isobaric}} > \Delta T_{\text{adiabatic}}$
C	$W_{\text{isobaric}} > W_{\text{adiabatic}}$	$\Delta T_{\text{isobaric}} < \Delta T_{\text{adiabatic}}$
D	$W_{\text{isobaric}} > W_{\text{adiabatic}}$	$\Delta T_{\text{isobaric}} > \Delta T_{\text{adiabatic}}$

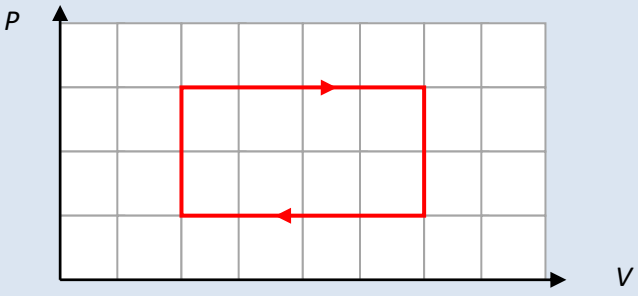
4. A piston moving slowly compresses an ideal gas isothermally. An amount of work equal to 500 J is done on the gas. What is correct about the magnitude of the thermal energy exchanged between the gas and the surroundings?

A It is zero.
B It is less than the work done.
C It is equal to the work done.
D It is greater than the work done.

5. An ideal gas loses 120 J of thermal energy and 150 J of work is done on the gas. What is the change in the internal energy of the gas?

A 30 J **B** –30 J **C** 270 J **D** –270 J

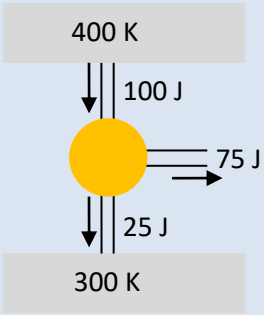
6. The diagram shows the working cycle of a heat engine operating with an ideal gas.



What is the efficiency of this engine?

A $\frac{1}{8}$ **B** $\frac{2}{9}$ **C** $\frac{4}{15}$ **D** $\frac{2}{5}$

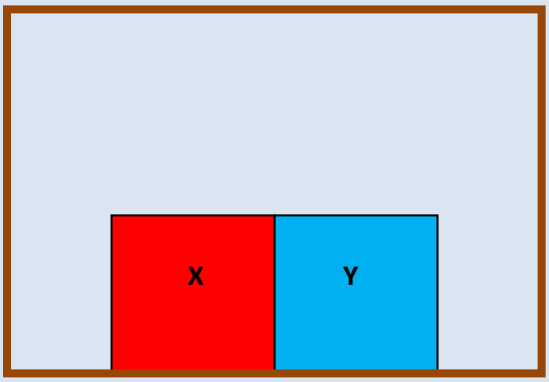
7. The diagram shows a proposed heat engine.



What is correct about this engine?

A It is a possible heat engine violating no law of Physics.
B The engine violates the first law of thermodynamics.
C The engine violates the second law of thermodynamics.
D The engine violates the first and second laws of thermodynamics.

8. Two large bodies, X and Y, are placed in contact in a thermally insulated, evacuated container. X has temperature $127\ ^{\circ}\text{C}$ and Y a temperature $27\ ^{\circ}\text{C}$. A quantity of 1 J of energy leaves body X and enters body Y without appreciably changing the temperature of either body.



What is the change in the entropy of the Universe?

A 0 **B** $(\frac{1}{27}-\frac{1}{127})\ \text{J K}^{-1}$ **C** $(\frac{1}{300}-\frac{1}{400})\ \text{J K}^{-1}$ **D** $(\frac{1}{400}-\frac{1}{300})\ \text{J K}^{-1}$

9. A jar of perfume is opened in a room. The perfume molecules eventually spread into the entire room. The perfume molecules will never return to the jar no matter how long one waits. What law of physics is responsible for this?

A The law of conservation of energy.
B The law of conservation of momentum.
C The first law of thermodynamics.
D The second law of thermodynamics.

10. The efficiency of a Carnot engine operating between temperatures T_H and T_C is 0.6. What is the efficiency when the cold reservoir temperature is halved?

A 0.8 **B** 0.7 **C** 0.5 **D** 0.2

Quiz B10 Answers	
1	B
2	B
3	D
4	C
5	A
6	B
7	C
8	C
9	D
10	A