Practice Question Set For A-Level
Subject : Physics
Paper-2 Topic: Thermal Physics

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Name of the Student:_____
Max. Marks : 25 Marks **Time : 25 Minutes**

Q1.

(a) The concept of an absolute zero of temperature may be explained by reference to the behaviour of a gas.
Discuss **one** experiment that can be performed using a gas which would enable you to explain absolute zero and determine its value.
It is not necessary to give full details of the apparatus. Your answer should:

- include the quantities that are kept constant
- identify the measurements to be taken
- explain how the results may be used to find absolute zero
- justify why the value obtained is absolute zero.

The quality of your written communication will be assessed in your answer.

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(6)

(b) (i) State **two** assumptions about the **movement** of molecules that are used when deriving the equation of state, $pV = \frac{1}{3} N m (c_{rms})^2$ for an ideal gas.

1. _____

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2. _____

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(2)

(ii) Three molecules move at the speeds shown in the table below.

molecule	**speed / m s^{-1}**
1	2000
2	3000
3	7000

Calculate their mean square speed.

mean square speed _____ $m^2\ s^{-2}$

(1)

(c) The average molecular kinetic energy of an ideal gas is 6.6×10^{-21} J.
Calculate the temperature of the gas.

temperature _____ K

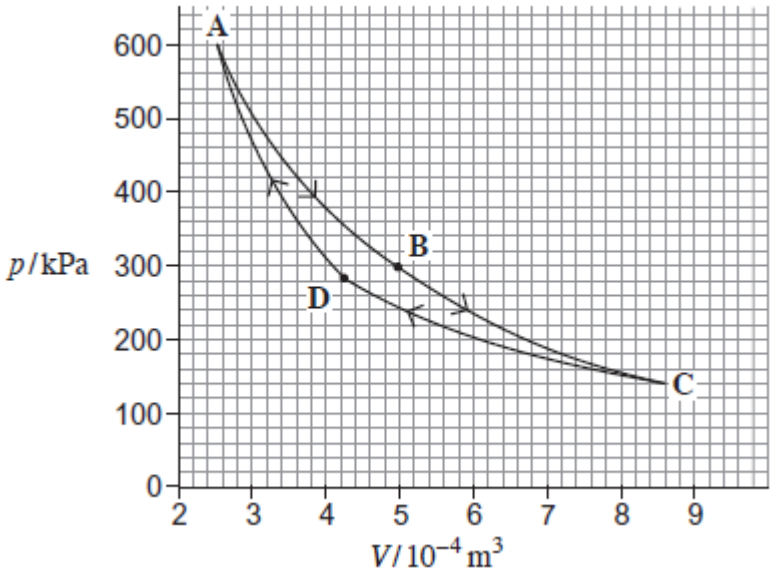
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(2)
(Total 11 marks)

Q2.

The Carnot cycle is the most efficient theoretical cycle of changes for a fixed mass of gas in a heat engine.

The graph below shows the pressure−volume ($p-V$) diagram for a gas undergoing a Carnot cycle of changes **ABCDA**.



(a) (i) Show that during the change **AB** the gas undergoes an isothermal change.

(3)

(ii) Explain how the first law of thermodynamics applies to the gas in the change **BC**.

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(3)

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(iii) Determine the ratio $\frac{T_A}{T_C}$,

where T_A is the temperature of the gas at **A** and T_C is the temperature of the gas at **C**.

ratio _____

(3)

(b) Show that the work done during the change **AB** is about 110 J.

(2)

(c) When running at a constant temperature, one practical engine goes through 2400 cycles every minute. In one complete cycle of this engine, 114 J of energy has to be removed by a coolant so that the engine runs at a constant temperature. The temperature of the coolant rises by 18 °C as it passes through the engine.

Calculate the volume of the coolant that flows through the engine in one second.

specific heat capacity of coolant = 3.8×10^3 J kg^{-1} K^{-1}
density of coolant = 1.1×10^3 kg m^{-3}

volume flowing in one second _____ m^3

(3)

(Total 14 marks)

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