# PHYSICS

## BOOKS - A2Z PHYSICS (HINGLISH)

## KINETIC THEORY OF GASES AND THERMODYNAMICS

### Kinetic Theory Of Gases

**1.** Four molecules of a gas are having speeds of $1, 4, 8$ and $16 ms^{-1}$. The root mean square velocity of the gas molecules is

A. $7.25 m/s$

B. $52.56 m/s$

C. $84.2 m/s$

D. $9.2 m / s$

**Answer: D**

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**2.** An ideal gas is heated at constant volume until its pressure doubles. Which one of the following statements is correct?

A. The mean speed of the molecule doubles.

B. The number of molecules doubles.

C. The mean square speed of the molecules doubles.

D. The number of molecules per unit volume doubles.

**Answer: C**

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**3.** If the volume of a gas is doubled at constant pressure, the average translational kinetic energy of its molecules will

A. be doubled

B. remain the same

C. increase by a factor

D. become fore times

**Answer: A**

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**4.** The average translational kinetic energy of the molecules of a gas will be doubled if at constant

A. Volume, its pressure is doubled

B. temperature, its pressure is doubled

C. pressure, its volume is halved

D. temperature, its volume is doubled

**Answer: A**

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**5.** The ratio of the number of moles of a monoatomic to a polyatomic gas in a mixture of the two, behaving as an diatomic gas is : (vibrational modes of freedom is to be ignored)

A. $2:1$

B. $1:2$

C. $2:3$

D. $3:2$

**Answer: B**

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**6.** If masses of all molecules of a gas are halved and the speed doubled. Then the ratio of initial and final pressure is :

A. $2:1$

B. $1:2$

C. $4:1$

D. $1:4$

**Answer: A**

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**7.** The average kinetic energy of $H_2$ molecules at $300K$ is $E$ at the same temperature the average kinetic energy of $O_2$ molecules is :

A. $E$

B. $E/4$

C. $E/16$

D. $16E$

**Answer: A**

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**8.** Molecular hydrogen at one atmosphere and helium at two atmosphere occupy volume $V$ each at the same temperature.

The rms velocity of hydrogen molecules is $x$ times the rms velocity of helium molecules. What is the value of $x$?

A. $1$

B. $2$

C. $\sqrt{2}$

D. $\sqrt{3}$

**Answer: C**

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**9.** What is the ratio of the total energy of all the molecules of one mole of $O_2$ to the total energy of all the molecules of two moles of helium at the same temperature?

A. $1:2$

B. $2:1$

C. $2:3$

D. $3:2$

**Answer: A**

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**10.** On the basis of kinetic theory of gases, the mean $K.E.$ of $1mo \leq perdegree$ of freedom is

A. $\frac{1}{2}RT$

B. $\frac{3}{2}RT$

C. $\frac{1}{2}kT$

D. $\frac{3}{2}kT$

**Answer: A**

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**11.** At a certain temperature, the rms velocity for $O_2$ is $400ms^{-1}$. At the same temperature, the rms velocity for $H_2$ molecules will be

A. $100ms^{-1}$

B. $25ms^{-1}$

C. $1600ms^{-1}$

D. $6400ms^{-1}$

**Answer: C**

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**12.** A gas in a vessel is at the pressure $P_0$. If the masses of all the molecules be made half and their speeds be made double, then find the resultant pressure.

A. $4P_0$

B. $2P_0$

C. $P_0$

D. $P_0/2$

**Answer: B**

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**13.** The energy density $\frac{u}{V}$ of an ideal gas is related to its pressure P as

A. $\frac{u}{V} = 3P$

B. $\frac{u}{V} = \frac{3}{2}P$

C. $\frac{u}{V} = \frac{1}{3}P$

D. $\frac{u}{V} = \frac{2}{3}P$

**Answer: B::D**

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**14.** The molecular weighs of oxygen and hydrogen are 32 and 2 respectively. The root mean square velocities of oxygen and hydrogen at $NTP$ are in the ratio

A. $4:1$

B. $1:16$

C. $16:1$

D. $1:4$

**Answer: C**

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**15.** A sample of oxygen is compressed to half of its original volume at constant temperature. If the rms velocity of gas molecules was originally C, their new rms velocity is

A. $4C$

B. $2C$

C. $C$

D. $C/2$

**Answer: C**

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**16.** At what temperature is the $K.E.$ Of a gas molecules half that of its value at $27^{\circ}C$

A. $13.5^{\circ}C$

B. $150^{\circ}C$

C. $150K$

D. $-123K$

**Answer: C**

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**17.** Oxygen and hydrogen in two enclosures have same mass, volume and pressure. The ratio of the temperatures of the two gases is

A. $1:4$

B. $4:1$

C. $16:1$

D. $1:16$

**Answer: C**

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**18.** $250 litre$ of an ideal gas is heated at constant pressure from $27^\circ C$ such that its volume becomes $500 litre$. The final temperature is

A. $54^\circ C$

B. $300^\circ C$

C. $327^\circ C$

D. $600^\circ C$

**Answer: C**

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**19.** The rms velocity of hydrogen gas molecules at $NTP$ is $Vrms^{-1}$. The gas is heated at constant volume till the pressure becomes four times. The final rms velocity is

A. $V/2$

B. $V$

C. $2V$

D. $4V$

**Answer: C**

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**20.** The rms speed of oxygen molecules at a certain temperature $T$ is $v$. If the temperature is doubled and oxygen gas dissociates into atomic oxygen, then the rms speed

A. remains same

B. becomes double

C. increase by a factor of

D. None of these

**Answer: B**

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**21.** The ratio of the vapour densities of two gases at the same temperature is $8:9$. The ratio of the rms velocities of their molecules is

A. $8:9$

B. $9:8$

C. $\sqrt{9}:\sqrt{8}$

D. $\sqrt{8}:\sqrt{9}$

**Answer: C**

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**22.** Two perfect gases at absolute temperature $T_1$ and $T_2$ are mixed. There is no loss of energy. The masses of the molecules are $m_1$ and $m_2$. The number of molecules in the gases are $n_1$ and $n_2$. The temperature of the mixture is

A. $T_1 + T_2$

B. $T_1 + \frac{T_2}{2}$

C. $n_1 T_1 + n_2 \frac{T_2}{n_1} + n_2$

D. None of these

**Answer: C**

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**23.** At what temperature, rms velocity of $O_2$ molecules will be $1/3$ of $H_2$ molecules at $-3^\circ C$

A. $90K$

B. $1167^\circ C$

C. $-3^{\circ} C$

D. $207^{\circ} C$

**Answer: D**

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**24.** When the temperature of a gas is raised from $27^{\circ} C$ to $90^{\circ} C$, the percentage increase in the rms velocity of the molecules will be

A. $10\%$

B. $15\%$

C. $20\%$

D. `17.5 %

**Answer: A**

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**25.** An assembly of smoke particle in air at $NTP$ is under consideration. If the mass of each particles is $5 \times 10^{-17} kg$. Then the rms speed is

(Given: $k = 1.38 \times 19^{-23} JK^{-1}$)

A. $1.5 cms^{-1}$

B. $1.5 mms^{-1}$

C. $1.5 ms^{-1}$

D. $1.5 kms^{-1}$

**Answer: A**

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**26.** Four molecules of a gas have speed $1, 2, 3$ and $4 kms^{-1}$ respectively. The value of rms speed of the molecules is (in $kms^{-1}$)

A. $\sqrt{\frac{15}{2}}$

B. $2\sqrt{15}$

C. $\frac{\sqrt{15}}{2}$

D. None of these

**Answer: A**

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**27.** At a pressure of $24 \times 10^5 dy \neq cm^{-2}$. The volume of $O_2$ is $10 litre$ and mass is $20g$. The rms velocity will be

A. $800ms^{-1}$

B. $400ms^{-1}$

C. $600ms^{-1}$

D. Data is incomplete

**Answer: C**

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**28.** The temperature at which the root mean square velocity of the gas molecules would become twice of its value at $0^{\circ}C$ is

A. $819^{\circ}C$

B. $1092^{\circ}C$

C. $1100^{\circ}C$

D. $1400^{\circ}C$

**Answer: A**

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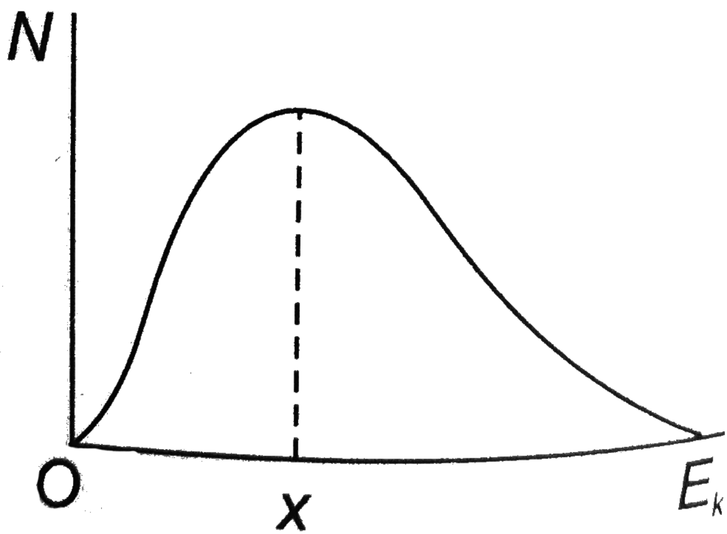
**29.** The adjoining graph shows the distribution of kinetic energies $E_k$ among the consultant molecules of a gas at a uniform temperature. $N$ is the number of molecules each having energy in a small energy band around $E-(k)$. Which of the following statements is true?



A. Provided that the temperature does not change, the kinetic energy of each molecules is fixed.

B. The commonest value of kinetic energy is also the greatest kinetic energy of any of the molecules.

C. The total kinetic of the molecules is independent of the temperature of the gas.

D. The value $x$ of $E_k$ at which the peak of the curve occurs increase when the temperature rises.

**Answer: D**

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**30.** At identical temperatures, the rms speed of hydrogen molecules is $4$ times that for oxygen molecules. In a mixture of these in mass ratio $H_2 : O_2 = 1 : 8$, the rms speed of all molecules in n times the rms speed for $O_2$ molecules, where n is

A. $3$

B. $4/3$

C. $(8/3)^{1/2}$

D. $(11)^{1/2}$

**Answer: D**

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**31.** The temperature at which rms velocity of helium molecules is equal to the rms velocity of hydrogen molecules at $NTP$ is

A. $100K$

B. $300K$

C. $502K$

D. $546K$

**Answer: D**

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**32.** If $P = 106kT$, then the number of molecules per unit volume of the gas is [the letters have usual meanings.]

A. $100K$

B. $300K$

C. $502K$

D. $546K$

**Answer: D**

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**33.** N molecules , each of mass m, of gas A and 2 N molecules , each of mass 2m, of gas B are contained in the same vessel which is maintained at a temperature T. The mean square volcity of molecules of B type is denoted by $V_2$ and the mean square velocity of A type is denoted by $V_1$ then $\frac{V_1}{V_2}$ is

A. $2$

B. $1$

C. $1/2$

D. $2/3$

**Answer: A**

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**34.** The pressure P, Volume V and temperature T of a gas in the jar A and the other gas in the jar B at pressure $2P$, volume $V/4$ and temperature $2T$, then the ratio of the number of molecules in the jar A and B will be

A. $1:1$

B. $1:2$

C. $2:1$

D. $4:1$

**Answer: D**

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**35.** At what temperature is the root mean square velocity of gaseous hydrogen molecules is equal to that of oxygen molecules at $47^\circ C$?

A. $20K$

B. $80K$

C. $-73K$

D. $3K$

**Answer: A**

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**36.** Gas at a pressure $P_0$ in contained as a vessel. If the masses of all the molecules are halved and their speeds are doubles. The resulting pressure P will be equal to

A. $4P_0$

B. $2P_0$

C. $P_0$

D. $P_0 / 2$

**Answer: B**

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**37.** The root mean square speed of the molecules of a diatomic gas is v. When the temperature is doubled, the molecules dissociates into two atoms. The new root mean square speed of the atom is

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**38.** The molecules of a given mass of gas have a rms velocity of $200 m / \sec$ at $27^\circ C$ and $1.0 \times 10^5 N / m^2$ pressure. When the temperature is $127^{\circ} C$ and pressure is $0.5 \times 10^5 N/m^2$ , the rms velocity in $m/\sec$ will be

A. $100\frac{\sqrt{2}}{3}$

B. $100(\sqrt{2})$

C. $\frac{400}{\sqrt{3}}$

D. None of these

**Answer: C**

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**39.** Which of the following statement is true?

A. Absolute zero degree temperature is not zero energy temperature

B. Two different gases at the same temperature pressure have equal root mean square velocities

C. The rms speed of the molecules of different ideal gases. Maintained at the same temperature are the same.

D. Given sample of 1 cc of hydrogen and $1$ of oxygen both at N.T.P. Oxygen sample has a large number of molecules.

**Answer: A**

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**40.** At which of the following temperatures would the molecules of a gas have twice the average kinetic energy they have at $20^\circ C$ ?

A. $40^\circ C$

B. $80^\circ C$

C. $313^\circ C$

D. $586^\circ C$

**Answer: C**

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**41.** A vessel contains a mixture of one mole of oxygen and two moles of nitrogen at 300K. The ratio of the average rorational kinetic energy per $O_2$ molecules to that per $N_2$ molecules is

A. $1:1$

B. $1:2$

C. $2:1$

D. Depends on the moments of inertial of the two molecules

**Answer: A**

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**42.** Three closed vessels $A, B$ and $C$ are at the same temperature T and contain gases which obey the Maxwellian distribution of velocities. Vessel A contains only $O_2, B$ only $N_2$ and $C$ a mixture of equal quantities of $O_2$ and $N_2$. If the average speed of the $O_2$ molecules in vessel $A$ is $V_1$, that of the $N_2$ molecules in vessel $B$ is $V_2$, the average speed of the $O_2$ molecules in vessel $C$ is (where $M$ is the mass of an oxygen molecules)

A. $\frac{V_1 + V_2}{2}$

B. $V_1$

C. $(V_1 V_2)^{1/2}$

D. $\sqrt{3kT / M}$

**Answer: B**

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**43.** In a period of $1.00s$, $5 \times 10^{23}$ nitrogen molecules strike a wall with an area of $8.00cm^2$. Assume the molecules move with a speed of $300m / s$ and strike the wall head-on in elastic collisions. What is the pressure exerted on the wait?

Note : The mass of one $N_2$ molecules is $4.65 \times 10^{-26} kg$

A. $17.4kPa$

B. $24.5kPa$

C. $36.2kPa$

D. $8.24kPa$

**Answer: A**

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**44.** Two molecules of gas have speeds of $9 \times 10^6 ms^{-1}$ and $1 \times 10^6 ms^{-1}$ respectively. What is the root mean square speed of these molecules?

A. $(\sqrt{21}) \times 10^6 m/s$

B. $(\sqrt{41}) \times 10^6 m/s$

C. $8.5 \times 10^6 m/s$

D. $(\sqrt{17}) \times 10^6 m/s$

**Answer: B**

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**45.** The molecules of a given mass of gas have root mean square speeds of $100ms^{-1}$ at $27^{\circ}C$ and $1.00$ atmospheric pressure. What will be the root mean square speeds of the molecules of the gas at $127^{\circ}C$ and $2.0$ atmospheric pressure?

A. $\frac{150}{\sqrt{3}}m/s$

B. $\frac{125}{\sqrt{3}}m/s$

C. $\frac{200}{\sqrt{3}}m/s$

D. $100(\sqrt{3})m/s$

**Answer: C**

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**46.** Two vessels A and B contain ideal gases with the temperature of B double that of A. Both gases are heated, so that they attain the same temperature. It is found that the fractional increase in the most probable speed of gas in vessel A is double that of the mean speed of gas in B. The ratio of the final to the initial temperature of gas in vessel A is

A. $3 - 2(\sqrt{2})$

B. $2 - 3(\sqrt{2})$

C. $3 + 2(\sqrt{2})$

D. $2 + 3(\sqrt{2})$

**Answer: C**

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**47.** The rms speed of particle of mass $5 \times 10^{-17} kg$. In their random motion in air at NTP will be (Boltzmann's constant) $K = 1.38 \times 10^{-23} J/K$

A. $15 \times 10 + m / s$

B. $15 \times 10^{-3} m / s$

C. $10 \times 10^{-2}$

D. $1.5 \times 10^{2} m / s$

**Answer: B**

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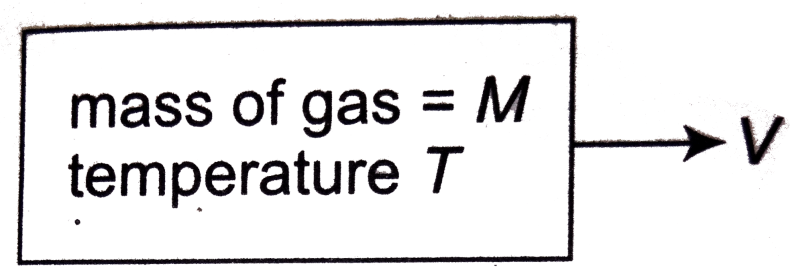
**48.** A light container having a diatomic gas enclosed with in is moving with velocity v. Mass of the gas is M and number of moles is n. The kinetic energy of gas w.r.t ground is



A. $\frac{1}{2}MV^2 + \frac{3}{2}nRT$

B. $\frac{1}{2}MV^2$

C. $\frac{1}{2}MV^2 + \frac{5}{2}nRT$

D. $\frac{5}{2}nRT$

**Answer: C**

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**49.** A cylinder contains a mixture of helium and argon gas in equilibrium at $150^\circ C$. What is the average kinetic energy for each type of gas molecules?

A. $3.26 \times 10^{-21} J$

B. $8.76 \times 10^{-21} J$

C. $6.28 \times 10^{-21} J$

D. $4.14 \times 10^{-21} J$

**Answer: B**

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**50.** In the previous equation, what is the rms speed of each type of molecules?

A. $21 km / s$

B. $1.62 km / s$

C. $4.62 km / s$

D. $3.24 km / s$

**Answer: B**

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**51.** Calculate the ratio of the mean free paths of the molecules of two gases having molecular diameters $1\text{Å}$ and $2\text{Å}$. The gases may be considered under identical conditions of temperature, pressure and volume.

A. $2:1$

B. $3:1$

C. $4:3$

D. $4:1$

**Answer: D**

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**52.** An insulated container containing monoatomic gas of molar mass s is moving with a velocity $v_0$. If the container is suddenly stopped, find the change in temperature.

A. $m\frac{v_0^2}{2R}$

B. $m\frac{v_0^2}{3R}$

C. $3m\frac{v_0^2}{2}R$

D. $5m\frac{v_0^2}{3}R$

**Answer: B**

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**53.** A spherical balloon of volume V contains helium at a pressure P. How many moles of helium are in the balloon if the average kinetic energy of the helium atoms is $\vec{K}$?

A. $\frac{2PV}{\vec{K}}N_A$

B. $3P\frac{V}{K}N_A$

C. $5P\frac{V}{3}KN_A$

D. $3P\frac{V}{K}N_A$

**Answer: D**

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**54.** A spherical balloon of volume $4.00 \times 10^3 cm^3$ contains helium at a pressure of $1.20 \times 10^5 Pa$. How many moles of helium are in the balloon if the average kinetic energy of the helium atoms is $3.60 \times 10^{-22} J$?

A. $3.32mol$

B. $2.16mol$

C. $4.12mol$

D. $2.8mol$

**Answer: A**

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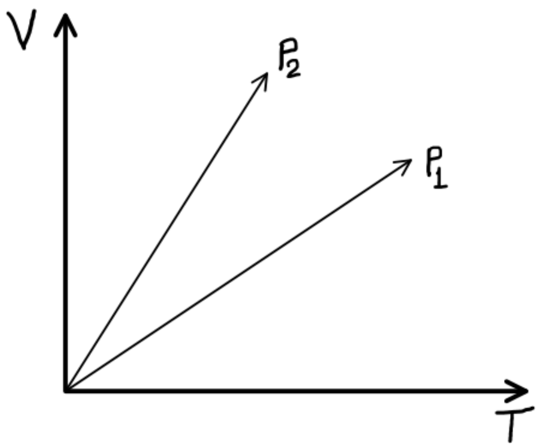
## Ideal Gas Equation

**1.** Figure shows the volume versus temperature graph for the same mass of a gas (assumed ideal) corresponding to two different pressure $P_1$ and $P_2$. Then




A. $P_1 > P_2$

B. $P_1 < P_2$

C. $P_1 = P_2$

D. The information is insufficient

**Answer: A**

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**2.** A volume V of air saturated with water vapour experts a pressure P. Pressure of saturated vapour is $P_0$. If the volume is made $V/2$ isothermally, the final pressure will be

A. $P$

B. $2P_0$

C. $2P + P_0$

D. $2(P - P_0)$

**Answer: B**

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**3.** During an experiment, an ideal gas is found to obey an additional law $VP^2 = cons\tan t$, The gas is initially at a temperature T, and volume V. When it expands to a volume $2V$, the temperature becomes.......

A. $T$

B. $2T$

C. $T(\sqrt{2})$

D. $T/2$

**Answer: D**

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**4.** A vessel containing $0.1m^3$ of air at $76cm$ of Hg is connected to an evacuated vessel of capacity $0.09m^3$. The resultant air pressure is:

A. $20cm of Hg$

B. $30cm of Hg$

C. $40cm of Hg$

D. $60cm of Hg$

**Answer: C**

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**5.** Two gases $A$ and $B$ having the same temperature $T$, same pressure $P$ and same volume $V$ are mixed. If the mixture is at the same temperature and occupies a volume $V$, then the pressure of the mixture is

A. $P$

B. $2P$

C. $4P$

D. $6P$

**Answer: B**

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**6.** If N is Avogadro's number, then the number of molecules in $6g$ of hydrogen at NTP is

A. $2N$

B. $3N$

C. $N$

D. $N/6$

**Answer: B**

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**7.** A gas is at on atmosphere. To what pressure it should be subjected at constant temperature so as to have to its initial volume?

A. $2 atmosphere$

B. $4 atmosphere$

C. $3 atmosphere$

D. 1 atmosphere

**Answer: B**

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**8.** If the volume of air at $0^{\circ}C$ and $10atmospheric$ pressure is $10litre$. Its volume, in litre, at normal temperature and pressure would be

A. $1$

B. $10$

C. $100$

D. $1000$

**Answer: C**

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**9.** It is required to doubled the pressure of a gas in a container at $27^{\circ}C$ by heating it. To what temperature the gas should be raised?

A. $273^{\circ}C$

B. $373^{\circ}C$

C. $327^{\circ}C$

D. $108^{\circ}C$

**Answer: C**

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**10.** A sample of a perfect gas occupies a volume V at a pressure P and obsolete temperature T. The mass of each molecules is m, which of the following expression given the number of molecules in the sample?

A. $\frac{PV}{m}$

B. $\frac{k}{PVT}$

C. $\frac{m}{k}$

D. $\frac{PV}{kT}$

**Answer: D**

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**11.** In order to increase the volume of a gas to $3$ times at constant pressure at $40^{\circ}C$, the final temperature should be

A. $666^{\circ}C$

B. $777^{\circ}C$

C. $555^\circ C$

D. $333^\circ C$

**Answer: A**

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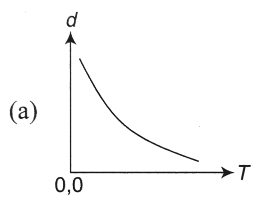
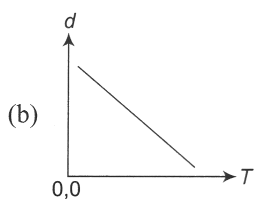
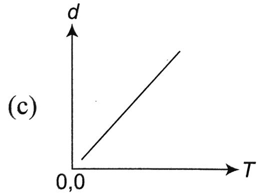
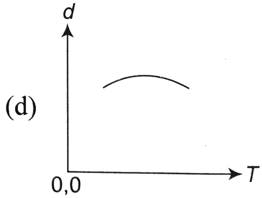
**12.** At a constant pressure, of the following graphs that one which represents the variation of the density of an ideal gas with the absolute temperature T, is

A. 


