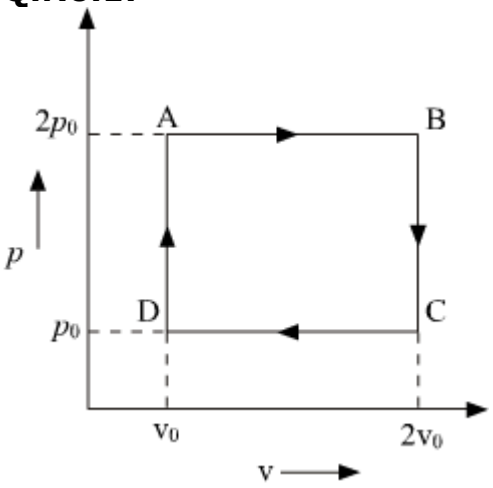
Kinetic Theory

Q.No.1:



The above *p*-*v* diagram represents the thermodynamic cycle of an engine, operating with an ideal monoatomic gas. The amount of heat, extracted from the source in a single cycle is:

JEE 2013

A. p_0v_0

B. $\left(\frac{13}{2}\right)p_0v_0$

C. $\left(\frac{11}{2}\right)p_0v_0$

D. $4p_0v_0$

Q.No.2: Consider a spherical shell of radius *R* at temperature *T*. The black body radiation inside it can be considered as an ideal gas of photons with internal energy per unit volume $u = \frac{U}{V} \propto T^4$ and pressure $P = \frac{1}{3}\left(\frac{U}{V}\right)$. If the shell now undergoes an adiabatic expansion the relation between *T* and *R* is:

JEE 2015

A. $T \propto e^{-R}$

B. $T \propto e^{-3R}$

C. $T \propto \frac{1}{R}$

D. $T \propto \frac{1}{R^3}$

Q.No.3: An ideal gas undergoes a quasi static, reversible process in which its molar heat capacity C remains constant. If during this process the relation of pressure *P* and volume *V* is given by PV^n = constant, then *n* is given by (Here C_P and C_V are molar specific heat at constant pressure and constant volume, respectively): **JEE 2016**

A. $n = \frac{C-C_P}{C-C_V}$

B. $n = \frac{C_P-C}{C-C_V}$

C. $n = \frac{C-C_V}{C-C_P}$

D. $n = \frac{C_V}{C_P}$

Q.No.4: The temperature of an open room of volume 30 m^3 increased from 17°C to 27°C due to the sunshine. The atmospheric pressure in the room remains 1×10^5 Pa. If n_i and n_f are the number of molecules in the room before and after heating, then $n_f - n_i$ will be : **JEE 2017**

A. -2.5×10^{25}

B. -1.61×10^{23}

C. 1.38×10^{23}

D. 2.5×10^{25}

Q.No.5: A mixture of 2 moles of helium gas (atomic mass = 4u), and 1 mole of argon gas (atomic mass = 40u), is kept at 300 K in a container. The ratio of their rms speeds $\left[\frac{v_{\text{rms}}\,(\text{helium})}{v_{\text{rms}}\,(\text{argon})}\right]$, is close to: **JEE 2019**

A. 3.16

B. 0.32

C. 0.45

D. 2.24

Q.No.6: A 15 g mass of nitrogen gas is enclosed in a vessel at a temperature 27°C. Amount of heat transferred to the gas, so that rms velocity of molecules

is doubled, is about: [Take R = 8.3 J/K mole] **JEE 2019**

A. 0.9 kJ

B. 6 kJ

C. 10 kJ

D. 14 kJ

Q.No.7: A gas mixture consists of 3 moles of oxygen and 5 moles of argon at temperature T. Considering only translational and rotational modes, the total internal energy of the system is: **JEE 2019**

A. 15 RT

B. 12 RT

C. 4 RT

D. 20 RT

Q.No.8: On the basis of kinetic theory of gases, the gas exerts pressure because its molecules : **JEE 2021**

A. suffer change in momentum when impinge on the walls of container.

B. continuously stick to the walls of container.

C. continuously lose their energy till it reaches wall.

D. are attracted by the walls of container.

Q.No.9: In a certain thermodynamical process, the pressure of a gas depends on its volume as kV^3. The work done when the temperature changes from 100°C to 300°C will be _____nR, where n denotes number of moles of a gas. **JEE 2021**

Q.No.10: A monoatomic gas of mass 4.0 u is kept in an insulated container. Container is moving with velocity 30 m/s. If container is suddenly stopped then change in temperature of the gas (R = gas constant) is $\frac{x}{3R}$ Value of x is _____. **JEE 2021**