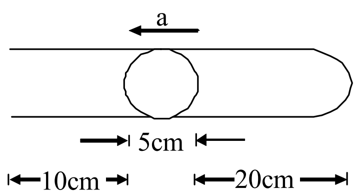
[SINGLE CORRECT CHOICE TYPE]

Q.1 One mole of a gas expands with temperature according to the relation $V = kT^{2/3}$. What is the workdone when the temperature changes by 30°C? **[3]**

(A) 10R (B*) 20R (C) 30R (D) 40R

Q.2 A mercury pallet of length 5 cm is trapped in a horizontal tube of small cross-section area. Length of tube enclosed by mercury pallet is 20 cm when it is accelerated with a = g/2 in the direction shown. The length of tube enclosed by pallet if it is accelerated in opposite direction with same acceleration is : (Atmospheric pressure is 72.5 cm of Hg) **[3]**



(A) 22 cm (B) 22.5 cm (C) 21 cm (D*) 21.4 cm

Q.3 What is fraction of molecule below an altitude h in atmosphere? Assume uniform gravitational field, isothermal conditions, mass of a molecule m, Boltzman constant k, temperature T. **[3]**

(A) $f = e^{(mgh/kT)}$ (B) $f = e^{-(mgh/kT)}$ (C*) $f = 1 - e^{-(mgh/kT)}$ (D) $f = 1 - e^{(mgh/kT)}$

Q.4 CO_2 has specific heat capacity of 630 J/kg °C at constant volume. If it's temperature rises from 20°C to 45°C. What is the change in it's internal energy per unit mass? **[3]**

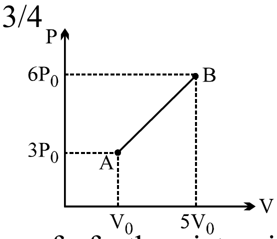
(A) 12.6 kJ/kg (B*) 15.75 kJ/kg (C) 17.6 kJ/kg (D) 20.5 kJ/kg

Q.5 A diatomic ideal gas is heated at constant volume until its pressure is doubled. It is again heated at constant pressure until its volume is doubled. The molar heat capacity for the whole process is kR where k is: **[3]**

(A) 23/5 (B) 19/5 (C*) 19/6 (D) 13/4

Q.6 One mole of a monoatomic ideal gas undergoes the process $A \to B$ in the given P-V diagram. The specific heat for this process is **[3]**

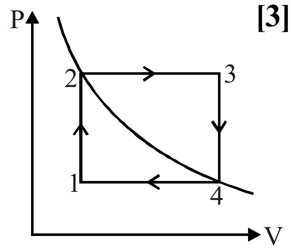
(A) 3R/2 (B*) 13R/6 (C) 5R/2 (D) 2R



Q.7 If one mole of monoatomic gas is mixed with one mole of a diatomic gas, the value of γ for the mixture is **[3]**

(A) 1.40 (B*) 1.50 (C) 1.53 (D) 3.07

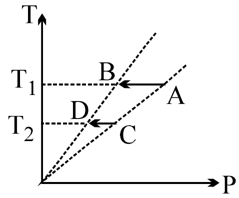
Q.8 One mole of an ideal gas undergoes a cycle of process, consisting of two isochores and two isobars. Temperatures at 1 and 3 equal T_1 and T_3 respectively. Find the work done by the gas over the cycle, if the point 2 and 4 lie on the same isotherm. **[3]**



(A) $\frac{R(T_1 + T_3)}{2}$ (B*) $R\left(\sqrt{T_3} - \sqrt{T_1}\right)^2$

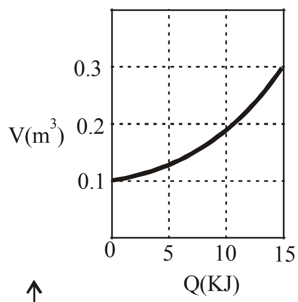
(C) $\frac{R}{2}\left(\sqrt{T_1} + \sqrt{T_3}\right)^2$ (D) $R\sqrt{T_1T_3}$

Q.9 On a TP diagram, two moles of ideal gas perform process AB and CD. If the work done by the gas in the process AB is two times the work done in the process CD, then what is the value of T_1 / T_2? **[3]**