B. 

C. 


D. 


**Answer: A**

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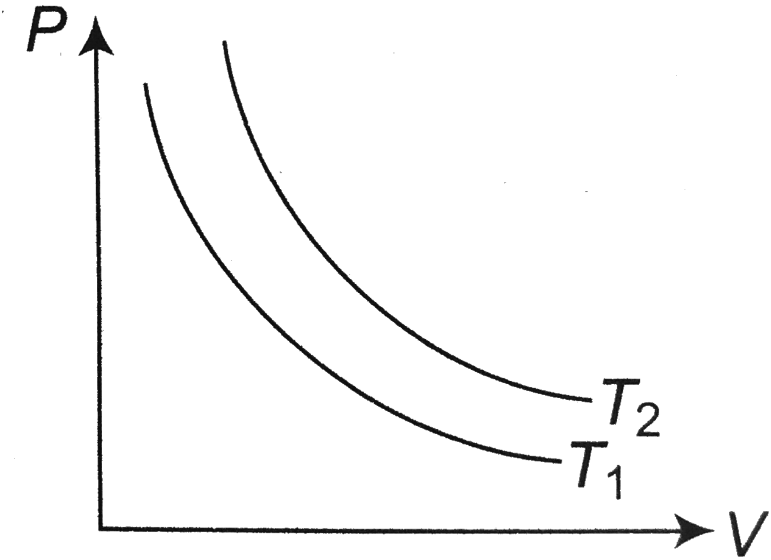
**13.** Figure shows the pressure P versus volume V graphs for a certains mass of a gas at two constant temperature $T_1$ and $T_2$.

Which of the following interface is correct?




A. $T_1 = T_2$

B. $T_1 > T_2$

C. $T_1 < T_2$

D. no inference can be drawn due to insufficient information

**Answer: C**

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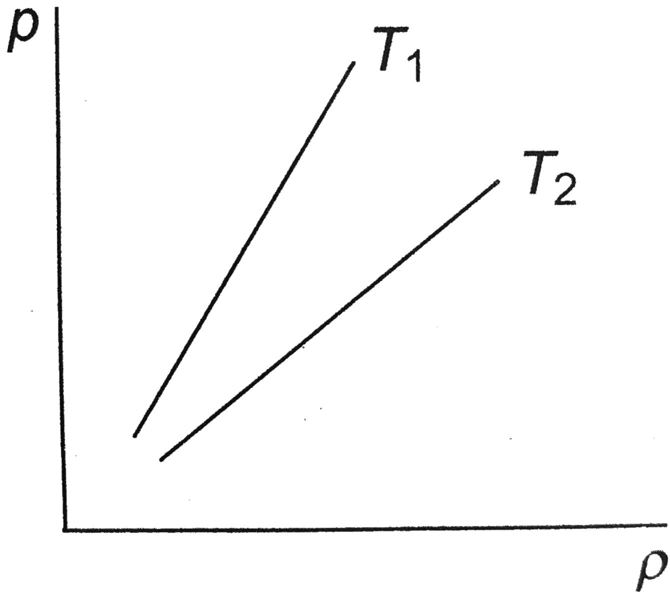
**14.** Figure shows graphs of pressure vs density for an ideal gas at two temperature $T_1$ and $T_2$. Which of the following is correct?




A. $T_1 > T_2$

B. $T_1 = T_2$

C. $T_1 < T_2$

D. any of the three is possible

**Answer: A**

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**15.** Suppose ideal gas equation follows $VP^3 = cons\tan t$. Initial temperature and volume of the gas are T and V respectively. If gas expand to $27V$ temperature will become

A. $T$

B. $9T$

C. $27T$

D. $T/9$

**Answer: B**

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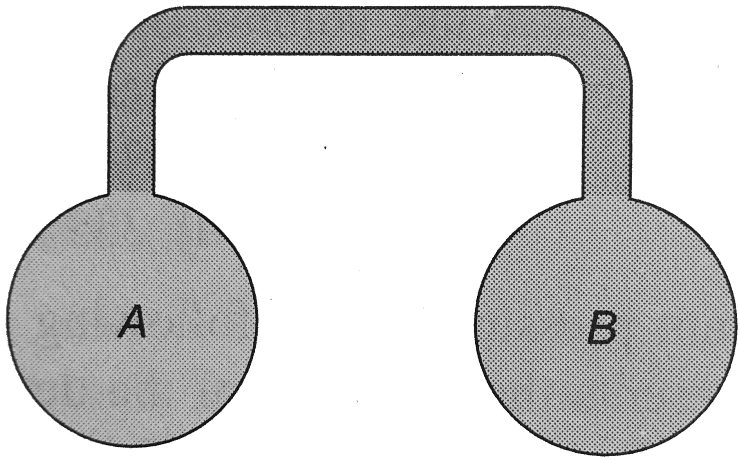
**16.** Two spherical vessel of equal volume are connected by a n arrow tube. The apparatus contains an ideal gas at one atmosphere and $300K$. Now if one vessel is immersed in a bath of constant temperature $600K$ and the other in a bath of constant temperature $300K$. then the common pressure will be




A. $1atm$

B. $\frac{4}{5}atm$

C. $\frac{4}{3}atm$

D. $\frac{3}{4}atm$

**Answer: C**

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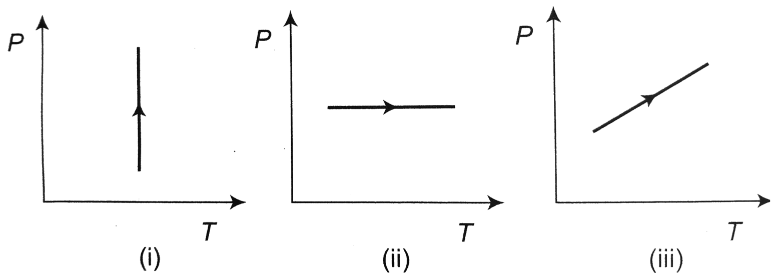
**17.** Pressure versus temperature graphs of an ideal gas are as shown in figure. Choose the wrong statement




A. Density of gas is increased in graph (i)

B. Density of gas is decrease in graph (ii)

C. Density of gas is constant in graph (iii)

D. None of these

**Answer: C**

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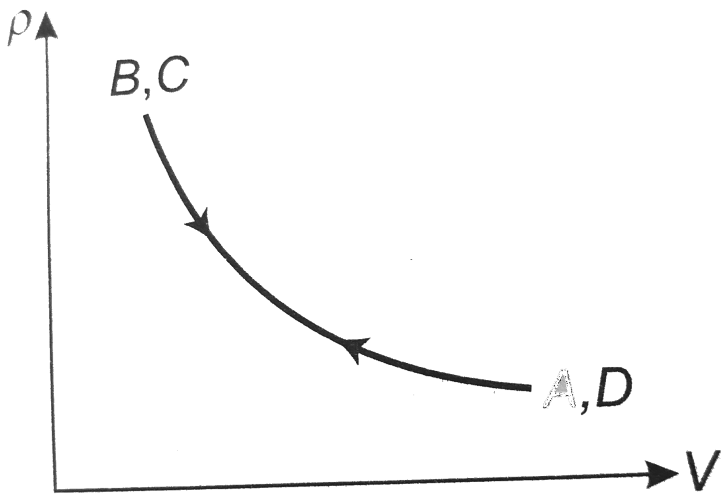
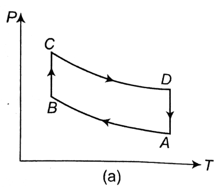
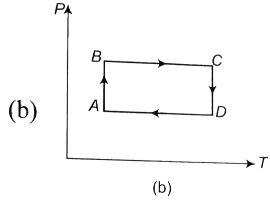
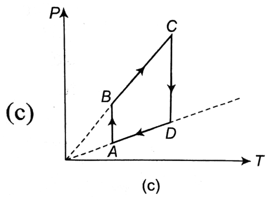
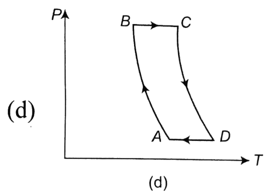
**18.** Density vs volume graph is shown in the figure. Find corresponding pressure vs temperature graph




A. (a) 

B. 


C. 


D. 


**Answer: C**

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**19.** The initial temperature of a gas is $100^{\circ} C$. The gas is contained in closed vessel. If the pressure on the gas is increased by $5\%$ calculate the increase in temperature of the gas

A. $1^{\circ}C$

B. $2^{\circ}C$

C. $4^{\circ}C$

D. $5^{\circ}C$

**Answer: D**

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**20.** A closed hollow insulated cylinder is filled with gas at $0^{\circ}C$ and also contains an insulated piston of negligible weight and negligible thickness at the middle point. The gas on one side of the piston is heated to $100^{\circ}C$. If the piston moves $5cm$ the length of the hollow cylinder is

A. $13.65cm$

B. $27.3cm$

C. $38.6cm$

D. $64.6cm$

**Answer: D**

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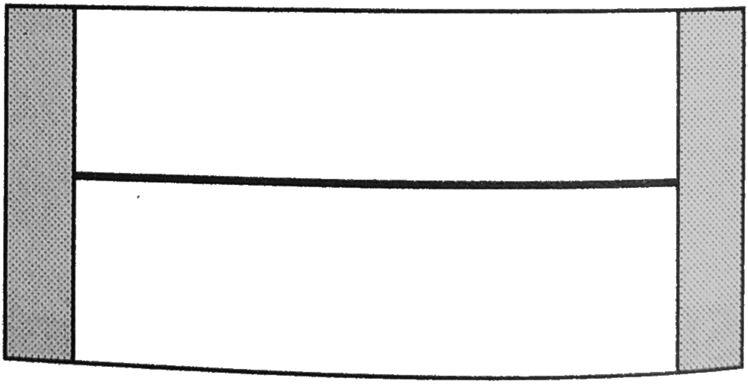
**21.** The air tight and smooth piston of a cylindrical vessel are connected with a string as shown. Initially pressure and temperature of the gas are $P_0$ and $T_0$. The atmospheric pressure is also $P_0$. At a later time, tension in the string is $\frac{3}{8}P_0A$ where A is cthe cross-sectional are of the cylinder. at this time, the temperature of the gas has become.



A. $\frac{3}{8}T_0$

B. $\frac{3}{4}T_0$

C. $\frac{11}{8}T_0$

D. $\frac{13}{8}T_0$

**Answer: C**

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**22.** An ideal gas has a volume of $3V$ at $2$ atmosphere pressure. Keeping the temperature constant. Its pressure is doubled. The volume of the gas will be

A. $6V$

B. $3V$

C. $1.5V$

D. $1V$

**Answer: C**

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**23.** The volume of a given mass of a gas at $27^\circ C, 1 atm$ is $100.$ What will be its volume at $327^\circ C$?

A. $200$

B. $150$

C. $300$

D. $100$

**Answer: A**

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**24.** A vessel of volume $1660cm^3$ contains $0.1\text{mole}$ of oxygen and $0.2\text{mole}$ of nitrogen. If the temperature of the mixture is $300K$, find its pressure.

A. $2.5 \times 10^5 Pa$

B. $1.5 \times 10^5 Pa$

C. $4.5 \times 10^5 Pa$

D. $6.5 \times 10^5 Pa$

**Answer: C**

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**25.** One litre of helium gas at a pressure $76cm$. Of Hg and temperature $27^\circ C$ is heated till its pressure and volume are double. The final temperature attained by the gas is:

A. $327^\circ C$

B. $927^\circ C$

C. $1027^\circ C$

D. $827^\circ C$

**Answer: B**

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**26.** A constant pressure $V_1$ and $V_2$ are the volumes of a given mass of a gas at temperature $27^\circ C$ and $54^\circ C$ respectively. Then the ratio $\frac{V_1}{V_2}$ will be

A. $\frac{100}{109}$

B. $\left(\sqrt{\frac{100}{109}}\right)$

C. $\frac{10}{54}$

D. $\frac{54}{10}$

**Answer: A**

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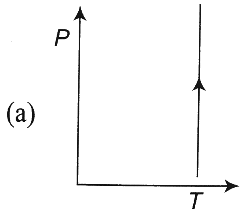
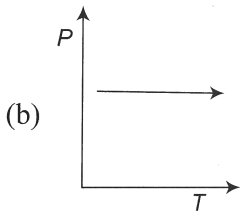
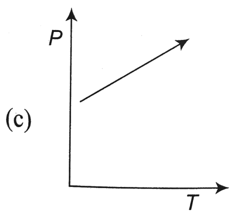
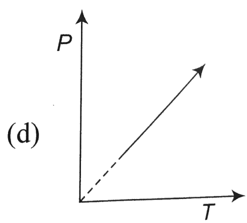
**27.** In which of these diagrams, the density of an ideal gas remains constant?

A. 


B. 


C. 


D. 


**Answer: D**

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**28.** $V = k\left(\frac{P}{T}\right)^{0.33}$ where k is constant. It is an,

A. isothermal process

B. adiabatic process

C. isochoric process

D. isobaric process

**Answer: C**

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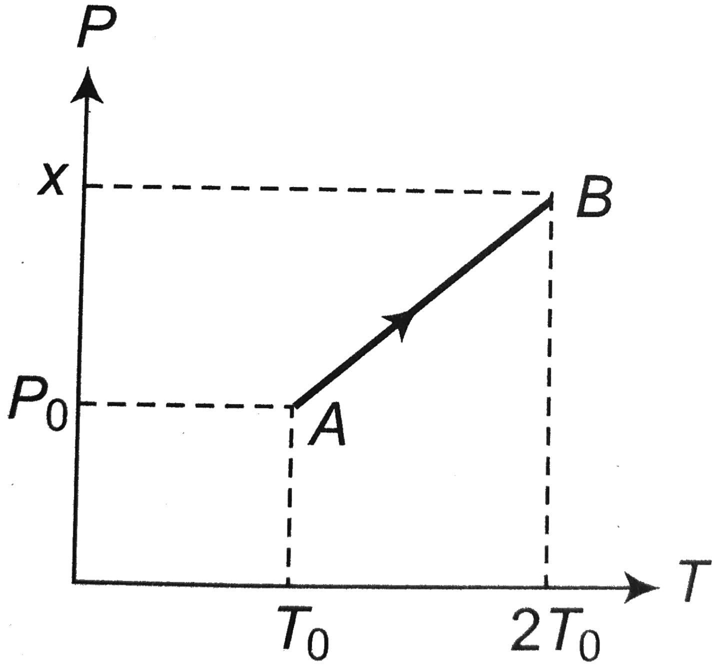
**29.** The densities at points A and B are $\rho_0$ and $\frac{3\rho_0}{2}$. Find the value of x on P-axis.




A. $2P_0$

B. $\frac{3}{2}P_0$

C. $3P_0$

D. $4P_0$

**Answer: C**

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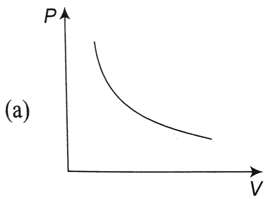
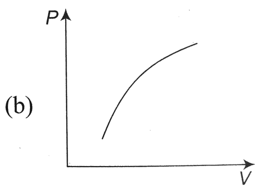
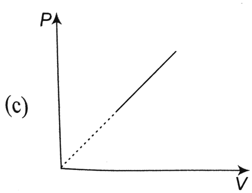
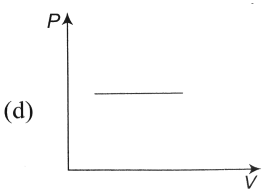
**30.** The given curve represents the variation of temperatue as a function of volume for one mole of an ideal gas. Which of the following curves best represents the variation of pressure as a function of volume ?

(##DCP_V03_C20_E01_099_Q01##).

A. 


B. 


C. 


D. 

**Answer: A**

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**31.** One mole of an ideal gas undergoes a process $P = P_0\left[1 + \left(\frac{2V_0}{V}\right)^2\right]^{-1}$, where $P_0V_0$ are constants. Change in temperature of the gas when volume is changed from $V = V_0 \rightarrow V = 2V_0$ is:

A. $\frac{4}{5}\frac{P_0V_0}{nR}$

B. $\frac{3}{4}\frac{P_0V_0}{nR}$

C. $\frac{2}{3}\frac{P_0V_0}{nR}$

D. $\frac{9}{7}\frac{P_0V_0}{nR}$

**Answer: A**

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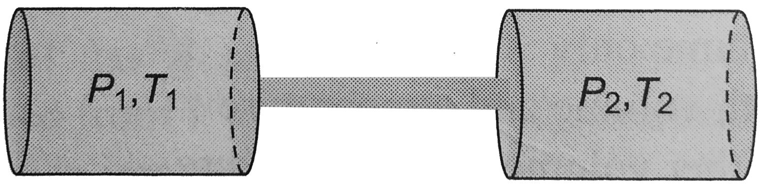
**32.** Two identical vessels contain the same gas at pressure $P_1$ and $P_2$ at absolute temperature $T_1$ and $T_2$, respectively. On joining the vessels with a small tube as shown in the figure. The gas reaches a common temperature T and a common pressure P. Determine the ratio $P/T$




A. $\left[\frac{P_1T_1 + P_2T_2}{T_1T_2}\right]$

B. $\frac{1}{2}\left[\frac{P_1T_1 + P_2T_2}{T_1T_2}\right]$

C. $\frac{1}{2}\left[\frac{P_1T_2 + P_2T_1}{T_1T_2}\right]$

D. $\left[\frac{P_1T_2 + P_2T_1}{T_1T_2}\right]$

**Answer: C**

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## First Law Of Thermodynamics , Internal Energy And Work Done

**1.** A system is said to be in thermal equilibrium if

A. the macroscopic variable do not change in time

B. the microscopic variable change in time

C. the macroscopic variables depend on time

D. none of above

**Answer: A**

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**2.** Two system in thermal equilibrium with a third system separately are in thermal equilibrium with each other. The above statement is

A. First law of thermodynamics

B. Second law of thermodynamics

C. Third law of thermodynamics

D. Zeroth law of thermodynamics

**Answer: D**

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**3.** Internal energy of an ideal gas depends upon

A. temperature only

B. volume only

C. both volume and temperature

D. neither volume nor temperature

**Answer: A**

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**4.** The internal energy of an ideal diatomic gas corresponding to volume $V$ and pressure $P$ is $U = 2.5PV$. The gas expands from 1 litre to 2 litre at a constant pressure of one atmosphere. The heat supplied to the gas is

A. $100J$

B. $250J$

C. $350J$

D. $50J$

**Answer: C**

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**5.** A certain mass of an ideal diatomic gas contained in a closed vessel to heated it is observed that the temperature remains constant. However, half the amount of gas gets dissociated. The ratio of the heat supplied to the gas initial internal energy of the gas will be

A. $1:2$

B. $1:4$

C. $1:5$

D. $1:10$

**Answer: D**

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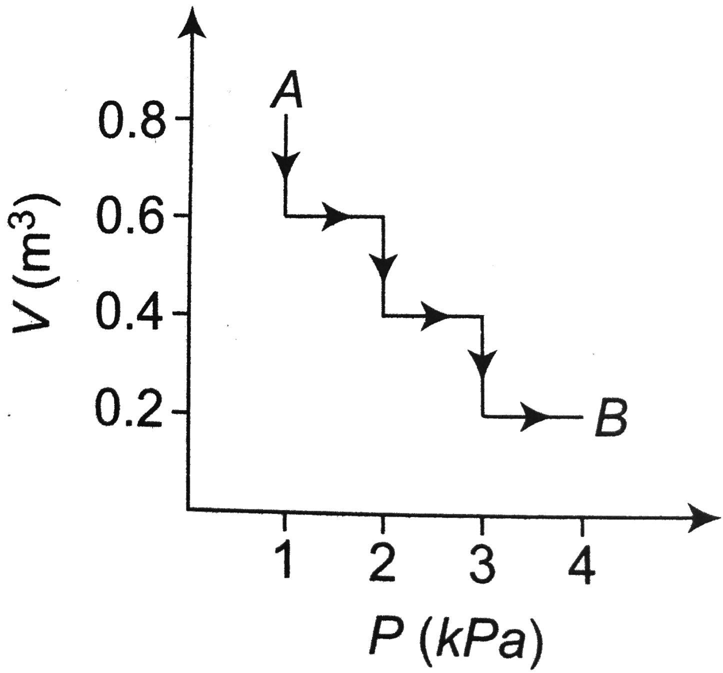
**6.** An ideal gas is taken along the path $AB$ as shown in the figure. The work done by the gas is




A. $600J$

B. $1200J$

C. $-600J$

D. $-1200J$

**Answer: D**

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**7.** Helium gas is subjected to a polytropic process in which the heat supplied to the gas is four times the work done by it. The molar heat capacity of the gas for the process is: (R is universal gas constant)

A. $R/2$

B. $R$

C. $2/R$

D. $3/R$

**Answer: C**

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**8.** When 1 gm of water changes from liquid to vapour phase at constant pressure of 1 atmosphere, the volume increases from 1cc to 1671cc. The heat of vaporisation at his pressure is 540 cal/gm. Increase in internal energy of water is (1 atmosphere =1.01x $10^6$ dyne/$cm^2$)

A. $2099J$

B. $3000J$

C. $992j$

D. $2122j$

**Answer: A**

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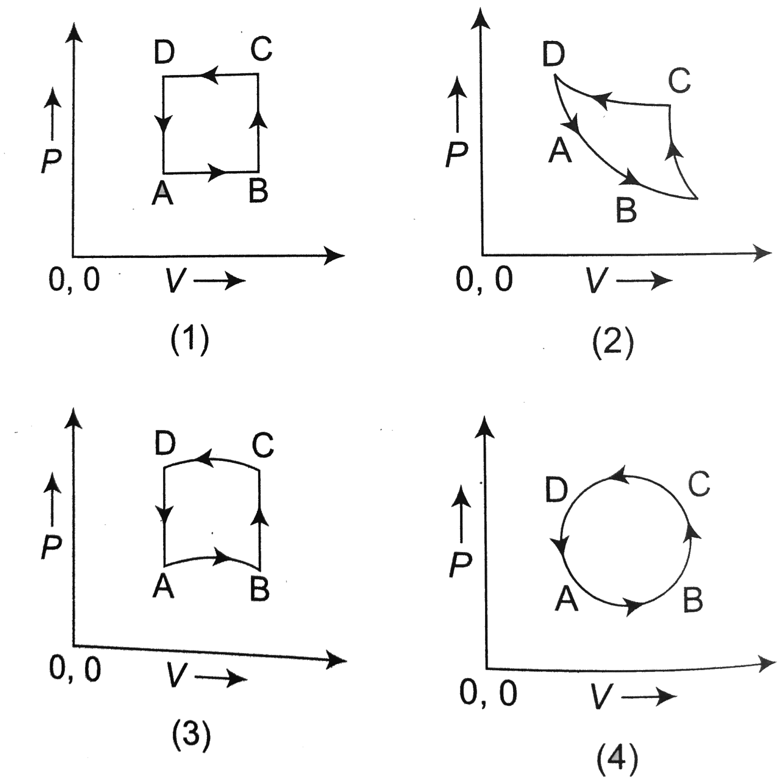
**9.** In following figs. Variation of volume by change of pressure is shown in Fig. A gas is taken along the path $ABCDA$. The change in internal energy of the gas will be:



A. positive in all cases from $(1) \to (4)$

B. Positive in cases $(1), (2)$ and $(3)$ but zero in case $(4)$

C. Negative in case $(1), (2)$ and $(3)$ but zero in case $(4)$

D. zero in all the four cases

**Answer: D**

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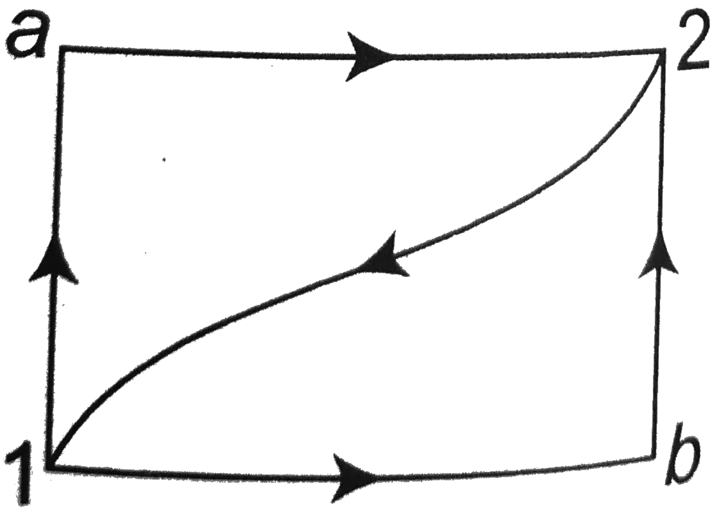
**10.** When a system is taken from state $1 \to 2$ along the path $1a2$ it absorbs $50cal$ of heat and work done is $20cal$. Along the path

$1b2. Q = 36cal$. What is the work done along $1b2$?