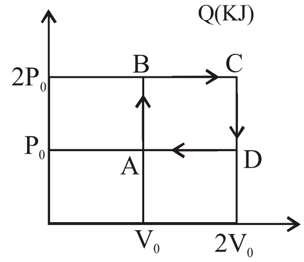
(A) 1/2 (B) 1 (C*) 2 (D) 4

Q.10 Suppose 0.5 mole of an ideal gas undergoes an isothermal expansion as energy is added to its as heat Q. Graph shows the final volume v_f verses Q. The temperature of gas is (use ln 3 $\approx$ 10 and R = 25/3 J/mol-K) **[3]**



(A*) 360 K
(B) 260 K
(C) 390 K
(D) 490 K

Q.11 One mole of certain diatomic gas is under taken the cyclic process shown in the diagram . For this cyclic process efficiency equals : **[3]**

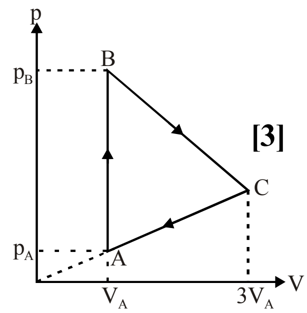


(A) $\frac{6}{7}$ (B*) $\frac{2}{19}$ (C) $\frac{12}{19}$ (D) $\frac{2}{9}$

[PARAGRAPH TYPE]

Paragraph for question nos. 12 to 14

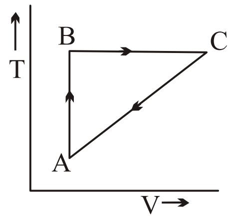
A sample of ideal gas is taken through the cyclic process shown in the figure. The temperature of the gas at state A is T_A = 200 K. At states B and C the temperature of the gas is the same.

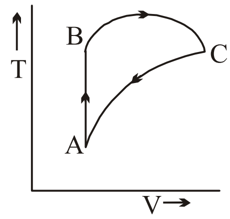


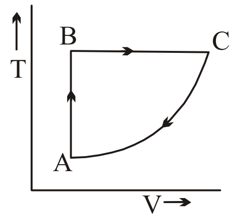
Q.12 Net work done by the gas in the process is **[3]**

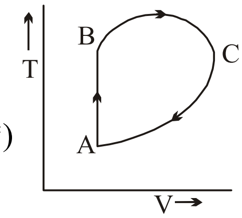
(A) $2P_AV_A$ (B) $4P_AV_A$
(C) $6P_AV_A$ (D*) $8P_AV_B$

Q.13 Which of the following graphs best represent the cyclic process in T-V diagram. **[3]**

(A)


(B)


(C)


(D*)


Q.14 What is the greatest temperature of the gas during the cyclic process ? **[3]**

(A) 600 K (B) 1200 K (C*) 2400 K (D) None of these

[REASONING TYPE]

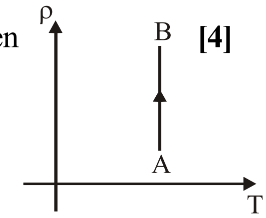
Q.15 **Statement - 1 :** For real gas $C_p - C_v > R$. **[3]**

Statement -2 : In isobaric process, part of heat is spent on doing work during expansion against external pressure.

(A) Statement-1 is True, Statement-2 is True, Statement-2 is a correct explanation for Statement-1
(B*) Statement -1 is True, Statement -2 is True; Statement -2 is NOT a correct explanation for Statement - 1
(C) Statement - 1 is True, Statement- 2 is False
(D) Statement -1 is False, Statement -2 is True

[MULTIPLE CORRECT CHOICE TYPE]

Q.16 The density (ρ) of an ideal gas varies with temperature T as shown in figure. Then **[4]**

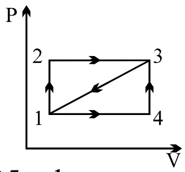


(A*) the product of P and V at A is equal to the product of P and V at B
(B*) pressure at B is greater than the pressure at A
(C*) work done by the gas during the process AB is negative
(D*) the change in internal energy from A to B is zero.

Q.17 A monoatomic gas undergoes a process given by a (dU) + b(dW) = 0. Now if (dU → internal energy change, dW → work done by gas) **[4]**

(A) $\frac{a}{b} = 1$, then the process is isobaric
(B*) b = 0, then the process is isothermal
(C*) $\frac{a}{b} = 1$, then the process is adiabatic
(D*) $\frac{a}{b} = -\frac{2}{3}$, then the process is isobaric

Q.18 Figure shows an indicator diagram. During path 1-2-3, 100 cal are given to the system and 40 cal work is done. During path 1-4-3, the work done is 10 cal. **[4]**

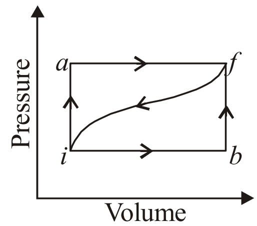


(A*) Heat given to the system during path 1-4-3 is 70 cal
(B) If the system is brought from 3 to 1 along straight line path 3-1, work done is 25 cal
(C*) Along straight line path 3-1, the heat ejected by the system is 85 cal
(D) The internal energy of the system in state 3 is 140 cal above that in state 1.