A. $56cal$

B. $66cal$

C. $16cal$

D. $6cal$

**Answer: D**

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**11.** The ratio of work done by an ideal diatomic gas to the heat supplied by the gas in an isobaric process is

A. $\frac{5}{7}$

B. $\frac{3}{5}$

C. $\frac{2}{7}$

D. $\frac{5}{3}$

**Answer: C**

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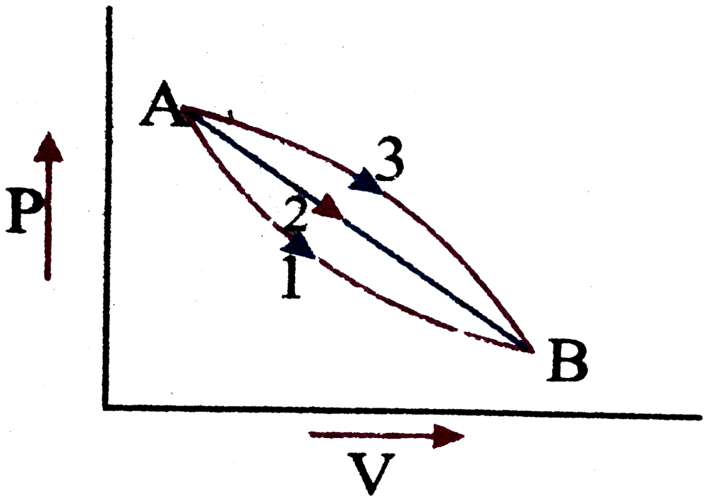
**12.** A given mass of a gas expands from the state A to the state B by three paths 1,2 and 3 as shown in the figure, If $W_1$, $W_2$ and $W_3$ respectively be the work done by the gas along the three paths then




A. $W_1 > W_2 > W_3$

B. $W_1 < W_2 < W_3$

C. $W_1 = W_2 = W_3$

D. $W_1 < W_2, W_1 < W_3$

**Answer: B**

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**13.** When an ideal diatomic gas is heated at constant pressure, the fraction of the heat energy supplied which increases the internal energy of the gas is

A. $2/5$

B. $3/5$

C. $3/7$

D. $3/4$

**Answer: B**

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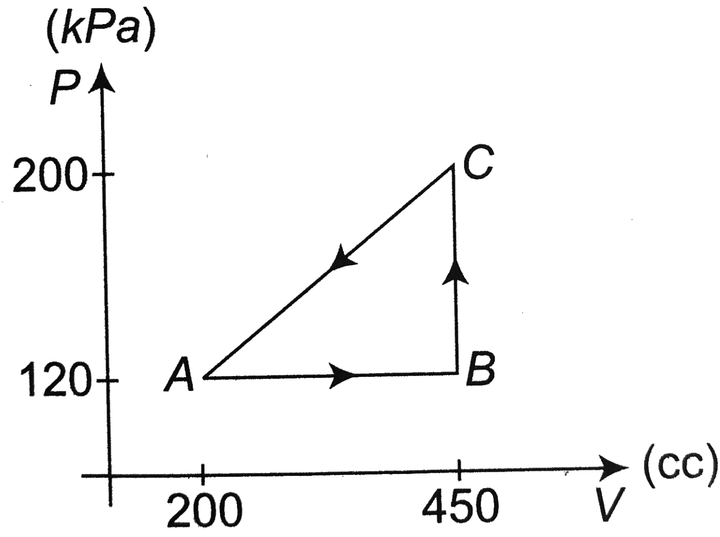
**14.** Calculate the work done by the gas in the state diagram shown.




A. $30J$

B. $20J$

C. $-20J$

D. $-10J$

**Answer: D**

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**15.** $Q$ cal of heat is required to raise the temperature of $1\text{mole}$ of a monatomic gas from $20^\circ C \rightarrow 30^\circ C$ at constant pressure. The amount of heat required to raise the temperature of $1\text{mole}$ of diatomic gas from $20^\circ C \rightarrow 25^\circ C$ at constant pressure is

A. $Q$

B. $\frac{3}{2}Q$

C. $\frac{5}{6}Q$

D. $\frac{7}{10}Q$

**Answer: D**

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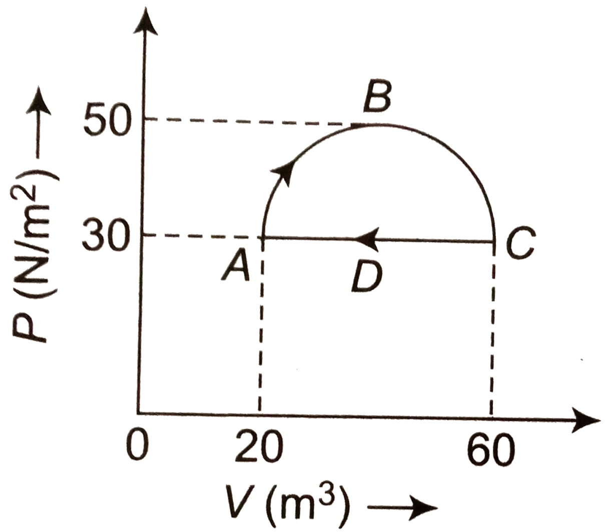
**16.** A gas undergoes a cyclic process $ABCDA$ as shown in the figure. The part $ABC$ of process is semicircular. The work done by the gas is




(b) 2456 J
(d) 1826 J

A. $400\pi J$

B. $2456 J$

C. $200\pi$

D. $1826 J$

**Answer: c**

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**17.** A gas mixture consists of 2 moles of oxygen and 4 moles of argon at temperature T. Neglecting all vibrational modes, the total internal energy of the system is

A. $4RT$

B. $15RT$

C. $9RT$

D. $11RT$

**Answer: D**

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**18.** $1g$ mole of an ideal gas at STP is subjected to a reversible adiabatic expansion to double its volume. Find the change in internal energy $(\gamma = 1.4)$

A. $1169.5J$

B. $769.5J$

C. $1369.5J$

D. $969.5J$

**Answer: C**

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**19.** A monoatomic gas is supplied heat Q very slowly keeping the pressure constant. The work done by the gas is

A. $\frac{2}{5}Q$

B. $\frac{3}{5}Q$

C. $\frac{Q}{5}$

D. $\frac{2}{3}Q$

**Answer: D**

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**20.** An ideal gas A and a real gas B have their volumes increases from $V \rightarrow 2V$ under isothermal condtitions. The increase in internal energy

A. will be same in both A and B

B. will be zero in bothe the gases

C. of B will be more than that of A

D. of A will be more than that of B

**Answer: B**

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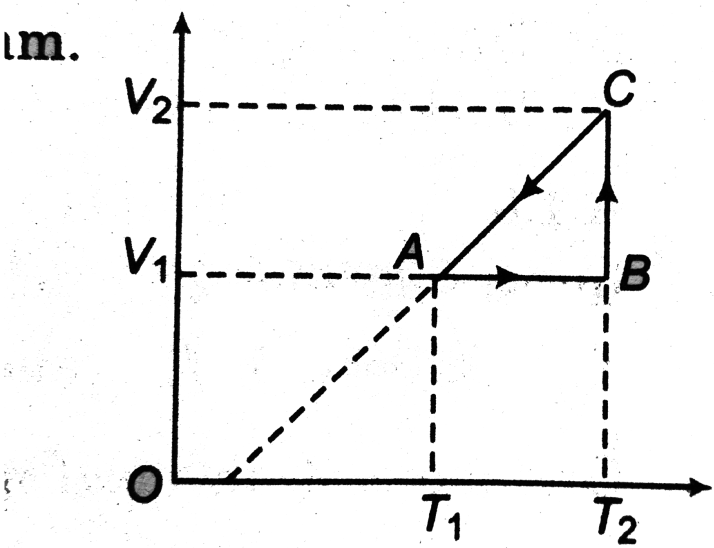
**21.** The cyclic process for 1 mole of an ideal gas is shown in the V-T diagram. The work done in AB, BC and CA respectively is



A. $0, \; RT_2 In\left(\frac{V_1}{V_2}\right), \; R(T_1 - T_2)$

B. $R(T_1 - T_2), \; 0, \; RT_1 In\left(\frac{V_1}{V_2}\right.$

C. $0, \; RT_2 In\left(\frac{V_2}{V_1}\right), \; R(T_1 - T_2)$

D. $0, \; RT_2 In\left(\frac{V_2}{V_1}\right), \; R(T_2 - T_1)$

**Answer: C**

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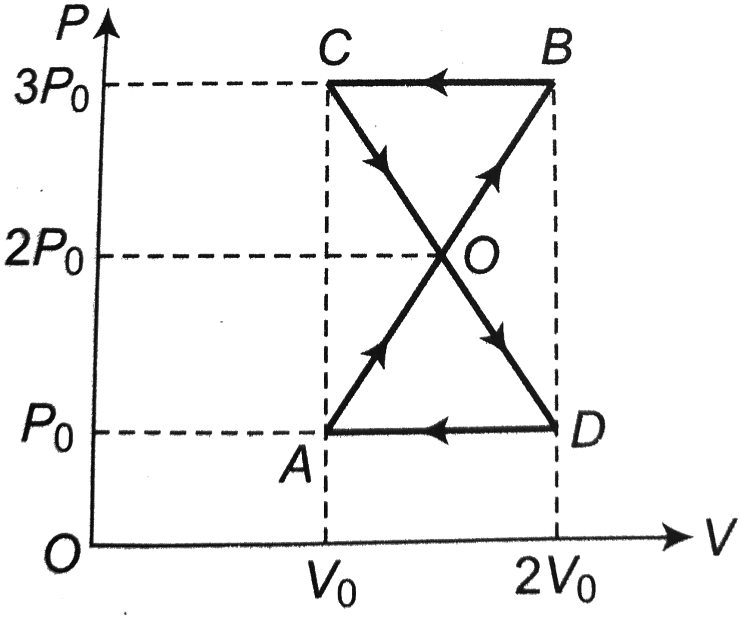
**22.** A thermodynamic system undergoes cyclic process $ABCDA$ as shown in figure. The work done by the system is




A. $P_0V_0$

B. $2P_0V_0$

C. $P_0\dfrac{V_0}{2}$

D. $zero$

**Answer: D**

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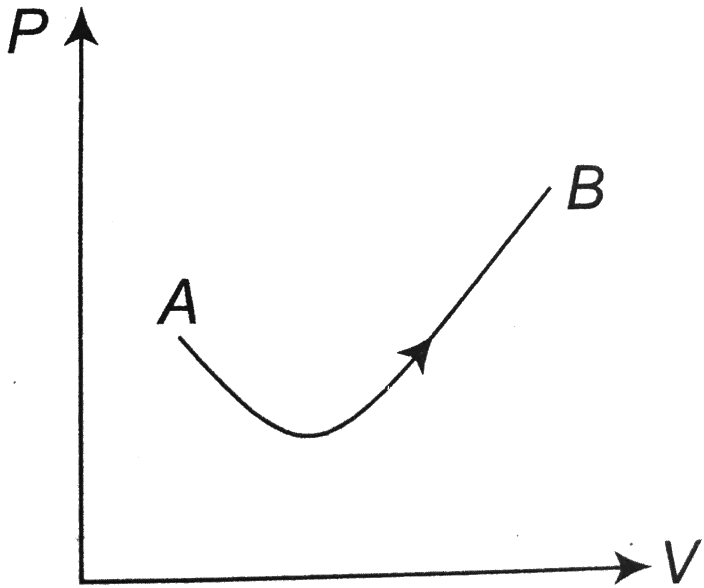
**23.** Consider a process shown in the figure. During this process the work done by the system




A. Continuously increases

B. Continuously decreases

C. First increases, then decreases

D. First decreases, then increases

**Answer: A**

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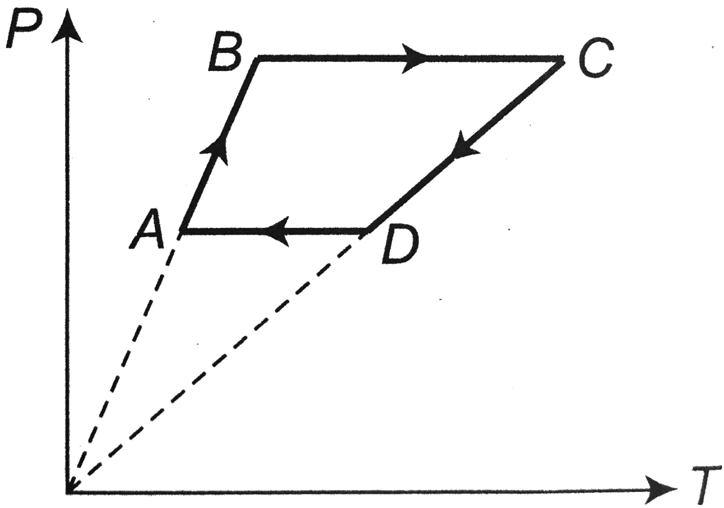
**24.** Six moles of an ideal gas performs a cycle shown in figure. If the temperature are $T_A = 600K, T_B = 800K, T_C = 2200K$ and $T_D = 1200K$, the work done per cycle is




A. $20kJ$

B. $30kJ$

C. $40kJ$

D. $60kJ$

**Answer: C**

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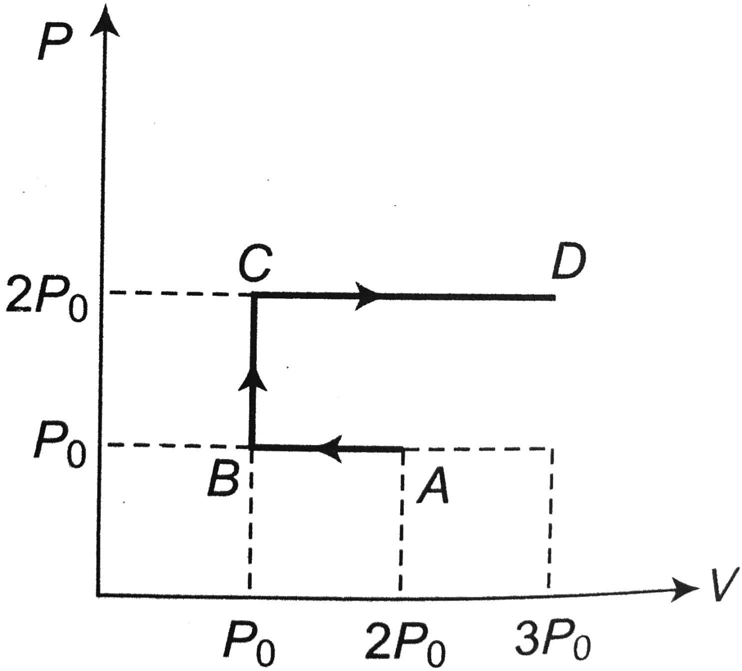
**25.** $P - V$ diagram of an ideal gas is as shown in figure. Work done by the gas in process $ABCD$ is




A. $4P_0V_0$

B. $2P_0V_0$

C. $3P_0V_0$

D. $P_0V_0$

**Answer: C**

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**26.** A gas expand with temperature according to the relation $V = KT^{2/3}$. What is the work done when the temperature changes by $30^{\circ} C$?

A. $10R$

B. $20R$

C. $30R$

D. $40R$

**Answer: B**

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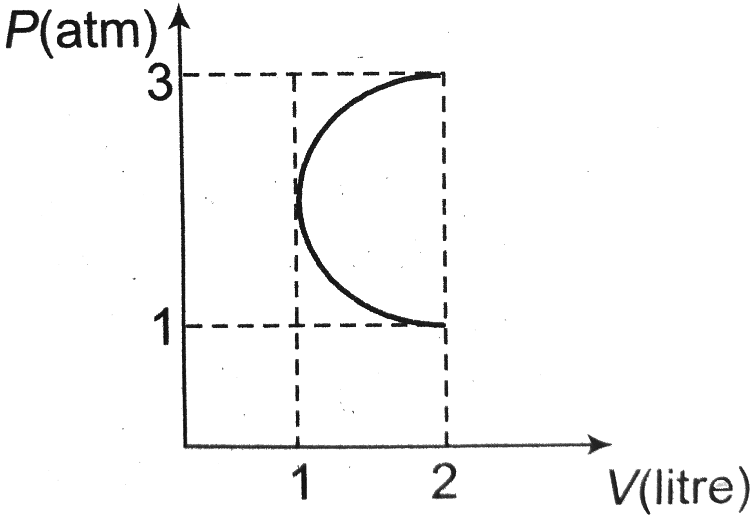
**27.** In the $P - V$ diagram shown in figure $ABC$ is a semicircle. The work done in the process $ABC$ is




A. zero

B. $\frac{\pi}{2} atm - It$

C. $-\frac{\pi}{2} atm - It$

D. $4 atm - It$

**Answer: B**

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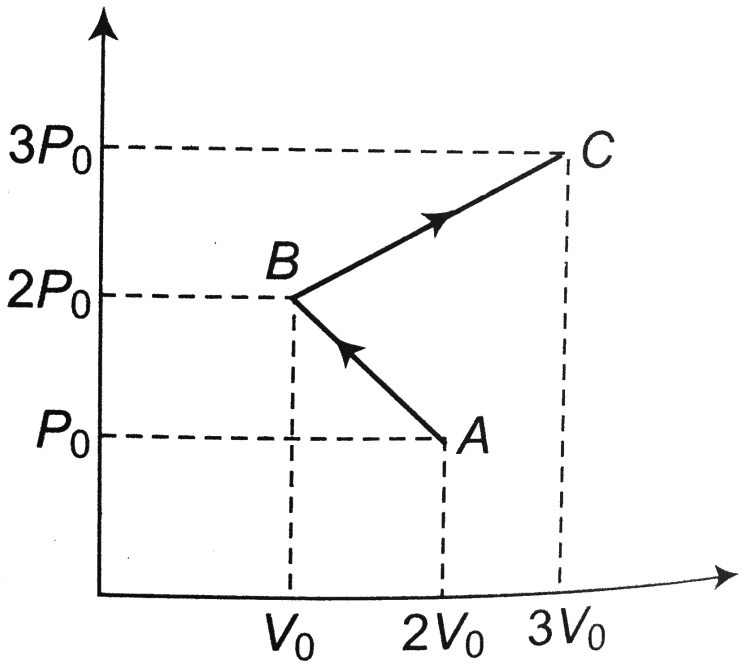
**28.** Find the work done by the gas in the process $ABC$.




A. $\frac{3}{2}P_0V_0$

B. $\frac{5}{2}P_0V_0$

C. $\frac{7}{2}P_0V_0$

D. $4P_0V_0$

**Answer: C**

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**29.** An ideal gas is taken through a quasi-static process described by $P = \alpha V^2$, with $\alpha = 5.00 atm / m^6$. The gas is expanded to twice its original volume of $1.00 m^3$. How much work is done by the gas in expanding gas in this process?

A. $1.8 MJ$

B. $2.18 MJ$

C. $1.28 MJ$

D. $3.18 MJ$

**Answer: A**

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**30.** Find the amount of work done to increase the temperature of one mole jof an ideal gas by $30^{\circ} C$, if it is expanding under condition $V \infty T^{2/3}$.

A. $10R$

B. $20R$

C. $30R$

D. $40R$

**Answer: B**

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**31.** We consider a thermodynamic system. If $\Delta U$ represents the increase in its internal energy and W the work done by the system, which of the following statements is true?

A. $\Delta U = -W$ in adiabatic process

B. $\Delta U = W$ in an isothermal process

C. $\Delta U = -W$ in an isothermal process

D. $\Delta U = W$ in an adiabatic process

**Answer: A**

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**32.** When heat in given to a gas in an isobaric process, then

A. The work is done by the gas

B. Internal energy of the gas increases

C. Both (a) and (b)

D. None from (a) and (b)

**Answer: C**

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**33.** Which of the following is correct in terms of increasing work done for the same initial and final state?

A. Adiabatic lt Isothermal lt Isobaric

B. Isobaric lt Adiabatic lt Isothermal

C. Adiabatic lt Isobaric lt Isothermal

D. None of these

**Answer: A**

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**34.** When an ideal diatomic gas is heated at constant pressure, the fraction of the heat energy supplied which increases the internal energy of the gas is

A. $\frac{2}{5}$

B. $\frac{3}{5}$

C. $\frac{3}{7}$

D. $\frac{5}{7}$

**Answer: D**

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**35.** The molar heat capacity in a process of a diatomic gas if it does a work of $\frac{Q}{4}$ when a heat of $Q$ is supplied to it is

A. $\frac{2}{5}R$

B. $\frac{5}{2}R$

C. $\frac{10}{3}R$

D. $\frac{6}{7}R$

**Answer: C**

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**36.** An insulator container contains $4$ moles of an ideal diatomic gas at temperature T. Heat Q is supplied to this gas, due to which $2$ moles of the gas are dissociated into atoms but temperature of the gas remains constant. Then

A. $Q = 2RT$

B. $Q = RT$

C. $Q = 3RT$

D. $Q = 4RT$

**Answer: B**

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**37.** Which one of the following gases possesses the largest internal energy

A. 2 moles of helium occupying $1m^3 at 300K$

B. 56 kg of nitrogen at $107Nm^{-2}$ and $300K$

C. 8 grams of oxygen at $8atm 300K$

D. $6 \times 10^{26}$ molecules of argon occupying $40m^3 at 900K$

**Answer: B**

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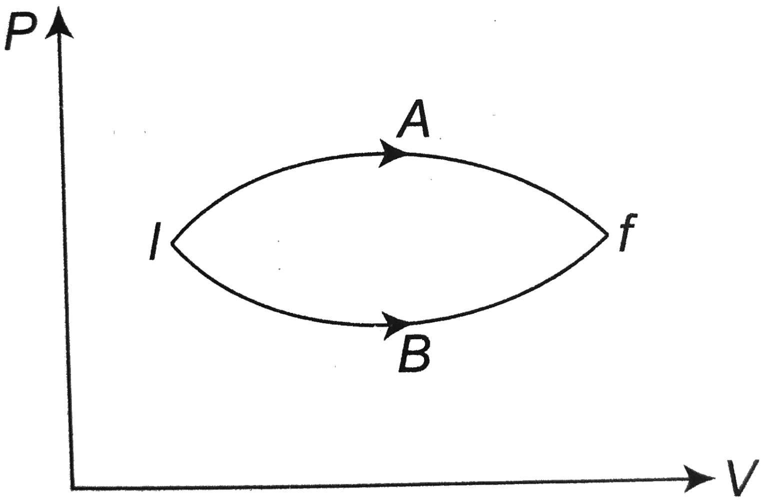
**38.** In the figure given two processes $A$ and $B$ are shown by which a thermodynamic system goes from initial to final state F. if $\Delta Q_A$ and $\Delta Q_B$ are respectively the heats supplied to the systems then




A. $\Delta Q_A = \Delta Q_B$

B. $\Delta Q_A \geq \Delta Q_B$

C. $\Delta Q_A < \Delta Q_B$

D. $\Delta Q_A > \Delta Q_B$

**Answer: D**

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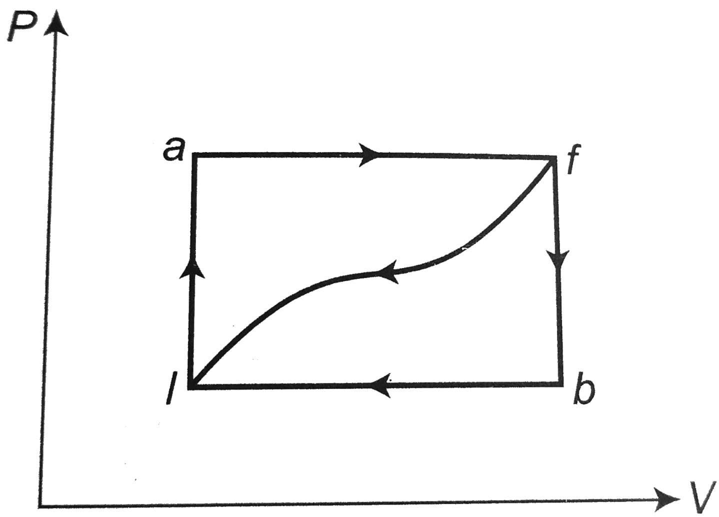
**39.** When a system is taken from state f along path $iaf, Q = 50J$ and $W = 20J$. Along path $ibf, Q = 35J$. If $W = -13J$ for the curved return path $fI$, $Q$ for this path is



A. $33J$

B. $23J$

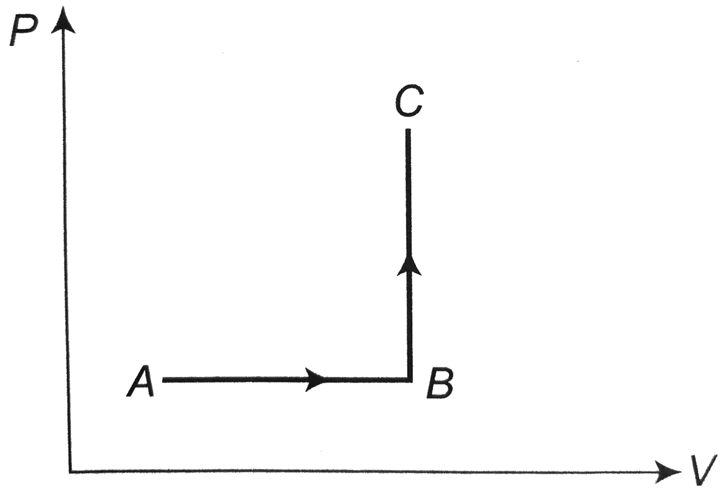
C. $-7J$

D. $-43J$

**Answer: D**

Watch Video Solution

**40.** The $P-V$ diagram of a system undergoing thermodynamic transformation is shown in figure. The work done by the system in going from $A \rightarrow B \rightarrow C is 30J$ and $40J$ heat is given to the system. The change in internal energy between $A$ and $C$ is




A. $10J$

B. $70J$

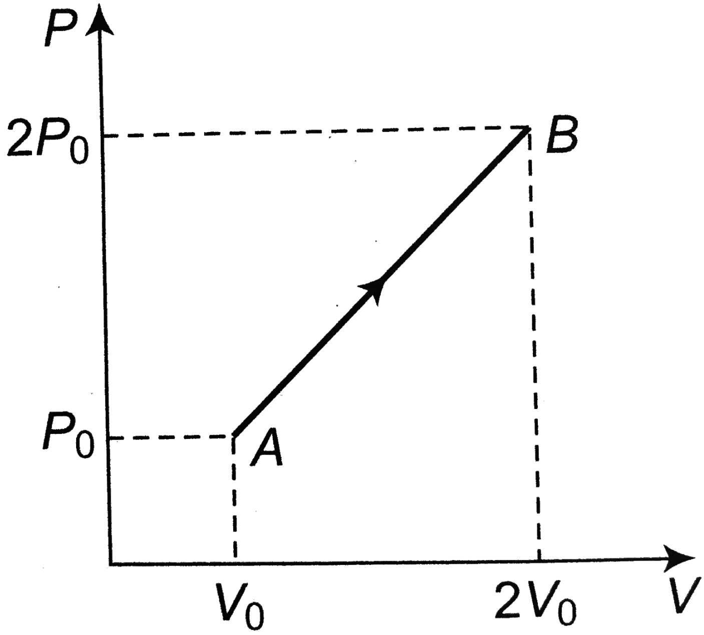
C. $84J$

D. $134J$

**Answer: A**

Watch Video Solution

**41.** The $P-V$ diagram of 2 gm of helium gas for a certain process $A \rightarrow B$ is shown in the figure. What is the heat given to the gas during the process $A \rightarrow B$?




A. $4P_0V_0$

B. $6P_0V_0$

C. $4.5P_0V_0$

D. $2P_0V_0$

**Answer: B**

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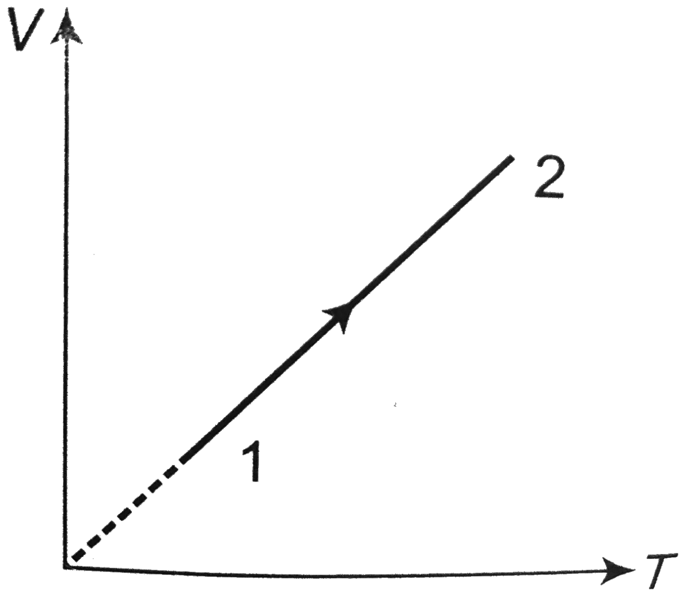
**42.** Volume versus temperature graph of two moles of helium gas is as shown in figure. The ratio of heat absorbed and the work done by the gas in process $1-2$ is




A. $3$

B. $\frac{5}{2}$

C. $\frac{5}{3}$

D. $\frac{7}{2}$

**Answer: B**

Watch Video Solution

**43.** Heat is supplied to a diatomic gas at constant pressure.

The ratio of $\Delta Q : \Delta U : \Delta W$ is

A. $5:3:2$

B. $5:2:3$

C. $7:5:2$

D. $7:2:5$

**Answer: C**

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**44.** N moles of an ideal diatomic gas are in a cylinder at temperature T. suppose on supplying heat to the gas, its temperature remain constant but n moles get dissociated into atoms. Heat supplied to the gas is

A. $zero$

B. $\frac{1}{2}nRT$

C. $\frac{3}{2}nRT$

D. $\frac{3}{2}(N-n)RT$

**Answer: B**

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**45.** Some of the thermodynamic parameters are state variables while some are process variables. Some grouping of the parameters are given. Choose the correct one.

A. State variables: Temperature, No. of moles process variable: Internal energy, work done by the gas.

B. State variables: Volume, Temperature process variable: Internal energy, work done by the gas.

C. State variables: work done by the gas, heat rejected by the gas Process variables: Temperature, Volume.

D. State variables: Internal energy, volume process variables: Work done by the gas, heat absorbed by the gas.

**Answer: D**

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**46.** In a process, the pressure of an ideal gas is proportional to square of the volume of the gas. If the temperature of the gas increases in this process, then work done by this gas

A. is positive

B. is negative

C. is zero

D. may be positive

**Answer: B**

Watch Video Solution

**47.** In a process, the pressure of an ideal gas is proportional to square of the volume of the gas. If the temperature of the gas increases in this process, then work done by this gas

A. is positive

B. is negative

C. is zero

D. may be positive

**Answer: A**

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**48.** A vessel contains an ideal monoatomic gas which expands at constant pressure, when heat Q is given to it. Then the work done in expansion is

A. $Q$

B. $\frac{3}{5}Q$

C. $\frac{2}{5}Q$

D. $\frac{2}{3}Q$

**Answer: C**

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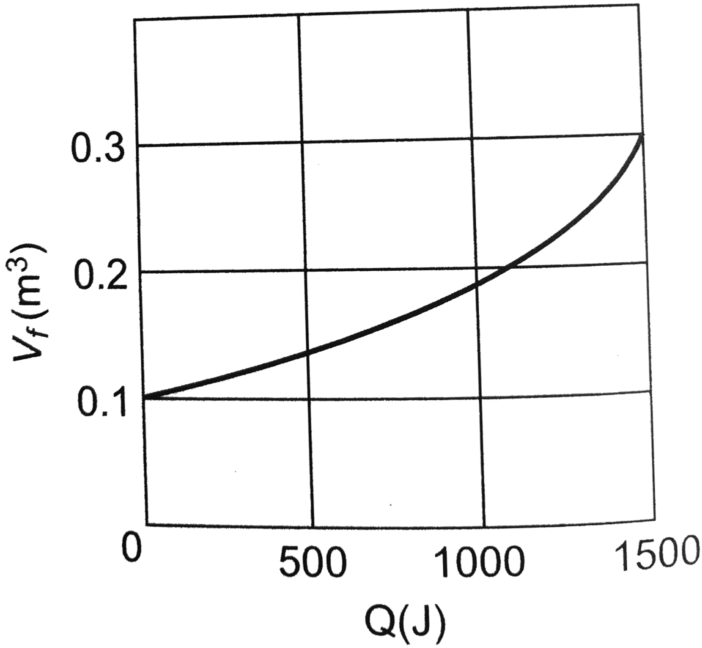
**49.** Suppose $0.5$ moles of an ideal gas undergoes an isothermal expansion as energy is added to it as heat Q. Graph shows the final volume $V_f$ versus Q. The temperature of the gas is

$\left(use \ln 9 = 2 \text{ and } R = \frac{25}{3} J/mol - K\right)$




A. $293K$

B. $360K$

C. $386K$

D. $412K$

**Answer: B**

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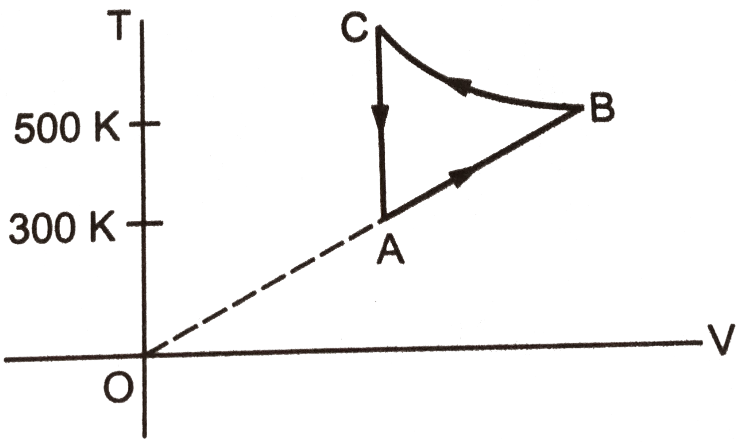
**50.** Consider the cyclic process ABCA, shown in figure, performed on a sample of $2.0 mol$ of an ideal gas. A total of $1200 J$ of heat is withdrawn from the sample in the process. Find the work done by the gas during the part BC.




A. $2580 J$

B. $3625 J$

C. $4520 J$

D. $1550 J$

**Answer: C**

Watch Video Solution

**51.** A quantity of heat Q is supplied to a monoatomic ideal gas which expands at constant pressure. The fraction of heat that goes into work done by the gas $\left(\frac{W}{Q}\right)$ is

A. $\frac{2}{5}$

B. $\frac{3}{5}$

C. $\frac{2}{3}$

D. $1$

**Answer: A**

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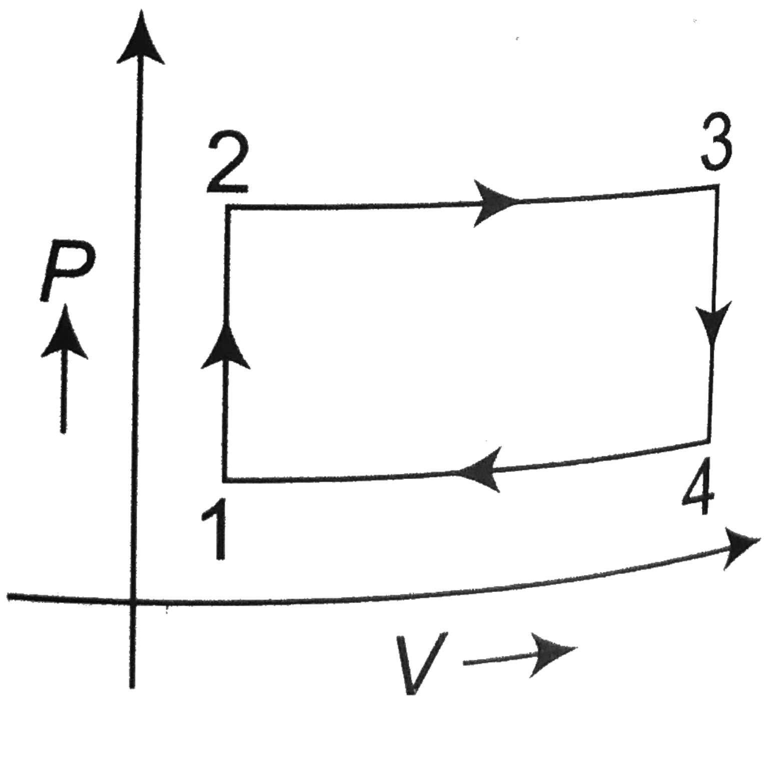
**52.** Three moles of an ideal monoatomic gas per form a cyclic as shown in the Fig. the gas temperature in different states are $T_1 = 400K, T_2 = 800K, T_3 = 2400K$ and $T_4 = 1200K$. The work done by the gas during the cyclic is




A. $10kJ$

B. $20kJ$

C. $5kJ$

D. $8.3kJ$

**Answer: B**

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**53.** In a thermodynamic process, pressure of a fixed mass of a gas is changed in such a manner that the gas release $20J$ of heat and $8J$ of work is done on the gas. If initial internal energy of the gas was $30J$, what will be the final internal energy?

A. $42J$

B. $12J$

C. $10J$

D. $18J$

**Answer: D**

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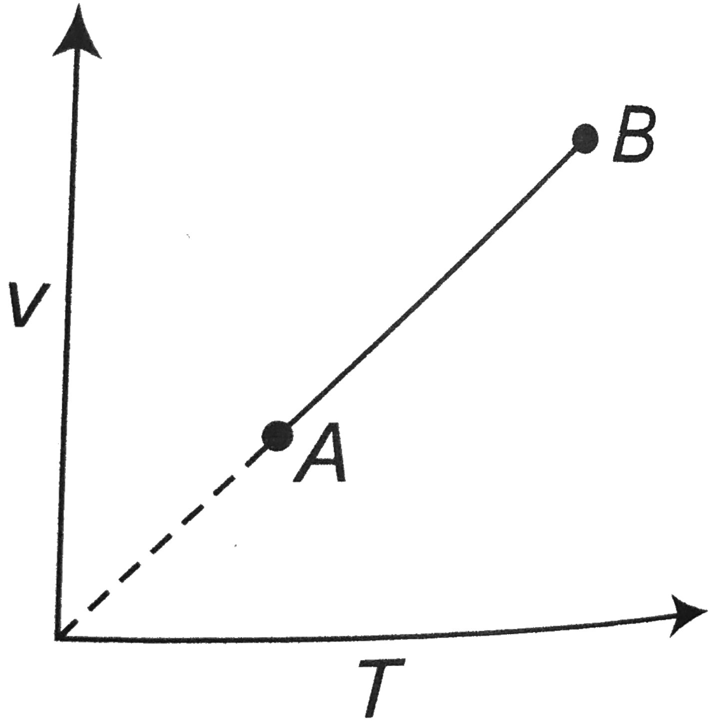
**54.** An ideal monoatomic gas undergoes the process AB as shown in the figure. If the heat supplied and the work done in the process are $\Delta Q$ and Delta W$respectively. The ratio$DeltaQ :

DeltaW` is




A. $2.50$

B. $1.67$

C. $0.67$

D. $0.40$

**Answer: A**

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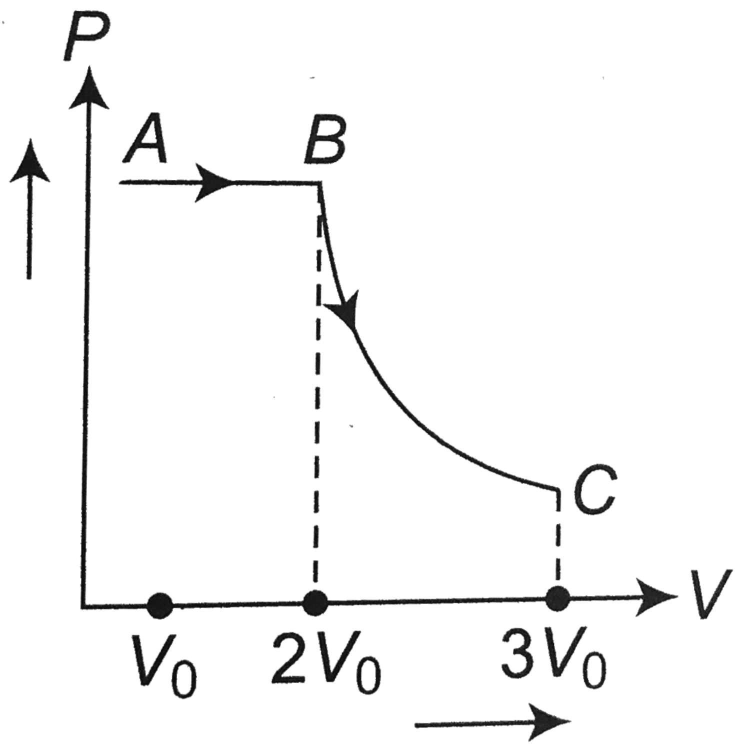
**55.** One mole of a gas is subjected to two process AB and BC, one after the other as shown in the figure. BC is represented by $PV^n = constant$. We can conclude that (where T = temperature, W = work done by gas, V = volume and U = internal energy).



A. $T_A = T_B = T_C$

B. $V_A < T_B, P_B < P_C$

C. $W_{AB} < W_{BC}$

D. $U_A < U_B$

**Answer: D**

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## Application Of First Law Of Thermodynamics In Different Situations

**1.** A fixed mass of a gas is adiabatically made to expand to double its volume and then isochorically heated to bring the gas to the original pressure. The ratio of final to initial temperature will be

A. $1:1$

B. $2:1$

C. $1:2$

D. Depends on the atomicity of the gas.

**Answer: B**

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**2.** The molar heat capacity of a gas in a process

A. is either $C_V$ or $C_P$

B. lies between $C_V$ or $C_P$

C. may range from zero to infinity

D. can have any real value

**Answer: D**

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**3.** When $1$ mole of a monatomic gas is mixed with $3$ moles of a diatomic gas, the value of adiabatic exponent $\gamma$ for the mixture is

A. $\frac{5}{3}$

B. $1.5$

C. $1.4$

D. $\frac{13}{9}$

**Answer: D**

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**4.** A tyre pumped to a pressure $3.375 atm at 27^\circ C$ suddenly bursts. What is the final temperature $(\gamma = 1.5)$?

A. $27^\circ C$

B. $-27^\circ C$

C. $0^\circ C$

D. $-73^\circ C$

**Answer: D**

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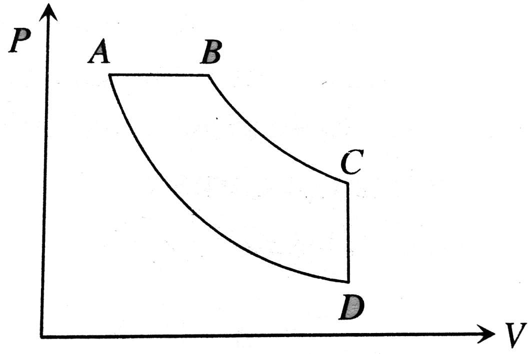
**5.** In the following pressure-volume diagram, the isochoric, isothermal and isobaric parts, respectively, are




A. $BA, AD, DC, CB$

B. $DC, CB, BA, AD$

C. $AB, BC, CD, DA$

D. $CD, DA, AB, BC$

**Answer: D**

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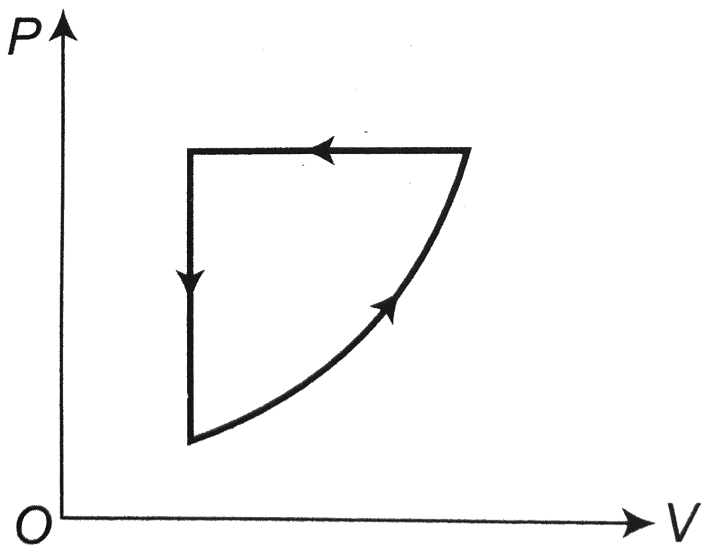
**6.** For one complete cycle of a thermodynamic process gas as shown in the P-V diagram, which of following correct?