Q.19 A fixed quantity of an ideal gas can be expanded from an initial state to a certain volume through two different processes **[4]**
(i) PV^2 = constant and (ii) $P = KV^2$ where K is a constant. Then
(A) Final temperature in (i) will be greater than that in (ii)
(B*) Final temperature in (ii) will be greater than that in (i)
(C) Heat is given to the gas in (i) & rejected by the gas in (ii)
(D*) Heat is given to the gas in (ii) & rejected by the gas in (i)

[MATRIX TYPE]

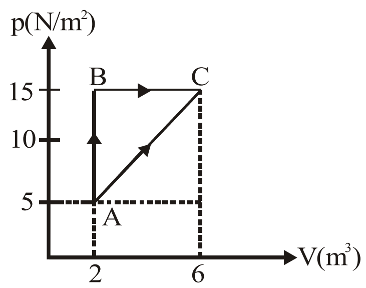
Q.20 When a sample of a gas is taken from state *i* to state *f* along path *iaf*, heat supplied to the gas is 50 cal and work done by the gas is 20 cal. If it is taken by path *ibf*, then heat supplied is 36 cal. **[6]**



(A)	Work done by the gas along path *ibf* is	(P) 6 cal
(B)	If work done upon the gas is 13 cal for the return path *fi*, then heat rejected by the gas along path *fi* is	(Q) 18 cal
(C)	If internal energy of the gas at state i is 10 cal, then internal energy at state *f* is	(R) 40 cal.
(D)	If internal energy at state *b* is 22 cal and at *i* is 10 cal then heat supplied to the gas along path *ib* is	(S) 43 cal

[Ans. (A)-P, (B)-S, (C)-R, (D)-Q]

Q.21 An ideal gas is taken along the reversible processes as represented by the adjoining diagram. **[6]**

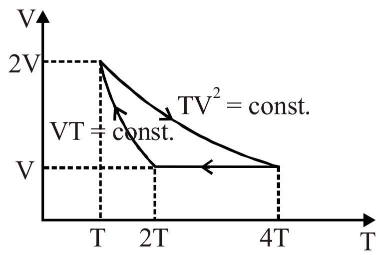


	Column-I		Column-II
(A)	For process $B \rightarrow C$	(P)	$\Delta Q > 0$
(B)	For process $A \rightarrow B$	(Q)	$\Delta W > 0$
(C)	For cycle $A \rightarrow B \rightarrow C \rightarrow A$	(R)	$\Delta U > 0$
(D)	For process $C \rightarrow A$	(S)	$\Delta W = 0$
		(T)	$\Delta Q < 0$

[Ans. (A) P,Q,R (B) P,R,S (C) P,Q (D) T]

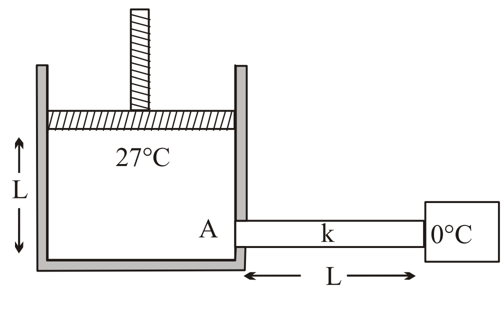
[SUBJECTIVE TYPE]

Q.22 Figure shows the VT diagram for helium gas in a cyclic process. Find the ratio of maximum and minimum pressure. **[5]**



[Ans. 0008]

Q.23 0.5 mole of an ideal gas is kept inside an adiabatic cylinder of length 'L' and cross-sectional area 'A' closed by massless adiabatic piston. The cylinder is attached with a conducting rod of length 'L', cross-sectional area $\frac{1}{900}$ m^2 and thermal conductivity 415.5 W/m-K, whose other end is maintained at 0°C. The piston is moved such that the temperature of the gas remains constant at 27°C. Find the velocity (in mm/sec) of piston when it is at height L/2 from the bottom of cylinder. Rod is well lagged and has negligible heat capacity. R = 8.31 J/mol-K. **[5]**



[Ans. 0005]