A. $\Delta E_{\int} = 0, Q < 0$

B. $\Delta E_{\int} = 0, Q > 0$

C. $\Delta E_{\int} > 0, Q < 0$

D. $\Delta E_{\int} < 0, Q > 0$

**Answer: A**

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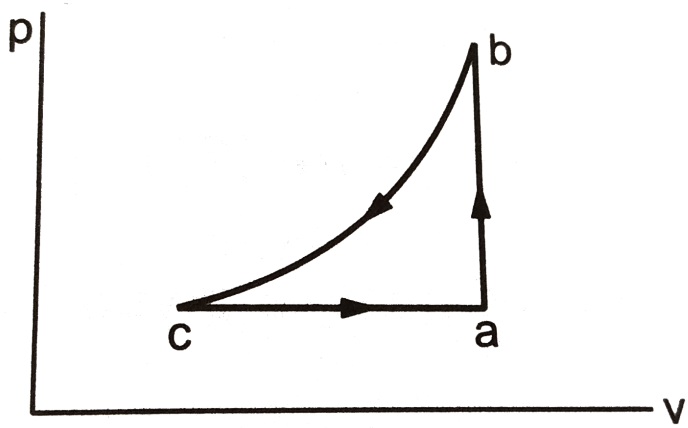
**7.** A sample of an ideal gas is taken through the cyclic process $abca$ . It absorbs $50J$ of heat during the part $ab$, no heat during $bc$ and rejects $70J$ of heat during $ca$. $40J$ of work is done on the gas during the part $bc$.

(a) Find the internal energy of the gas at $b$ and $c$ if it is $1500J$ at $a$.

(b) Calculate the work done by the gas during the part $ca$.




A. $1590J$

B. $1620J$

C. $1540J$

D. $1570J$

**Answer: A**

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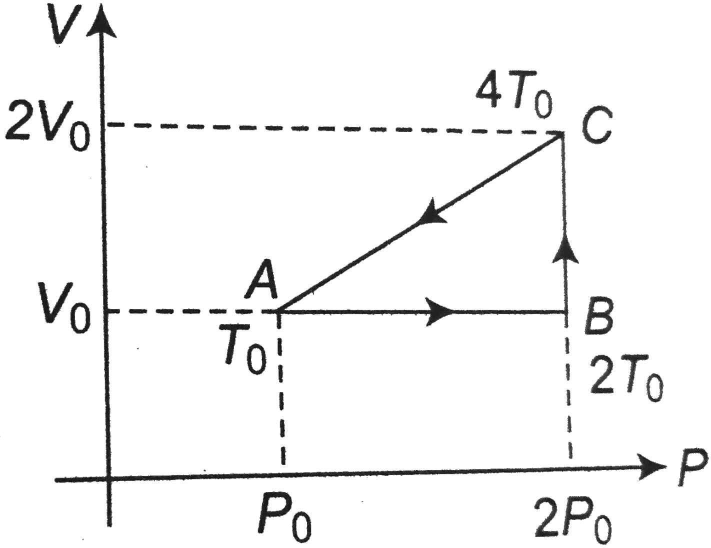
**8.** A thermodynamic process of one mole ideal monoatomic gas is shown in figure. The efficiency of cyclic process $ABCA$ will be




A. $25\ \%$

B. $12.5\ \%$

C. $50\ \%$

D. $7.7\ \%$

**Answer: D**

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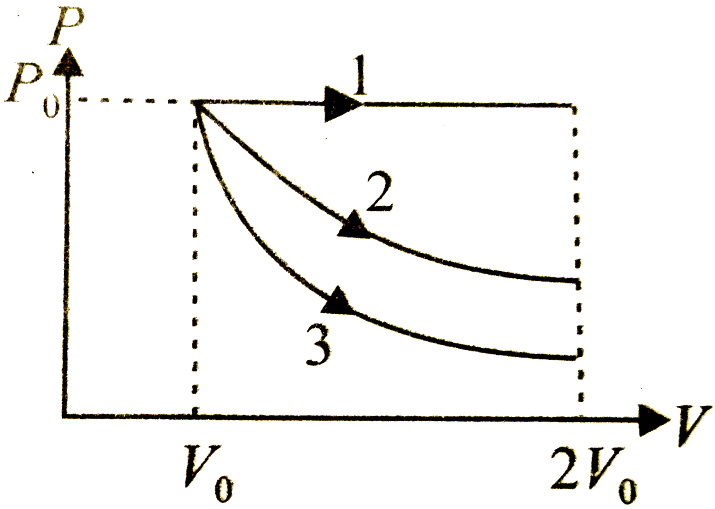
**9.** A gas is expanded form volume $V_0 \to 2V_0$ under three different processes as shown in the figure . Process 1 is isobaric process process 2 is isothermal and and process 3 is adiabatic . Let $\Delta U_1$, $\Delta U_2$ and $\Delta U_3$ be the change in internal energy of the gs in these three processes then




A. $\Delta U_1 > \Delta U_2 > \Delta U_2$

B. $\Delta U_1 < \Delta U_2 < \Delta U_2$

C. $\Delta U_2 < \Delta U_1 < \Delta U_3$

D. $\Delta U_2 < \Delta U_3 < \Delta U_1$

**Answer: A**

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**10.** During adiabatic process pressure P versus density $roh$ equation is

A. $P(roh)^{\gamma} = cons\tan t$

B. $P(roh)^{-\gamma} = cons\tan t$

C. $P^{\gamma}(roh)^{1+\gamma} = cons\tan t$

D.

**Answer: B**

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**11.** P-V diagram of a diatomic gas is a straight line passing through origin. The molar heat capacity of the gas in the process will be

A. $4R$

B. $2.5R$

C. $3R$

D. $4\frac{R}{3}$

**Answer: C**

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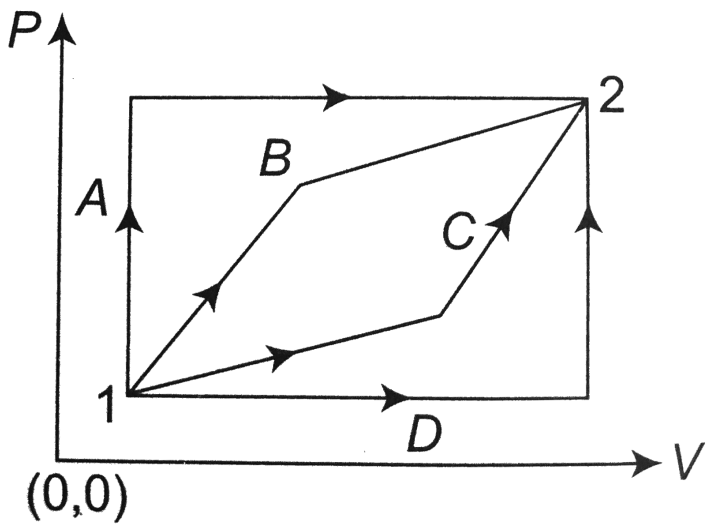
**12.** An ideal gas is taken from state $1$ to state $2$ through optional path $A, B, C$ and $D$ as shown in the $PV$ diagram. Let $Q, W$ and $U$ represent the heat supplied, work done and change in internal energy of the gas respectively.

Then,




A. $Q_A - Q(D) = W_A - W(D)$

B. $Q_B - W(B) > Q_C - W(C)$

C. $W_A < W(B) < W_C - W(D)$

D. $Q_A < Q(B) < Q_C - Q(D)$

**Answer: A**

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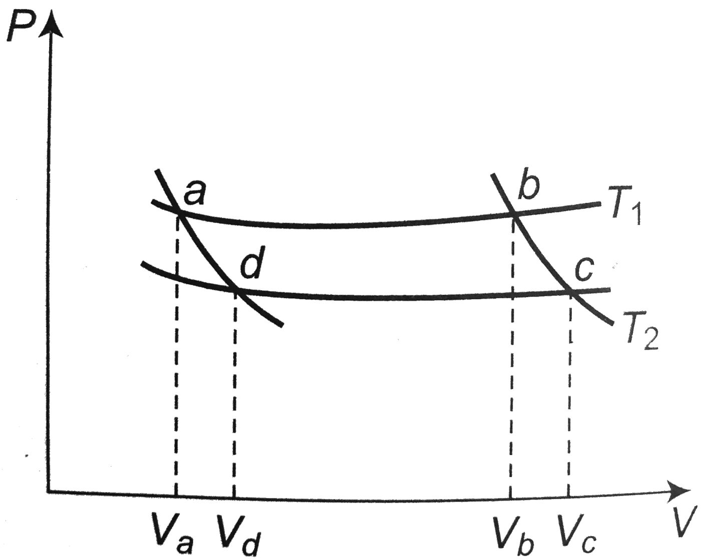
**13.** In the following P-V diagram two adiabatics cut two isothermals at temperature $T_1$ and $T_2$ (fig). The value of $\frac{V_a}{V_d}$ will be




A. $\frac{V_b}{V_c}$

B. $\frac{V_c}{V_b}$

C. $\frac{V_d}{V_a}$

D. $V_b V_c$

**Answer: A**

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**14.** In an adiabatic process, $R = \frac{2}{3}C_v$. The pressure of the gas will be proportional to:

A. $T^{5/3}$

B. $T^{5/2}$

C. $T^{5/4}$

D. $T^{5/6}$

**Answer: B**

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**15.** Initial volume of three samples of same gas $A, B$ and $C$ are same. The process A is adiabatic, B is isobaric and C is isothermal. Each of the sample has same final pressure and volume. The initial pressure of which sample was maximum.

A. $A$

B. $B$

C. $C$

D. Same pressure for all samples

**Answer: A**

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**16.** One mole of an ideal gas at temperature $T$ expands slowly according to the law $\frac{p}{V} =$ constant.

Its final temperature is $T_2$. The work done by the gas is

A. $R(T_2 - T_1)$

B. $2R(T_2 - T_1)$

C. $\frac{R}{2}(T_2 - T_1)$

D. $2\frac{R}{3}(T_2 - T_1)$

**Answer: C**

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**17.** If the ratio of specific heat of a gas of constant pressure to that at constant volume is $\gamma$, the change in internal energy of the mass of gas, when the volume changes from $V$ to $2V$ at constant pressure $p$ is

A. $\frac{R}{\gamma - 1}$

B. $pV$

C. $\frac{pV}{\gamma - 1}$

D. $\frac{\gamma pV}{\gamma - 1}$

**Answer: C**

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**18.** A polytropic process for an ideal gas is represented by equation $PV^n = cons\tan t$. If g is ratio of specific heats $\left(\frac{C_p}{C_v}\right)$, then value of n for which molar heat capacity of the process is negative is given as

A. $\gamma > n$

B. $\gamma > n > 1$

C. $n > \gamma$

D. none, as it is not possible

**Answer: B**

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**19.** During an experiment, an ideal gas is found to obey an additional law $VP^2 = cons\tan t$, The gas is initially at a temperature T, and volume V. When it expands to a volume $2V$, the temperature becomes.......

A. $(\sqrt{2})T$

B. $2T$

C. $\frac{3T}{2}$

D. $(\sqrt{3})T$

**Answer: A**

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**20.** Find the amount of work done to increase the temperature of one mole of an ideal gas by $30^{\circ} C$, if it is expanding under condition $V \infty T^{2/3}$.

A. $32R$

B. $15R$

C. $20R$

D. $25R$

**Answer: C**

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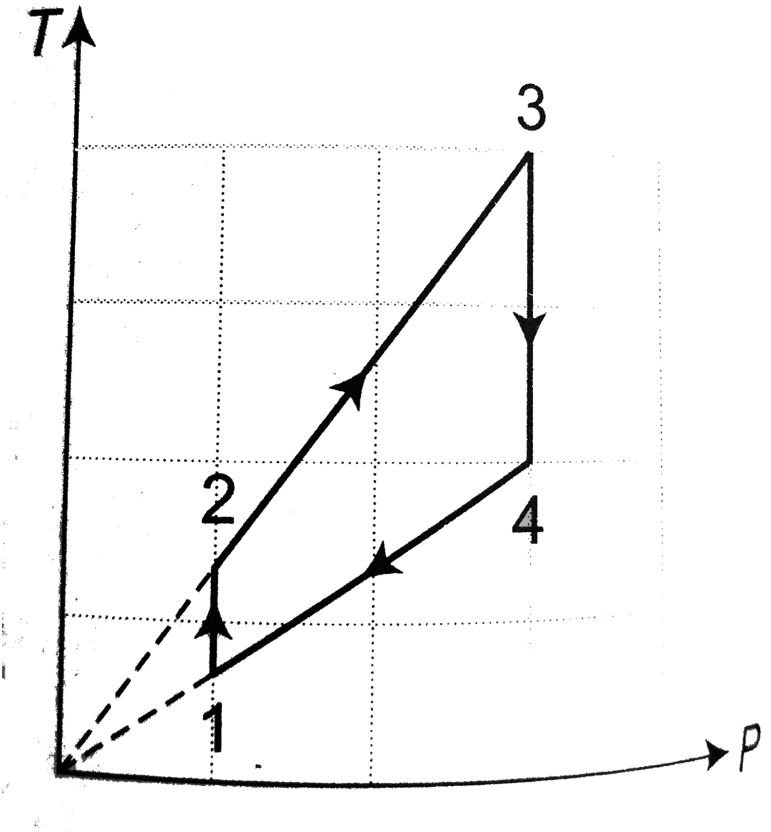
**21.** Two moles of an ideal mono-atomic gas undergo a cyclic process as shown in the figure. The temperatures in different states are given as $6T_1 = 3T_2 = 2T_4 = T_3 = 1800K$. Determine the work done by the gas during the cycle.




A. $-1200R$

B. $1200R$

C. $1575R$

D. $-800R$

**Answer: A**

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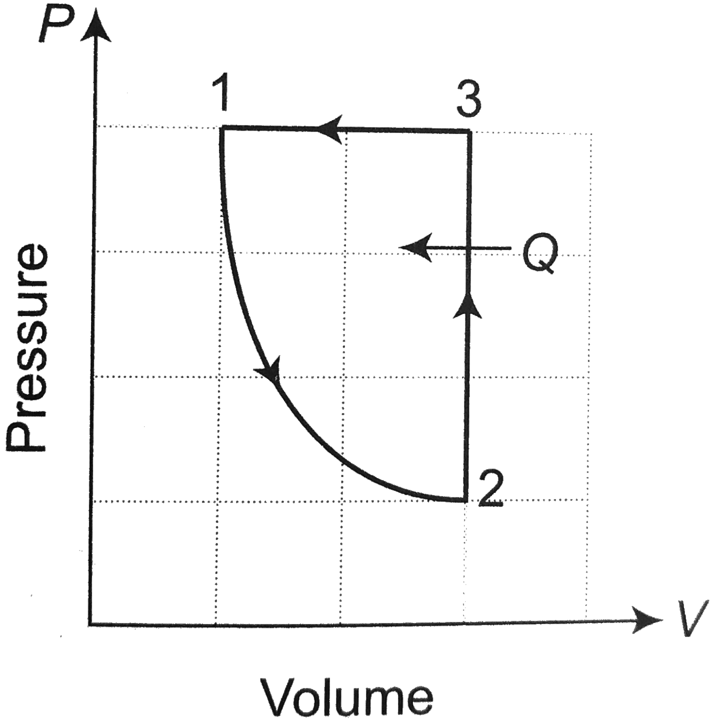
**22.** A sample of an ideal gas initially having internal energy $U_1$ is allowed to expand adiabatically performing work W. Heat Q is then supplied to it, keeping the volume constant at its new value, until the pressure raised to its original value. The internal energy is then $U_3$ (see figure). find the increase in internal energy $(U_3 - U_1)$?




A. $Q + W$

B. $Q - W$

C. $\gamma W - Q$

D. $Q - \gamma W$

**Answer: B**

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**23.** An amount $Q$ of heat is added to a monoatomic ideal gas in a process in which the gas performs work $\frac{Q}{2}$ on its surrounding. Find the molar heat capacity for the process.

A. $2R$

B. $3R$

C. $4R$

D. $6R$

**Answer: B**

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**24.** In a process, the molar heat capacity of a diatomic gas is $\frac{10}{3}R$. When heat Q is supplied to the gas, find the work done by the gas

A. $\frac{3Q}{4}$

B. $\frac{Q}{4}$

C. $\frac{Q}{3}$

D. $\frac{2Q}{3}$

**Answer: B**

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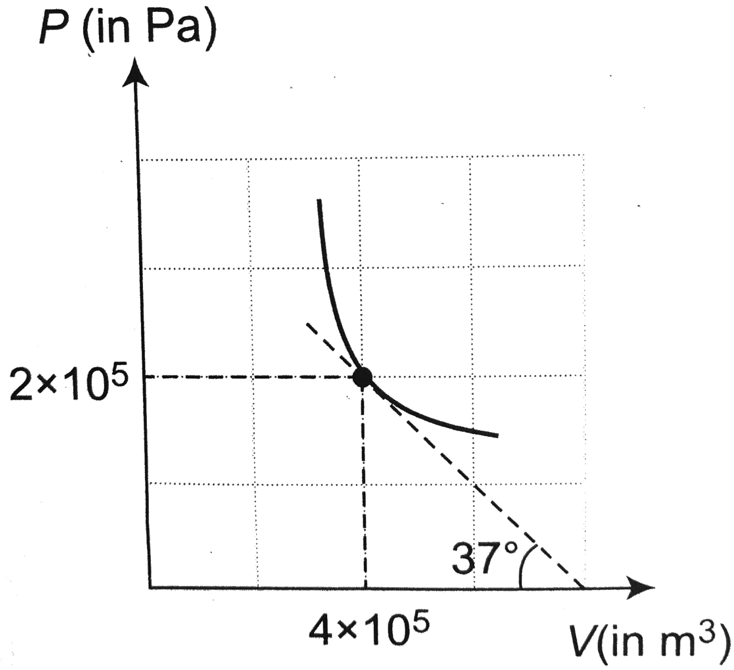
**25.** P-V graph for an ideal gas undergoing polytropic process $PV^m = cons\tan t$ is shown here. Find the value of m.




A. $\frac{3}{4}$

B. $-\frac{3}{2}$

C. $\frac{5}{3}$

D. $\frac{3}{2}$

**Answer: D**

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## Second Law Of Thermodynamics

**1.** A sink, that is a system where heat is rejected, is essential for the conversion of heat into work. From which law the above inference follows?

A. zeroth

B. First

C. Second

D. Third

**Answer: C**

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**2.** The efficiency of a Carnot heat engine

A. is independent of the temperature of the source and the sink

B. is independent of the working substance

C. can be $10\%$

D. in not affected by the thermal capacity of the source of the sink

**Answer: B**

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**3.** The efficiency of the reversible heat engine is $\eta_r$ and that of irreversible heat engine is $\eta_l$. Which of the following relations is correct?

A. $\eta_r > \eta_l$

B. $\eta_r < \eta_l$

C. $\eta_r > \eta_l$

D. $\eta_r > 1 \text{ and } \eta_l < 1$

**Answer: A**

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**4.** A Carnot engine working between K 300 and 600 K has work output of 800 J per cycle. What is amount of heat energy supplied to the engine from source per cycle

A. 1800 J/cycle

B. 1000 J/cycle

C. 2000 J/cycle

D. 1600 J/cycle

**Answer: D**

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**5.** In a cyclic process, work done by the system is

A. zero

B. Equal to heat given to the system

C. More than the heat given to system

D. Independent of heat given to the system

**Answer: B**

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**6.** An ideal gas heat engine operates in a Carnot's cycle between $227^{\circ} C$ and $127^{\circ} C$. It absorbs $6 \times 10^4 J$ at high temperature. The amount of heat converted into work is

A. $4.8 \times 10^4 J$

B. $3.5 \times 10^4 J$

C. $1.6 \times 10^4 J$

D. $1.2 \times 10^4 J$

**Answer: D**

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**7.** Efficiency of Carnot engine is $100\,\%$ if

A. $T_2 = 273K$

B. $T_2 = 0K$

C. $T_1 = 273K$

D. $T_1 = 0K$

**Answer: B**

Watch Video Solution

**8.** A Carnot's engine used first an ideal monoatomic gas then an ideal diatomic gas. If the source and sink temperature are $411^\circ C$ and $69^\circ C$ respectively and the engine extracts $1000J$ of heat in each cycle, then area enclosed by the $PV$ diagram is

A. $100J$

B. $300J$

C. $500J$

D. $700J$

**Answer: C**

Watch Video Solution

**9.** A Carnot engine absorbs an amount Q of heat from a reservoir at an absolute temperature T and rejects heat to a sink at a temperature of $T/3$. The amount of heat rejects is

A. $Q/4$

B. $Q/3$

C. $Q/2$

D. $2Q/3$

**Answer: B**

Watch Video Solution

**10.** In a Carnot engine when $T_2 = 0^{\circ} C$ and $T_1 = 200^{\circ} C$ its efficiency is $\eta_1$ and when $T_1 = 0^{\circ} C$ and $T_2 = -200^{\circ} C$. Its efficiency is $\eta_2$, then what is $\eta_1 / \eta_2$?

A. $0.577$

B. $0.733$

C. $0.638$

D. Cannot be calculated

**Answer: A**

Watch Video Solution

**11.** A Carnot engine has the same efficiency between $800K$ to $500K$ and $xK \rightarrow 600K$. The value of $x$ is

A. $1000K$

B. $960K$

C. $846K$

D. $754K$

**Answer: B**

Watch Video Solution

**12.** A Carnot's engine is made to work between $200^{\circ}C$ and $0^{\circ}C$ first and then between $0^{\circ}C$ and $-200^{\circ}C$. The ratio of efficiencies of the engine in the two cases is

A. $1.73 : 1$

B. $1 : 1.73$

C. $1 : 1$

D. $1 : 2$

**Answer: B**

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**13.** Efficiency of a Carnot engine is $50\%$ when temperature of outlet is $500K$. In order to increase efficiency up to $60\%$ keeping temperature of intake the same what is temperature of outlet?

A. $200K$

B. $400K$

C. $600K$

D. $800K$

**Answer: B**

Watch Video Solution

**14.** An ideal heat engine working between temperature $T_1$ and $T_2$ has an efficiency $\eta$, the new efficiency if both the source and sink temperature are doubled, will be

A. $\frac{\eta}{2}$

B. $\eta$

C. $2\eta$

D. $3\eta$

**Answer: B**

Watch Video Solution

**15.** An ideal refrigerator has a freezer at a temperature of $-13^\circ C$. The coefficient of performance of the engine is $5$. The temperature of the air (to which heat is rejected) will be

A. $325^\circ C$

B. $325K$

C. $39^\circ C$

D. $320^\circ C$

**Answer: C**

Watch Video Solution

**16.** In a mechanical refrigerator the low temperature coils are at a temperature of $-23^{\circ}C$ and the compressed gas in the condenser has a temperature of $27^{\circ}C$. The theoretical coefficient of performance is

A. $5$

B. $8$

C. $6$

D. $6.5$

**Answer: A**

Watch Video Solution

**17.** An engine is supposed to operate between two reservoirs at temperature $727^{\circ}C$ and $227^{\circ}C$. The maximum possible efficiency of such an engine is

A. $1/2$

B. $1/4$

C. $3/4$

D. $1$

**Answer: A**

Watch Video Solution

**18.** An ideal gas heat engine operates in Carnot cycle between $227^{\circ} C$ and 127^(@)C. $It|$ or $|bs$6 xx 10^(4) cals` of heat at higher temperature. Amount of heat converted to work is

A. $2.4 \times 10^4 cal$

B. $6 \times 10^4 cal$

C. $1.2 \times 10^4 cal$

D. $4.8 \times 10^4 cal$

**Answer: C**

Watch Video Solution

**19.** Two Carnot engines are operated in succession. The first engine receives heat from a source at $T = 800K$ and rejects to sink at $T_2K$. The second engine receives heat rejected by the first engine and rejects to another sink at $T_3 = 300K$. If work outputs of the two engines are equal, then find the value of $T_2$.

A. $100K$

B. $300K$

C. $550K$

D. $700K$

**Answer: C**

Watch Video Solution

**20.** A Carnot engine whose low temperature reservoir is at $7^\circ C$ has an efficiency of $50\%$. It is desired to increase the efficiency to $70\%$ By low many degrees should the temperature of the high temperature reservoir be increased

A. $840K$

B. $280K$

C. $560K$

D. $380K$

**Answer: D**

Watch Video Solution

21. Carnot cycle (reversible) of a gas represented by a pressure volume curve is shown in the diagram

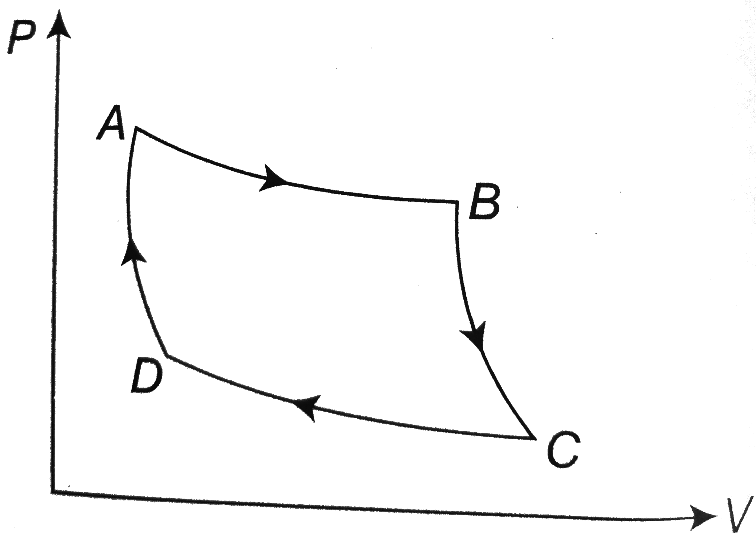
Consider the following statement

I Area ABCD = Work done on the gas

II Area ABCD = Net heat absorbed

III Change in the internal energy in cycle = $0$

Which of these are correct?



A. I only

B. II only

C. II and III

D. I, II and III

**Answer: C**

Watch Video Solution

**22.** A motor cycle engine delivers a power of $10kW$, by consuming petrol at the rate of $2.4kg/hour$. If the calorific value of petrol is $35.5MJ/kg$, the rate of heat rejection by the exhaust by

A. $5.5kW$

B. $13.7kW$

C. $11.2kW$

D. $9.7kW$

**Answer: B**

Watch Video Solution

**23.** A heat engine receives $50kcal$ of heat from the source per cycle, and operates with an efficiency of $20\%$. The heat rejected by engine to the sink per cycle is

A. $40kcal$

B. $25kcal$

C. $30kcal$

D. $50kcal$

**Answer: A**

Watch Video Solution

**24.** A Carnot's engine operates with an efficiency of $40\%$ with its sink at $27^{\circ}C$. By what amount should the temperature of the source be increased with an aim to increase the efficiency by $10\%$

A. $50K$

B. $150K$

C. $80K$

D. $100K$

**Answer: D**

Watch Video Solution

**25.** The efficiency of a Carnot cycle is $1/6$. By lowering the temperature of sink by $65K$, it increases to $1/3$. The initial and final temperature of the sink are

A. $390K$ and $325K$

B. $450K$ and $410K$

C. $350K$ and $275K$

D. $400K$ and $310K$

**Answer: A**

Watch Video Solution

**26.** A Carnot heat engine has an efficiency of $10\%$. If the same engine is worked backward to obtain a refrigerator, then find its coefficient of performance.

A. $8$

B. $9$

C. $6$

D. $5$

**Answer: B**

Watch Video Solution

**27.** In a cold storage, ice melts at the rate of $2kg/h$ when the external temperature is $20^{\circ}C$. Find the minimum power output of the motor used to drive the refrigerator which just prevents the ice from melting. Latent heat of fusion of $ice = 80cal/g$

A. $28.5W$

B. $9.75W$

C. $16.4W$

D. $13.6W$

**Answer: D**

Watch Video Solution

**28.** A Carnot engine used first an ideal monoatomic gas $(\gamma = 5/3)$ and then an ideal diatomic gas $(\gamma = 7/5)$ as its working substance. The source and sink temperatures are $411^{\circ}C$ and $69^{\circ}C$ respectively and the engine extracts $1000J$ of heat from the source in each cycle. then

A. the efficient of the engine in the two cases are in the ratio $21:25$

B. the area enclosed by the P-V diagram in the first case only is $500J$

C. the area enclosed by the P-V diagram in both cases only is $500J$

D. the heat energy rejected by the engine in the first case is $600J$ while that in the second case is $714.3J$

**Answer: C**

Watch Video Solution

**29.** Find the amount of work done to increase the engines ever developed operates between $2100K$ and $700K$. Its actual efficiency is $40\%$. What percentage of its maximum possible efficiency is this?

A. $40\ \%$

B. $60\ \%$

C. $66.67\ \%$

D. $33.37\ \%$

**Answer: B**

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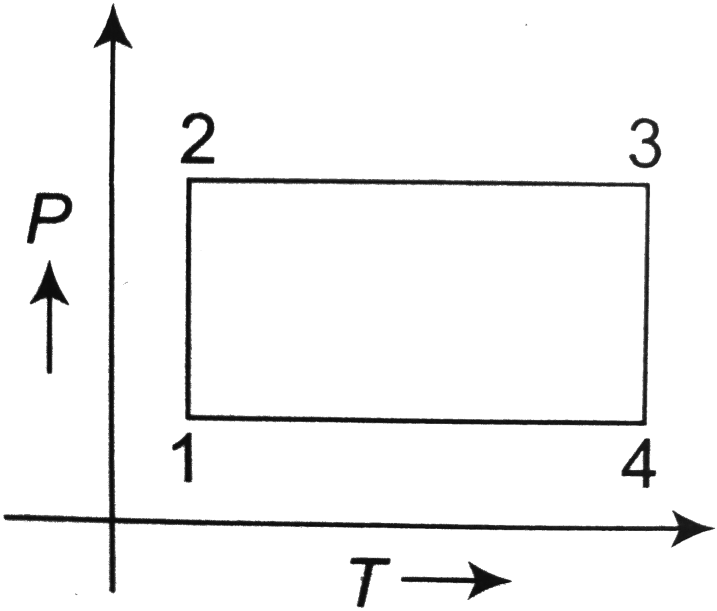
## Problems Based On Mixed Concepts

**1.** Three moles of an ideal monoatomic gas per form a cyclic as shown in the figure. The gas temperature in different states are: $T_1 = 400K, T_2 = 800K, T_3 = 2400K$ and $T_4 = 1200K$. The work done by the gas during the cyclic is




A. $10kJ$

B. $20kJ$

C. $5kJ$

D. $8.3kJ$

**Answer: B**

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**2.** One mole of an ideal gas undergoes a process in which $T = T_0 + aV^3$, where $T_0$ and $a$ are positive constants and V is molar volume. The volume for which pressure with be minimum is

A. $\left(\frac{T_0}{2a}\right)^{1/3}$

B. $\left(\frac{T_0}{3a}\right)^{1/3}$

C. $\frac{a}{(2T_0)^{2/3}}$

D. $\frac{a}{(3T_0)^{2/3}}$

**Answer: A**

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**3.** In the above question, maximum pressure attainable is

A. $\frac{3}{4}\left(a^{5/3}R^{2/3}T^{2/3} - (0)\right)2^{1/3}$

B. $\frac{3}{2}\left(a^{2/3}RT^{2/3} - (0)\right)3^{1/2}$

C. $\frac{3}{2}\left(a^{1/2}R^{2/3}T^{3/4} - (0)\right)4^{1/3}$

D. $\frac{3}{2}\left(a^{1/3}RT^{2/3} - (0)\right)2^{1/3}$

**Answer: D**

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**4.** In a certain gas, the ratio of the velocity of sound and root mean square velocity is $\sqrt{5/9}$. The molar heat capacity of the gas in a process given by $PT = cons\tan t$ is.

(Take $R = 2cal/molK$). Treat the gas as ideal.

A. $R/2$

B. $3\frac{R}{2}$

C. $5\frac{R}{2}$

D. $7\frac{R}{2}$

**Answer: D**

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**5.** Argon gas is adiabatically compressed to half its volume. If $P, V$ and $T$ represent the pressure, volume and temperature of the gaseous, respectively, at any stage, then the correct equation representing the process is

A. $TV^{2/5} = cons\tan t$

B. $VP^{5/3} = cons\tan t$

C. $TP^{2/5} = cons\tan t$

D. $PT^{2/5} = cons\tan t$

**Answer: C**

Watch Video Solution

**6.** A fixed mass of helium gas is made to undergo a process in which its pressure varies linearly from $1kPa$ to $2kPa$, in relation to its volume as the latter varies from $0.2m^3$ to $0.4m^3$. The heat absorbed by the gas will be

A. $300J$

B. $900J$

C. $1200J$

D. $1500J$

**Answer: C**

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**7.** Oxygen gas is made to undergo a process in which its molar heat capacity $C$ depends on its absolute temperature $T$ as $C = \alpha T$. Work done by it when heated from an initial temperature $T_0$ to a final temperature $2T_0$, will be

A. $4\alpha T_0^2$

B. $(\alpha T_0 - 1)\frac{3T_0}{2}$

C. $(3\alpha T_0 - 5)\frac{T_0}{2}$

D. None of these

**Answer: C**

Watch Video Solution

**8.** If the ratio of specific heat of a gas of constant pressure to that at constant volume is $\gamma$, the change in internal energy of the mass of gas, when the volume changes from $V$ to $2V$ at constant pressure $p$ is

A. $\frac{R}{\gamma - 1}$

B. $pV$

C. $\frac{pV}{\gamma - 1}$

D. $\frac{\gamma pV}{\gamma - 1}$

**Answer: C**

Watch Video Solution

**9.** A gas is at 1 atm pressure with a volume $800 cm^3$. When $100 J$ of heat is supplied to the gas, it expands to $1 L$ at constant pressure. The change in its internal energy is

A. $80J$

B. $-80J$

C. $20J$

D. $-20J$

**Answer: A**

Watch Video Solution

**10.** $14 g of N_2$ gas is heated in a closed rigid container to increase its temperature from $23^\circ C$ to $43^\circ C$. The amount of heat supplied to the gas is

A. $25cal$

B. $50cal$

C. $100 cal$

D. $30 cal$

**Answer: B**

Watch Video Solution

**11.** A fixed mass of a gas is first heated isobarically to double the volume and then cooled isochorically to decrease the temperature back to the initial value. By what factor would the work done by the decreased, had the process been isothermal?

A. $2$

B. $1/2$

C. $\in 2$

D. $\in 3$

**Answer: C**

Watch Video Solution

**12.** An ideal heat engine has an efficiency $\eta$. The cofficient of performance of the engine when driven backward will be

A. $1-\left(\frac{1}{\eta}\right)$

B. $\eta-\left(\frac{1}{\eta}\right)$

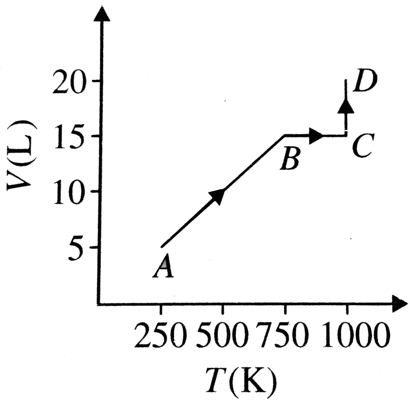
C. $\left(\frac{1}{\eta}\right)-1$

D. $\left(\frac{1}{1-\eta}\right)$

**Answer: C**

Watch Video Solution

**13.** Two moles of helium gas are taken along the path $ABCD$ (as shown in Fig.) The work done by the gas is




A. $2000R\left(1 + \text{in}\frac{4}{3}\right)$

B. $500R(3 + \text{in}4)$

C. $500R\left(2 + \text{In}\frac{16}{9}\right)$

D. $1000R\left(1 + \text{In}\frac{16}{9}\right)$

**Answer: C**

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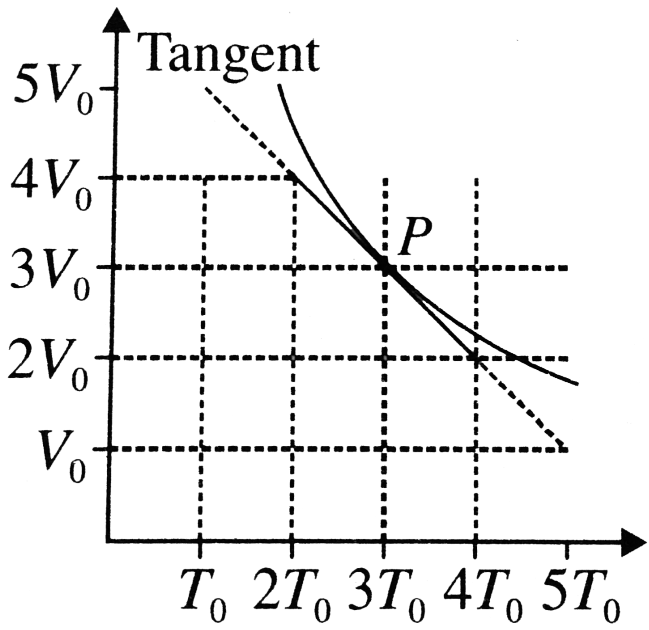
**14.** Figure shows the adiabatic curve for $n$ moles of an ideal gas, the bulk modulus for the gas corresponding to the point $P$ will be




A. $nR\left(1+\frac{2T_0}{V_0}\right)$

B. $nR\left(2+\frac{T_0}{V_0}\right.$

C. $nR\left(1+\frac{T_0}{V_0}\right.$

D. $nR\left(1+\frac{T_0}{2V_0}\right.$

**Answer: C**

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**15.** Two moles of an ideal gas is contained in a cylinder fitted with a frictionless movalbe piston, exposed to the atmosphere, at an initial temperature $T_0$. The gas is slowly heated so that its volume becomes fout times the initial value. The work done by gas is

A. zero

B. $2RT_0$

C. $4RT_0$

D. $6RT_0$

**Answer: B**

Watch Video Solution

16. The equation of state for a gas is given by $PV = \eta RT + \alpha V$, where $\eta$ is the number of moles and $\alpha$ a positive constant. The initial pressure and temperature of 1 mol of the gas contained in a cylinder is $P_0$ and $T_0$, respectively. The work done by the gas when its temperature doubles isobarically will be

A. $\dfrac{P_0 T_0 R}{P_0 - \alpha}$

B. $\dfrac{P_0 T_0 R}{P_0 + \alpha}$

C. $P_0 T_0 R In 2$

D. None of these

**Answer: A**

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**17.** A sound wave passing through air at $NTP$ produces a pressure of $0.001$ dyne/$cm^2$ during a compression. The corresponding change in temperature (given $\gamma = 1.5$ and assume gas to be ideal) is

A. $8.97 \times 10^{-4} K$

B. $8.97 \times 10^{-6} K$

C. $8.97 \times 10^{-8} K$

D. None of these

**Answer: C**

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**18.** A container of volume $1m^3$ is divided into two equal parts by a partition. One part has an ideal gas at 300K and the other part is vacuum. The whole system is thermally isolated from the surroundings. When the partition is removed, the gas expands to occupy the whole volume. Its temperature will now be .......

A. $300K$

B. $250K$

C. $200K$

D. $10K$

**Answer: A**

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**19.** A cannot engine has efficiency $\frac{1}{6}$. If temperature of sink is decreased by $62^\circ C$ then its efficiency becomes $\frac{1}{3}$ then the temperature of source and sink:

A. $99^\circ C, 37^\circ C$

B. $80^\circ C, 37^\circ C$

C. $95^\circ C, 37^\circ C$

D. $90^\circ C, 37^\circ C$

**Answer: A**

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**20.** In a thermodynamic process, pressure of a fixed mass of a gas is changed in such a manner that the gas release $20J$ of heat and $8J$ of work is done on the gas. If initial internal energy of the gas was $30J$, what will be the final internal energy?

A. $42J$

B. $12J$

C. $10J$

D. $18J$

**Answer: D**

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**21.** An ideal heat engine working between temperature $T_H$ and $T_L$ has efficiency $\eta$. If both the temperature are raised by $100K$ each the new efficiency of heat engine will be

A. equal to $\eta$

B. greater than $\eta$

C. less than $\eta$

D. greater or less than $\eta$ depending upon the nature of the working substance

**Answer: C**

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**22.** Four moles of hydrogen, 2 moles of helium and 1 mole of water form an ideal gas mixture. What is the molar specific heat at constant pressure of mixture ?

A. $\frac{16}{7}R$

B. $\frac{7R}{16R}$

C. R

D. $\frac{23}{7}R$

**Answer: D**

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**23.** In a adiabatic process pressure is increased by $2/3\%$ if $C_P/C_V = 3/2$. Then the volume decreases by about

A. $\frac{4}{9}\%$

B. $\frac{2}{3}\%$

C. $4\%$

D. $\frac{9}{4}\%$

**Answer: A**

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**24.** Two cylinders A and B fitted with pistons contain equal amounts of an ideal diatomic gas at 300K. The piston of A is free to move, while that B is held fixed. The same amount of heat is given to the gas in each cylinder. If the rise in temperature of the gas in A is 30K, then the rise in temperature of the gas in B is

A. $30K$

B. $18K$

C. $50K$

D. $42K$

**Answer: D**

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**25.** A gas under constant pressure of $4.5 \times 10^5 Pa$ when subjected to $800kJ$ of heat, changes the volume from $0.5m^3 \to 2.0m^3$. The change in internal energy of the gas is

A. $6.75 \times 10^5 J$

B. $5.25 \times 10^5 J$

C. $3.25 \times 10^5 J$

D. $1.25 \times 10^5 J$

**Answer: D**

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**26.** If for hydrogen $C_P - C_V = m$ and for nitrogen $C_P - C_V = n$, where $C_P$ and $C_V$ refer to specific heats per unit mass respectively at constant pressure and constant volume, the relation between $m$ and $n$ is (molecular weight of hydrogen = 2 and molecular weight or nitrogen = 14)

A. $n = 14m$

B. $n = 7m$

C. $m = 7n$

D. $m = 14n$

**Answer: C**

Watch Video Solution

**27.** One mole of an ideal gas at temperature $T$ expands slowly according to the law $\frac{p}{V} = $ constant.

Its final temperature is $T_2$. The work done by the gas is

A. $R(T_2 - T_1)$

B. $(R/2)(T_2 - T_1)$

C. $(R/4)(T_2 - T_1)$

D. $PV(T_2 - T_1)$

**Answer: B**

Watch Video Solution

**28.** Two moles of an ideal gas at temperature $T_0 = 300K$ was cooled isochorically so that the pressure was reduced to half. Then, in an isobaric process, the gas expanded till its temperature got back to the initial value. Find the total amount of heat absorbed by the gas in the processs

A. $150R$joules

B. $300R$joules

C. $75R\text{joules}$

D. $100Rjo\underline{e}s$

**Answer: B**

Watch Video Solution

**29.** During an adiabatic process, the pressure of a gas is found to be proportional to the cube of its absolute temperature. The ratio $C_P / C_V$ for the gas is

A. $2$

B. $3/2$

C. $5/3$

D. $4/3$

**Answer: B**

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**30.** A gaseous mixture consists of 16g of helium and 16 g of oxygen. The ratio $\frac{C_p}{C_v}$ of the mixture is

A. $1.4$

B. $1.54$

C. $1.59$

D. $1.62$

**Answer: D**

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**31.** Suppose a diatomic gas gets ionised to a certain extent without any expenditure of heat energy. If the fractional change in the number of moles of the gas be $\eta$, then ignoring any enegy loss, the fractional change in the temperature of the gas will be

A. $\frac{-\eta}{\eta+1}$

B. $\frac{-\eta}{\eta+5}$

C. $\frac{\eta}{\eta+1}$

D. $\frac{\eta}{\eta+5}$

**Answer: B**

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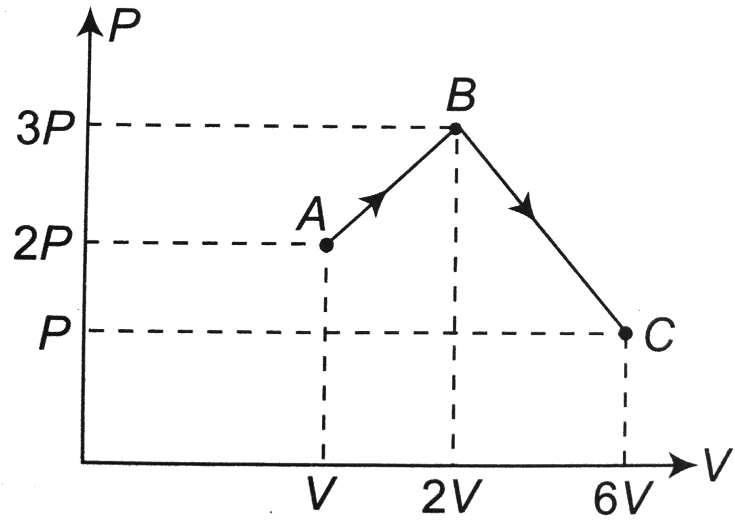
**32.** A monoatomic ideal gas undergoes a process $ABC$. The heat given to the gas is




A. $7.5PV$

B. $12.5PV$

C. $16.5PV$

D. $20.5PV$

**Answer: C**

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**33.** A balloon containing an ideal gas has a volume of $10 litre$ and temperature of $17^{\circ}$. If it is heated slowly to $75^{\circ} C$, the work done by the gas inside the balloon is (neglect elasticity of the balloon and take atmospheric pressure as $10^{5}$ Pa)

A. $100 J$

B. $200 J$

C. $250 J$

D. data insufficient

**Answer: B**

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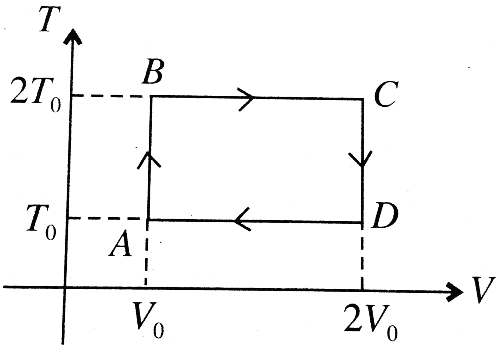
**34.** T-V curve of cyclic process is shown below, number of moles of the gas are n find the total work done during the cycle.




A. $\frac{3}{2}nRT_0In2$

B. $nRT_0In2$

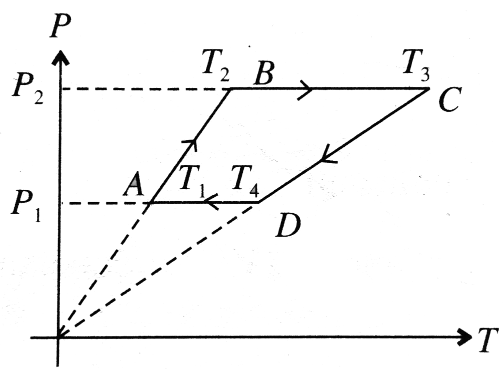
C. $\frac{nRT_0In2}{2}$

D. $2nRT_0In2$

**Answer: B**

Watch Video Solution

**35.** P-T curve of a cyclic process is shown. Find out the works done by the gas in the given proces if number of moles of the gas are n.




A. $nR(T_1 + T_3 - T_4 + T_2)$

B. $nR(T_1 - T_3 - T_4 + T_2)$

C. $nR(T_1 + T_3 + T_4 - T_2)$

D. $nR(T_1 + T_3 - T_4 - T_2)$

**Answer: D**

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**36.** A sample of an ideal gas has pressure $p_0$, volume $V_0$ and tempreture $T_0$. It is isothermally expanded to twice its original volume.It is then compressed at constant pressure to have the original volume $V_0$. Finally, the gas is heated at constant volume to get the original temperature.

(a) Show the process in a V-T diagram

(b) Calculate the heat absorbed in the process.

A. $P_0V_0\left[In2+\frac{1}{2}\right]$

B. $P_0V_0\left[In2+\frac{3}{2}\right]$

C. $P_0V_0[In2+2]$

D. $P_0V_0\left[In2-\frac{1}{2}\right]$

**Answer: D**

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**37.** Figure shows a vessel partitioned by a fixed diathermic separator. Different ideal gases are filled in the two parts. The rms speed of the molecules in the left part equals the mean speed of the molecules in the right part. Calculate the ratio of the mass of a molecule in the left part to the mass of a molecule in the right part.

A. $\frac{2\pi}{7}$

B. $\frac{3\pi}{8}$

C. $\frac{3\pi}{10}$

D. $\frac{\pi}{3}$

**Answer: B**

**38.** The internal energy of a monatomic ideal gas is $1.5nRT$.One mole of helium is kept in a cylinder of cross section $8.5cm^2$. The cylinder is closed by a light frictionless piston. The gas is heated slowly in a process during which a total of $42J$ heat is given to the gas. If the temperature rise through $2^\circ C$, find the distance moved by the piston. atmospheric pressure $= 100kPa$.

A. $10cm$

B. $15cm$

C. $20cm$

D. $5cm$

**Answer: C**

**39.** A sample of ideal gas $(\gamma = 1.4)$ is heated at constant pressure. If an amount $140J$ of heat is supplied to the gas, find (a) the changes in internal energy of the gas, (b) the work done by the gas.

A. $25J$

B. $40J$

C. $35J$

D. $20J$

**Answer: B**

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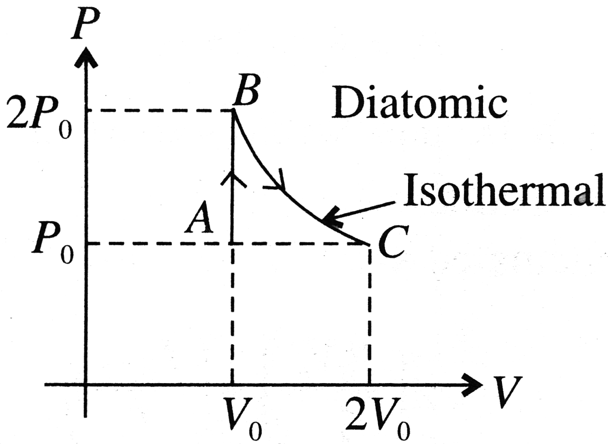
**40.** P-V curve of a diatomic gas is shown in the Fig. Find the total heat given to the gas in the process $A \rightarrow B \rightarrow C$




A. $P_0V_0 + 2P_0V_0 \text{in} 2$

B. $\frac{1}{2}P_0V_0 + P_0V_0 \text{in} 2$

C. $\frac{5}{2}P_0V_0 + 2P_0V_0 \text{in} 2$

D. $3P_0V_0 + 2P_0V_0 \text{in} 2$

**Answer: C**

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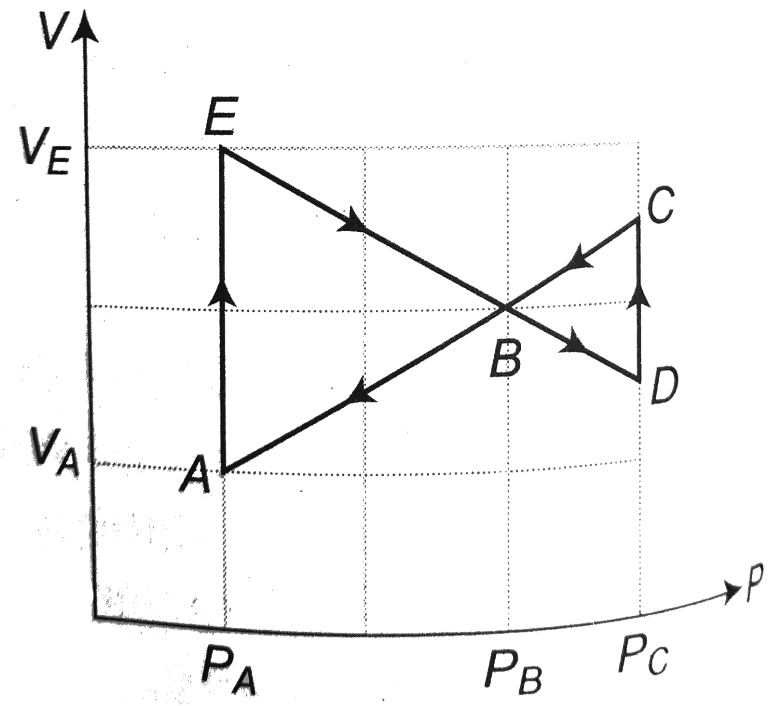
**41.** Figure shows a cyclic process $ABCDBEA$ performed on an ideal cycle. If $P_A = 2atm, P_B = 5atm$ and $P_6 = 6atm. V_E - V_A = 20\text{litre},$ find the work done by the gas in the complete, process ( $1atm. \text{Pressure} = 1 \times 10^5 Pa)$




A. $2.67kJ$

B. $1.33kJ$

C. $3.45kJ$

D. $4.25kJ$

**Answer: A**

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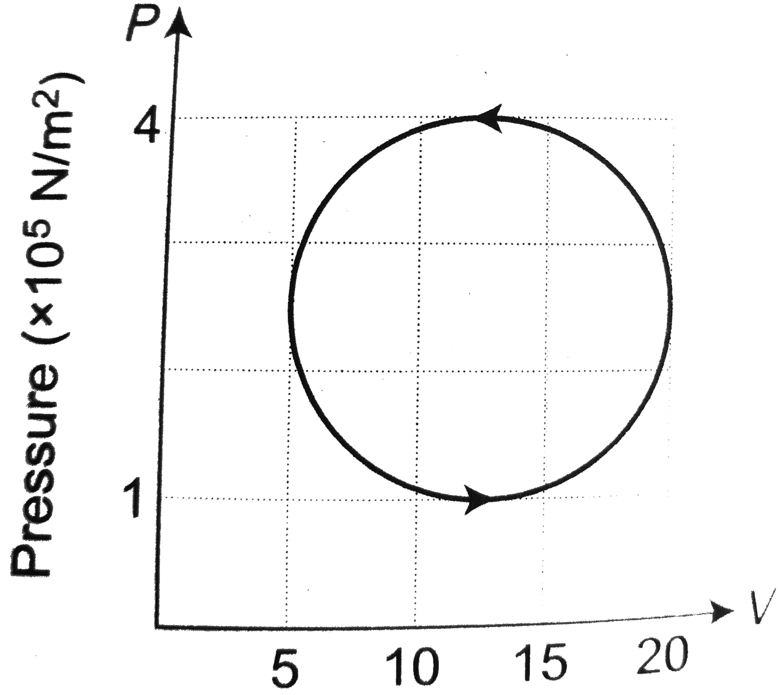
**42.** Find the work done by gas going through a cyclic process shown in figure?




A. $-\frac{225\pi}{2}kJ$

B. $-\frac{125\pi}{2}kJ$

C. $-\frac{200\pi}{3}kJ$

D. $-\frac{325\pi}{3}kJ$

**Answer: A**

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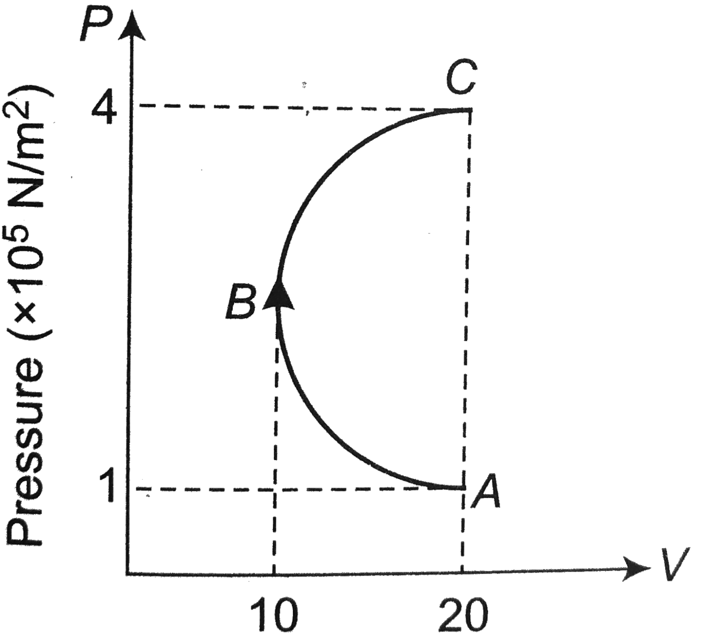
**43.** In the P-V diagram shown in figure, $ABC$ is a semicircle. Find the work done in the process $ABC$.




A. $450\pi kJ$

B. $275\pi kJ$

C. $375\pi kJ$

D. $175\pi kJ$

**Answer: C**

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**44.** A gas has molar heat capacity $C = 4.5R$ in the process $PT = cons\tan t$. The number of degrees of freedom of molecules in the gas is

A. $4$

B. $3$

C. $6$

D. $5$

**Answer: D**

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**45.** A gaseous mixture enclosed in a vessel consists of one gram mole of a gas A with $\gamma = \left(\frac{5}{3}\right)$ and some amount of gas B with $\gamma = \frac{7}{5}$ at a temperature T.

The gases A and B do not react with each other and are assumed to be ideal. Find the number of gram moles of the gas B if $\gamma$ for the gaseous mixture is $\left(\frac{19}{13}\right)$.

A. $2$

B. $3$

C. $4$

D. $6$

**Answer: A**

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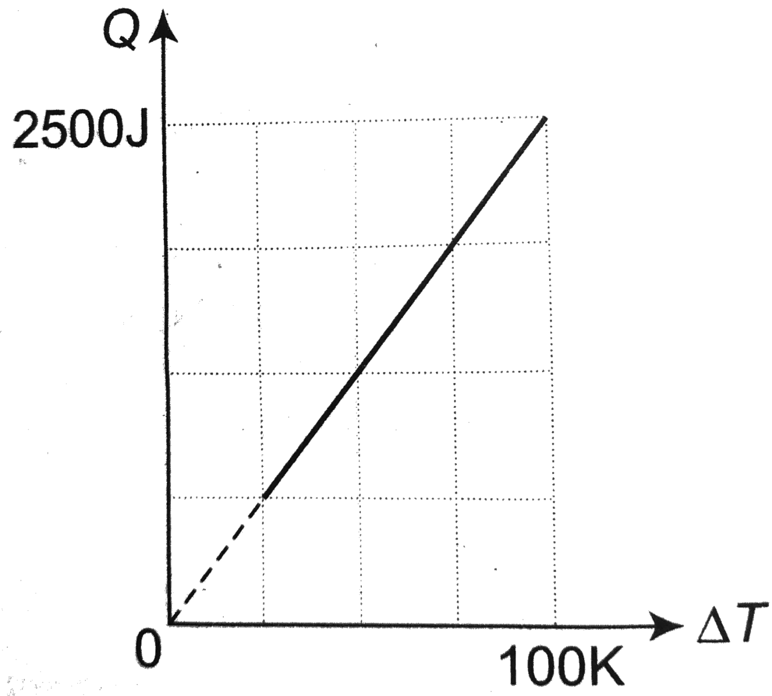
**46.** One mole of a gas mixture is heated under constant pressure, and heat required Q is plotted against temperature difference acquired. Find ghe value of $\gamma$ for mixture.




A. $\frac{3}{4}$

B. $\frac{1}{4}$

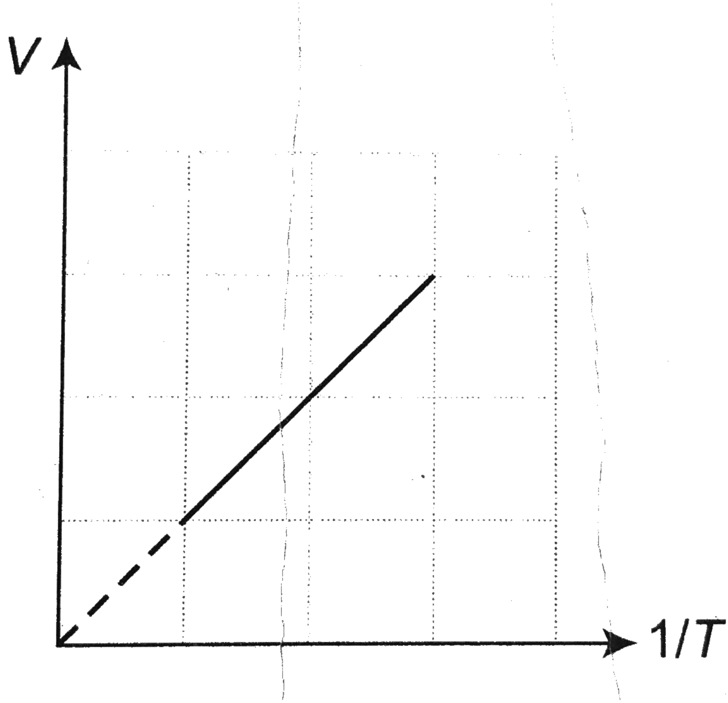
C. $\frac{3}{2}$

D. $\frac{2}{3}$

**Answer: C**

Watch Video Solution

**47.** One mole of an ideal monoatomic gas undergoes a process as shown in the figure. Find the molar specific heat of the gas in the process.




R is a gas constant.

A. $\frac{3R}{4}$

B. $\frac{R}{2}$

C. $\frac{R}{3}$

D. $\frac{2R}{3}$

**Answer: B**

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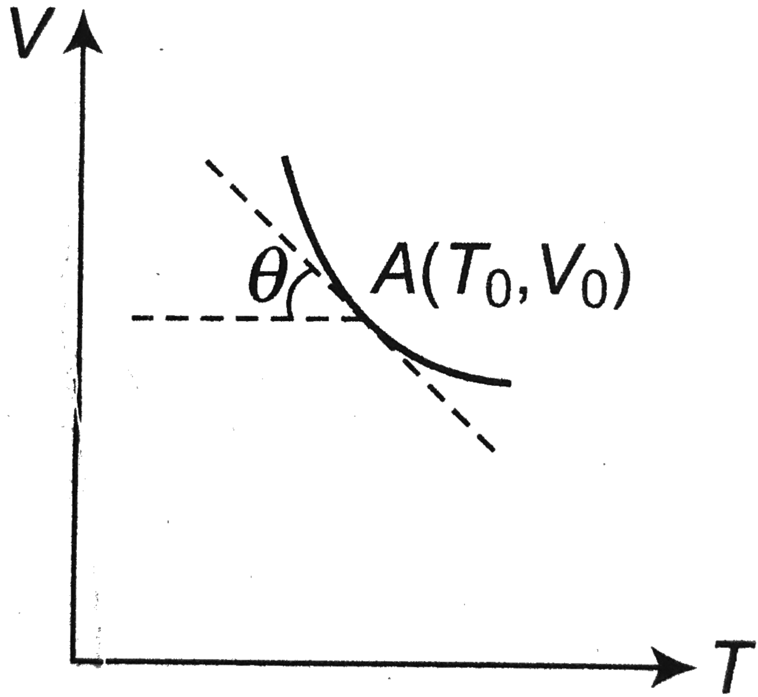
**48.** A gas is undergoing an adiabatic process. At a certain stage A, the values of volume and temperature $(V_0, T_0)$. From the details given in the graph, find the value of adiabatic constant $\gamma$




A. $\dfrac{V_0}{T_0 \tan\theta} + 1$

B. $\dfrac{V_0 \tan\theta}{T_0 + 1}$

C. $\dfrac{V_0 \tan^2\theta}{T_0} + 1$

D. $\dfrac{V_0}{T_0} + \tan\theta$

**Answer: A**

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**49.** The heat supplied to one mole of an ideal monoatomic gas in increasing temperature from $T_0$ to $2T_0$ is $2RT_0$. Find the process to which the gas follows

A. $P^2V^{-1} = cons\tan t$

B. $PV^{-1} = cons\tan t$

C. $P^{-1}V = cons\tan t$

D. $PV^{-1} = cons\tan t$

**Answer: D**

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## Assertion Reasoning

**1.** Assertion : The rms velocity of gas molecules is doubled, when temperature of gas becomes four times.

Reason : $c \propto \sqrt{T}$

A. If both assertion and reason are true and the reason is correct explanation of the assertion.

B. If both assertion and reason are true but reason is not the correct explanation of assertion.

C. If assertion is true, but the reason is false.

D. If assertion is false but the reason is true

**Answer: A**

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**2.** Assertion : The number of degrees of freedom of triatomic molecules is $6$

Reason : Triatomic molecules have three translational degrees of freedom and three rotational degrees of freedom.

A. If both assertion and reason are true and the reason is correct explanation of the assertion.

B. If both assertion and reason are true but reason is not the correct explanation of assertion.

C. If assertion is true, but the reason is false.

D. If assertion is false but the reason is true

**Answer: A**

Watch Video Solution

**3.** Assertion : All molecular motion ceases at $-273^\circ C$.

Reason : Temperature $-273^\circ C$ cannot be attained.

A. If both assertion and reason are true and the reason is correct explanation of the assertion.

B. If both assertion and reason are true but reason is not the correct explanation of assertion.

C. If assertion is true, but the reason is false.

D. If assertion is false but the reason is true

**Answer: C**

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**4.** Assertion : Mean free path of a gas molecule varies inversely as density of the gas.

Reason : Mean free path varies inversely as pressure of the gas.

A. If both assertion and reason are true and the reason is correct explanation of the assertion.

B. If both assertion and reason are true but reason is not the correct explanation of assertion.

C. If assertion is true, but the reason is false.

D. If assertion is false but the reason is true

**Answer: B**

Watch Video Solution

**5.** Assertion : The molecules of a monatomic gas has three degrees freedom.

Reason : The molecules of a diatomic gas has five degrees of freedom.

A. If both assertion and reason are true and the reason is correct explanation of the assertion.

B. If both assertion and reason are true but reason is not the correct explanation of assertion.

C. If assertion is true, but the reason is false.

D. If assertion is false but the reason is true

**Answer: B**

Watch Video Solution

**6.** Assertion : On reducing the value of a gas at constant temperature, the pressure of the gas increase.

Reason : At constant temperature according to Boyle's law, volume is inversely proportional to pressure.

A. If both assertion and reason are true and the reason is correct explanation of the assertion.

B. If both assertion and reason are true but reason is not the correct explanation of assertion.

C. If assertion is true, but the reason is false.

D. If assertion is false but the reason is true

**Answer: A**

View Text Solution

**7.** Assertion : Air pressure in a car tyre increase during driving.

Reason : Absolute zero temperature is not zero energy temperature.

A. If both assertion and reason are true and the reason is correct explanation of the assertion.

B. If both assertion and reason are true but reason is not the correct explanation of assertion.

C. If assertion is true, but the reason is false.

D. If assertion is false but the reason is true

**Answer: B**

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**8.** These questions consist two statements each, printed as Assertion and reason, while answering these question you are required to choose any one of the following four responsis:

(a) If both the assertion and reason are true and reason is a true explanation of the assertion.

(b) If both the assertion and reason are true but the reason is not the correct explanation of assertion.

(c ) If the assertion is true but reason is false.

(d) If both the assertion and reason are false.

Q. Assertion: A bubble comes from the bottom of a lake to the top.

Reason: Its radius increases.

A. If both assertion and reason are true and the reason is correct explanation of the assertion.
B. If both assertion and reason are true but reason is not the correct explanation of assertion.
C. If assertion is true, but the reason is false.
D. If assertion is false but the reason is true

**Answer: B**

Watch Video Solution

**9.** Assertion : On removing the value, the air escaping from a cycle tube becomes cool.

Reason : On removing the value, adiabatic expansion takes place.

A. If both assertion and reason are true and the reason is correct explanation of the assertion.

B. If both assertion and reason are true but reason is not the correct explanation of assertion.

C. If assertion is true, but the reason is false.

D. If assertion is false but the reason is true

**Answer: A**

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**10.** Assertion : First law of thermodynamics does not forbid flow of heat from lower temperature to higher temperature.

Reason : Heat supplied to a system always equal to the increase in its internal energy.

A. If both assertion and reason are true and the reason is correct explanation of the assertion.

B. If both assertion and reason are true but reason is not the correct explanation of assertion.

C. If assertion is true, but the reason is false.

D. If assertion is false but the reason is true

**Answer: B**

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**11.** Assertion: When a bottle of cold carbonated drink is opened, a slight fog forms around the opening.

Reason: Adiabatic expansion of the gas causes lowering of temperature and condersation of water vapours.

A. If both assertion and reason are true and the reason is correct explanation of the assertion.

B. If both assertion and reason are true but reason is not the correct explanation of assertion.

C. If assertion is true, but the reason is false.

D. If assertion is false but the reason is true

**Answer: A**

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**12.** Aseertion: Thermodynamics process in nature are irreversible.

Reason: Dissipactive effects cannot be eliminated.

A. If both assertion and reason are true and the reason is correct explanation of the assertion.

B. If both assertion and reason are true but reason is not the correct explanation of assertion.

C. If assertion is true, but the reason is false.

D. If assertion is false but the reason is true

**Answer: A**

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**13.** Assertion : Specific heat capacity is the cause of formation of land and sea breeze.

Reason : The specific heat of water is more than land.

A. If both assertion and reason are true and the reason is correct explanation of the assertion.

B. If both assertion and reason are true but reason is not the correct explanation of assertion.

C. If assertion is true, but the reason is false.

D. If assertion is false but the reason is true

**Answer: A**

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**14.** Assertion: The isothermal curves intersect each other at a certain point.

Reason: The isothermal changes takes place rapidly, so the isothermal curves have very little slope.

A. If both assertion and reason are true and the reason is correct explanation of the assertion.

B. If both assertion and reason are true but reason is not the correct explanation of assertion.

C. If assertion is true, but the reason is false.

D. If assertion is false but the reason is true

**Answer: D**

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**15.** Assertion: In an isothermal proces, whole of heat energy supplied to the body id converted into work.

Reason: According to first law of thermodynamics $\Delta Q = \Delta U + P\Delta V$

A. If both assertion and reason are true and the reason is correct explanation of the assertion.

B. If both assertion and reason are true but reason is not the correct explanation of assertion.

C. If assertion is true, but the reason is false.

D. If assertion is false but the reason is true

**Answer: D**

Watch Video Solution

**1.** A scientist says that the efficiency of his heat engine which operates at source temperature $127^\circ C$ and sink temperature $27^\circ C$ is $26\,\%$ , then

A. It is impossible

B. It is possible but less probable

C. It is quite probable

D. Data are incomplete

**Answer: A**

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**2.** The temperature of sink of Carnot engine is $27^\circ C$. Efficiency of engine is $25\%$ . Then temeperature of source is

A. $227^\circ C$

B. $327^\circ C$

C. $127^\circ C$

D. $27^\circ C$

**Answer: C**

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**3.** Efficiency of a Carnot engine is $50\%$ when temperature of outlet is $500K$. In order to increase efficiency up to $60\%$ keeping temperature of intake the same what is temperature of outlet?

A. $200K$

B. $400K$

C. $600K$

D. $800K$

**Answer: B**

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**4.** An ideal refrigerator has a freezer at a temperature of $-13^{\circ}C$. The coefficient of performance of the engine is $5$. The temperature of the air (to which heat is rejected) will be

A. $325^{\circ}C$

B. $325K$

C. $39^{\circ}C$

D. $320^\circ C$

**Answer: C**

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**5.** A perfect gas at $27^\circ C$ is heated at constant pressure to $327^\circ C$. If original volume of gas at $27^\circ C$ is V, then volume at $327^\circ C$ is

A. V

B. $3V$

C. $2V$

D. $V/2$

**Answer: C**

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**6.** For adiabatic processes $\left(\gamma = \frac{C_p}{C_v}\right)$

A. $P^{\gamma}V = cons\tan t$

B. $T^{\gamma}V = cons\tan t$

C. $TV^{\gamma-1} = cons\tan t$

D. $TV^{\gamma} = cons\tan t$

**Answer: C**

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**7.** If the door of a refrigerator is kept open, then which of the following is true

A. Room is cooled

B. Room is heated

C. Room is either cooled or heated

D. Room is neither cooled nor heated

**Answer: B**

Watch Video Solution

**8.** An ideal gas heat engine operates in a Carnot cycle between $27^\circ C$ and $127^\circ C$. It absorbs $6kcal$ at the higher temperature. The amount of heat (in kcal) converted into work is equal to

A. $3.5$

B. $1.6$

C. $1.2$

D. $4.8$

**Answer: C**

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**9.** The equation of state for 5 g of oxygen at a pressure P and temperature T, when occupying a volume V, will be

A. $PV = (5/32)RT$

B. $PV = 5RT$

C. $PV = (5/2)RT$

D. $PV = (5/16)RT$

**Answer: A**

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**10.** One mole of an ideal gas at an initial temperature of $TK$ does $6R$ joule of work adiabatically. If the ratio of specific heats of this gas at constant pressure and at constant volume is $5/3$, the final temperature of the gas will be

A. $(T+2.4)K$

B. $(T-2.4)K$

C. $(T+4)K$

D. $(T-4)K$

**Answer: D**

Watch Video Solution

**11.** If $300ml$ of a gas at $27^{\circ}C$ is cooled to $7^{\circ}C$ at constant pressure, then its final volume will be

A. $540ml$

B. $350ml$

C. $280ml$

D. $135ml$

**Answer: C**

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**12.** A monoatomic gas is supplied heat Q very slowly keeping the pressure constant. The work done by the gas is

A. $\frac{2}{3}Q$

B. $\frac{3}{5}Q$

C. $\frac{2}{5}Q$

D. $\frac{1}{5}Q$

**Answer: C**

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**13.** Which of the following processes is reversible?

A. Transfer of heat by radiation

B. Electrical heating of a nichrome wire

C. Transfer of heat by conduction

D. isothermal compression

**Answer: D**

Watch Video Solution

**14.** An ideal gas heat engine operates in Carnot cycle between $227^\circ C$ and $127^\circ C$. It absorbs $6x10^4 cals$ of heat at higher temperature. Amount of heat converted to work is

A. $2.4 \times 10^4 cal$

B. $6 \times 10^4 cal$

C. $1.2 \times 10^4 cal$

D. $4.8 \times 10^4 cal$

**Answer: C**

Watch Video Solution

**15.** Which of the following processes is reversible?

A. Transfer of heat by radiation

B. Electrical heating of a nichrome wire

C. Transfer of heat by conduction

D. isothermal compression

**Answer: D**

Watch Video Solution

**16.** A Carnot engine whose sink is at $300K$ has an efficiency of $40\%$. By how much should the temperature of source be increased so as to increase its efficiency by $50\%$ of original efficiency.

A. $275K$

B. $325K$

C. $250K$

D. $380K$

**Answer: C**

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**17.** The molar specific heat at constant pressure of an ideal gas is $(7/2R)$. The ratio of specific heat at constant pressure to that at constant volume is

A. $7/5$

B. $8/7$

C. $5/7$

D. $9/7$

**Answer: A**

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**18.** An engine has an efficiency of $\frac{1}{6}$. When the temperature of sink is reduced by $62^{\circ}C$, its efficiency is doubled. Temperature of the source is

A. $127^{\circ}C$

B. $37^{\circ}C$

C. $62^{\circ}C$

D. $99^{\circ}C$

**Answer: D**

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**19.** If Q, E and W denote respectively the heat added, change in internal energy and the work done in a closed cycle process, then

A. $W=0$

B. $Q=W=0$

C. $E=0$

D. $Q=0$

**Answer: C**

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**20.** At $10^{\circ}C$, the value of the density of a fixed mass of an ideal gas divided by its pressure is x. at $110^{\circ}C$, this ratio is

A. $x$

B. $\frac{383}{283}x$

C. $\frac{10}{110}x$

D. $\frac{283}{383}x$

**Answer: D**

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**21.** In thermodynamic processes which of the following statement is not true?

A. In an adiabatic process the system is insulated from the surroundings

B.

C.

D.

**Answer: B**

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**22.** The internal energy change in a system that has absorbed $2kcal$ of heat and done $500J$ of work is

A. $8900J$

B. $6400J$

C. $5400J$

D. $7900J$

**Answer: D**

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**23.** If $\Delta U$ and $\Delta W$ represent the increase in internal energy and work done by the system resectively in a thermodynamical process, which of the following is true?

A. $\Delta U = -\Delta W$, in an adiabatic process

B. $\Delta U = \Delta W$, in an isothermal process

C. $\Delta U = \Delta W$, in an adiabatic process

D. $\Delta U = -\Delta W$, in an isothermal process

**Answer: A**

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**24.** During an isothermal expansion, a confined ideal gas does $-150J$ of work aginst its surroundings. This implies that

A. $300J$ of heat has been added to the gas

B. no heat is transferred because the process is isothermal

C. $150J$ of heat has been added to the gas

D. $150J$ of heat has been removed from the gas

**Answer: C**

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**25.** When $1kg$ of ice at $0^{\circ} C$ melts to water at $0^{\circ} C$, the resulting change in its entropy, taking latent heat of ice to be $80cal / g$ is

A. $8 \times 10^4 cal / K$

B. $80cal / K$

C. $293cal / K$

D. $273cal / K$

**Answer: C**

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**26.** A mass of diatomic gas$(\gamma = 1.4)$ at a pressure of 2 atomphere is compressed adiabitically so that its temperature rises from $27^\circ C$ to $927^\circ C$. The pressure of the gas in the final state is

A. $28atm$

B. $68.7atm$

C. $256atm$

D. $8atm$

**Answer: C**

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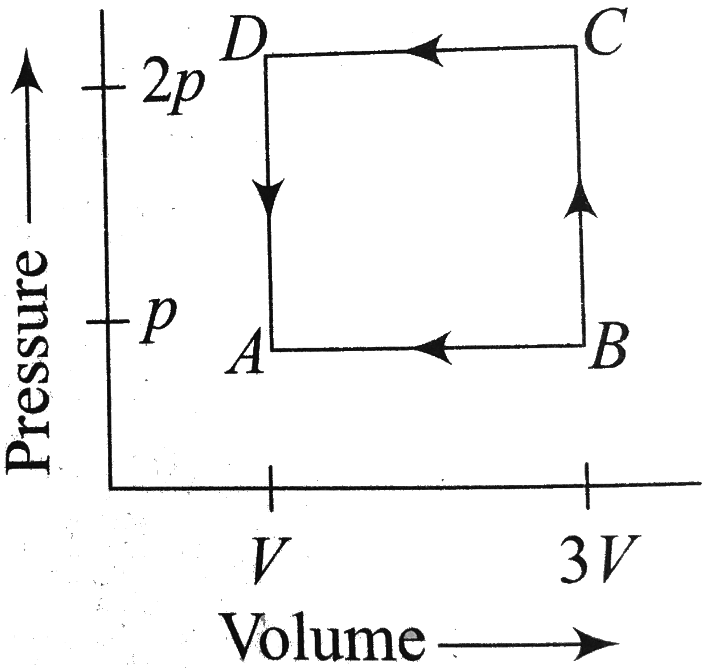
**27.** A thermodynamic system is taken through the cycle $ABCD$ as shown in the figure. Heat rejected by the gas during the cycle is




A. $PV$

B. $2PV$

C. $4PV$

D. $\frac{1}{2}PV$

**Answer: B**

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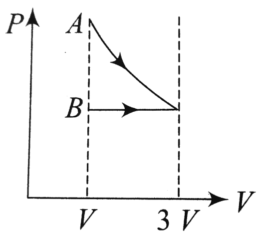
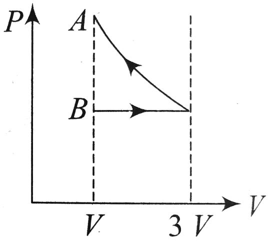
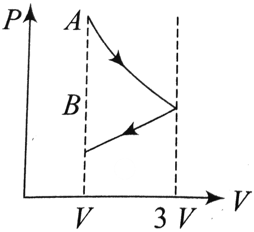
**28.** One mole of an ideal gas goes from an initial state A to final state B via two processs : It first undergoes isothermal expansion from volume $V$ to $3V$ and then its volume is reduced from $3V$ to $V$ at constant pressure. The correct $P-V$ diagram representing the two process in (figure)

A. 

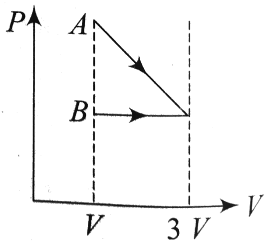
(a)

B. 

(b)

C. 

(c)

D. 

(d)

**Answer: A**

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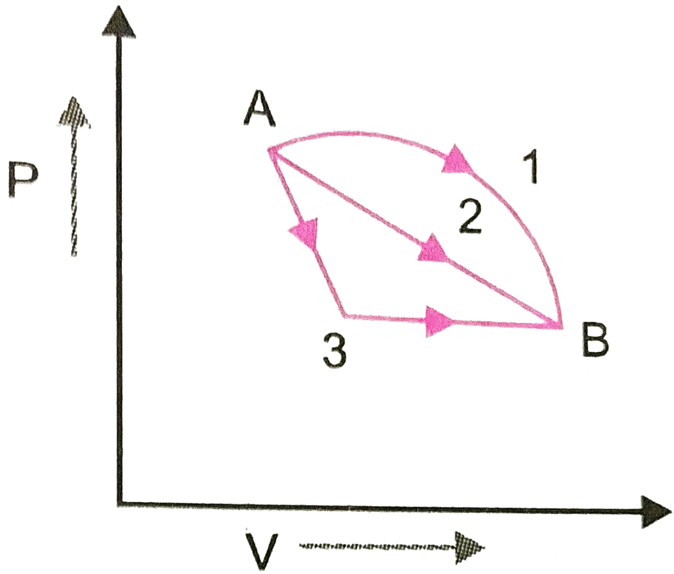
**29.** An ideal gas goes from State A to state B via three different process as indicate in the $P - V$ diagram.




If $Q_2, Q_3$ indicates the heat absorbed by the gas along the three processes and $\Delta U_1, \Delta U_2, \Delta U_3$ indicates the change in internal energy along the three processes respectively, then

A. $Q_1 > Q_2 > Q_3$ and $\Delta U_1 = \Delta U_2 = \Delta U_3$

B. $Q_3 > Q_2 > Q_1$ and $\Delta U_1 = \Delta U_2 = \Delta U_3$

C. $Q_1 = Q_2 = Q_3$ and $\Delta U_1 = \Delta U_2 = \Delta U_3$

D. $Q_3 > Q_2 > Q_1$ and $\Delta U_1 > \Delta U_2 > \Delta U_3$

**Answer: A**

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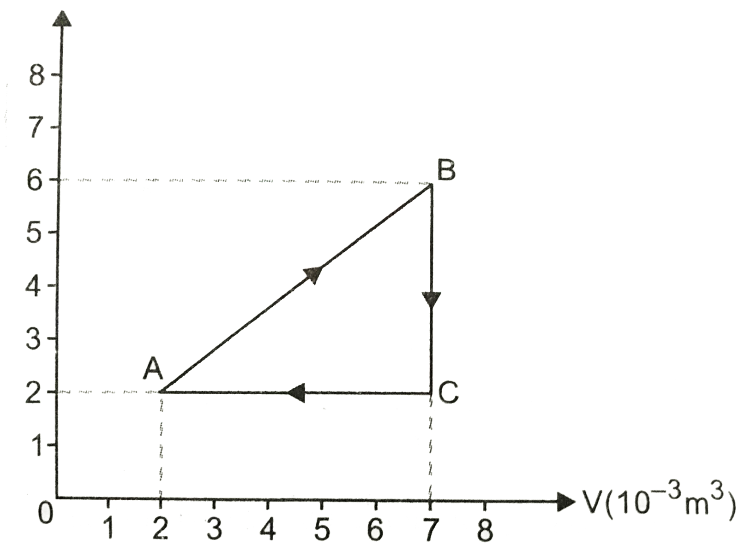
**30.** A gas is taken through the cycle $A \to B \to C \to A$, as shown in figure, what is the net work done by the gas?




A. $2000J$

B. $1000J$

C. Zero

D. $-2000J$

**Answer: B**

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**31.** During an adiabatic process, the pressure of a gas is found to be proportional to the cube of its absolute temperature. The ratio $C_P / C_V$ for the gas is

A. $\frac{4}{3}$

B. $2$

C. $\frac{5}{3}$

D. $\frac{3}{2}$

**Answer: D**

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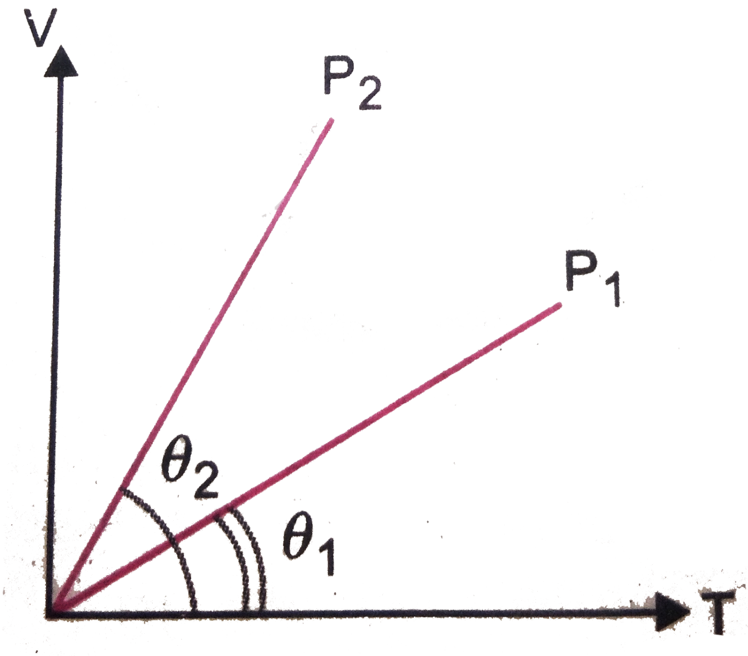
**32.** In the given (V-T) diagram, what is the relation between pressure $P_1$ and $P_2$ ?




A. $P_2 = P_1$

B. $P_2 > P_1$

C. $P_2 < P_1$

D. Cannot be predicated

**Answer: C**

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**33.** The amount of heat energy required to raise the temperature of $1g$ of Helium at $NTP$, from $T_1K$ to $T_2K$ is

A. $\frac{3}{8}N_a k_B(T_2 - T_1)$

B. $\frac{3}{2}N_a k_B(T_2 - T_1)$

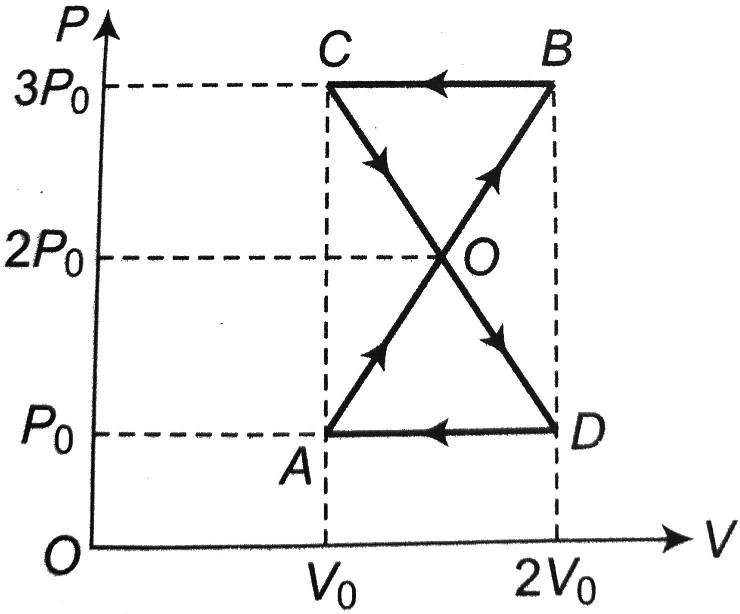
C. $\frac{3}{4}N_a k_B(T_2 - T_1)$

D. $\frac{3}{4}N_a k_B\left(\frac{T_2}{T_1}\right)$

**Answer: A**

Watch Video Solution

**34.** A thermodynamic system undergoes cyclic process $ABCDA$ as shown in figure. The work done by the system is




A. $P_0V_0$

B. $2P_0V_0$

C. $\frac{P_0V_0}{2}$

D. zero

**Answer: D**

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**35.** The mean free path of molecules of a gas (radius r) is inversely proportional to

A. $r^3$

B. $r^2$

C. $r$

D. $\sqrt{r}$

**Answer: B**

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**36.** A Carnot engine, having an efficiency of $\eta = 1/10$ as heat engine, is used as a refrigerator. If the work done on the system is 10J, the amount of energy absorbed from the reservoir at lower temperature is

A. $100J$

B. $99J$

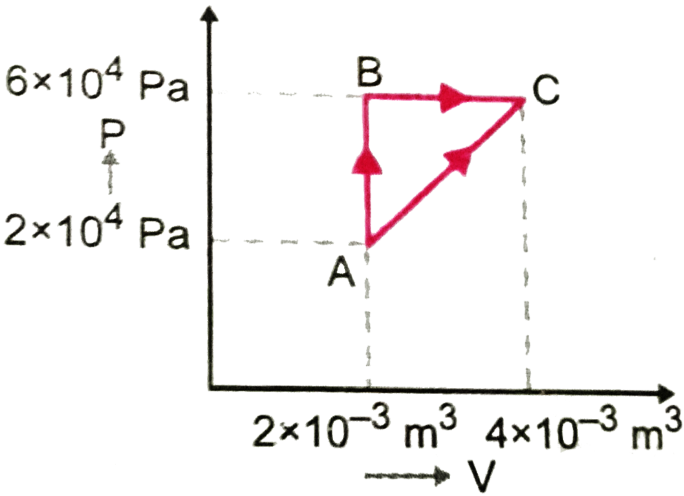
C. $90J$

D. $1J$

**Answer: C**

Watch Video Solution

**37.** In (figure). shows two path that may be taken by a gas to go from a state A to state C




In the process AB, $400J$ of heat is added to the system and in process Bc, $100J$ of heat is added to the system. The heat absorbed by the system in the process AC will be

A. $380J$

B. $500J$

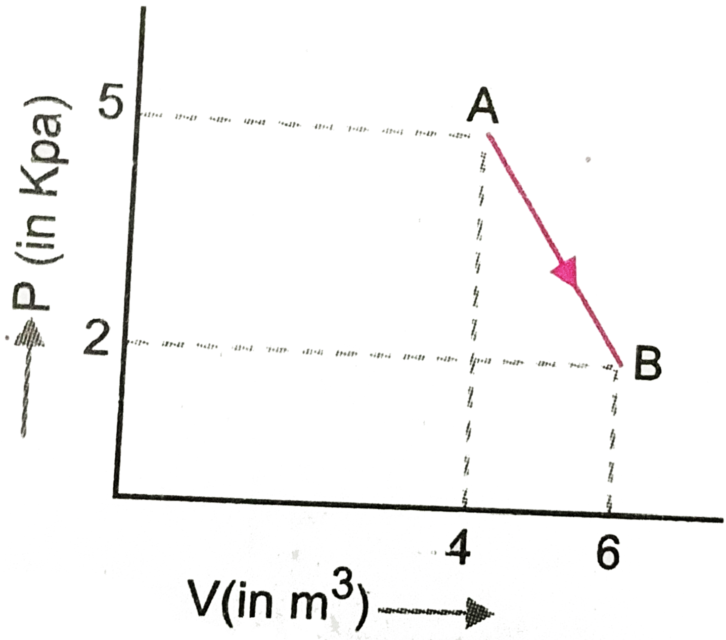
C. $460J$

D. $300J$

**Answer: C**

Watch Video Solution

**38.** One mole of an ideal diatomic gas undergoes a transition from A to B along a path AB as shown in (figure). The change in internal energy of the gas during the transition is $(\gamma = 3/5)$



A. $20kJ$

B. $-20kJ$

C. $20J$

D. $-12kJ$

**Answer: B**

Watch Video Solution

**39.** The ratio of the specific heats $\frac{C_P}{C_v} = \gamma$ in terms of degrees of freedom is given by

A. $\left(1+\frac{1}{n}\right)$

B. $\left(1+\frac{n}{3}\right)$

C. $\left(1+\frac{2}{n}\right)$

D. $\left(1+\frac{n}{2}\right)$

**Answer: C**

Watch Video Solution

**40.** Two vessel separately contains two ideal gases A and B at the same temperature, the pressure of A being twice that of B. under such conditions, the density of A is found to be 1.5 times the density of B. the ratio of molecular weight of A and B is

A. $\frac{1}{2}$

B. $\frac{2}{3}$

C. $\frac{3}{4}$

D. $2$

**Answer: C**

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**41.** $4.0g$ of a gas occupies $22.4$ litres at NTP. The specific heat capacity of the gas at constant volume is $5.0JK^{-1}mol^{-1}$. If the speed of sound in this gas at NTP is $952ms^{-1}$. Then the heat capacity at constant pressure is

A. $8.5JK^{-1}mol^{-1}$

B. $8.0JK^{-1}mol^{-1}$

C. $7.5JK^{-1}mol^{-1}$

D. $7.0JK^{-1}mol^{-1}$

**Answer: B**

Watch Video Solution

**42.** The coefficient of performance of a refrigerator is 5. If the temperature inside freezer is $-20^\circ C$, the temperature of the surroundings to which it rejects heat is :

A. $21^\circ C$

B. $31^\circ C$

C. $41^\circ C$

D. $11^\circ C$

**Answer: B**

Watch Video Solution

**43.** An ideal gas is compressed to half its initial volume by means of several peocesses. Which of the process results in the maximum work done on the gas ?

A. Isothermal

B. Adiabatic

C. Isobaric

D. Isochoric

**Answer: B**

Watch Video Solution

**44.** A refrigerator works between $4^\circ C$ and $30^\circ C$. It is required to remove $600 cal \text{ or } ies$ of heat every second in order to keep the temperature of the refrigerator space constant.The power required is (Take $1 cal \text{ or } ie = 4.2 J$)

A. $2.365 W$

B. $23.65 W$

C. $236.5W$

D. $2365W$

**Answer: C**

Watch Video Solution

**45.** The molecules of a given mass of a gas have rms velocity of $200m/sat27^{\circ}C$ and $1.0\times10^{5}N/m_{2}$ pressure. When the temperature and pressure of the gas are respectively $127^{\circ}C$ and $0.05\times10^{5}Nm^{-2}$, the rms velocity of its molecules in $ms^{-1}$ is

A. $100\sqrt{2}$

B. $\frac{400}{\sqrt{3}}$

C. $\frac{100\sqrt{2}}{3}$

D. $\frac{100}{3}$

**Answer: B**

Watch Video Solution

**46.** A gas is compressed isothermally to half its initial volume. The same gas is compressed separately through an adiabatic process untill its volume is again reduced to half. Then

A. compressing the gas isothermally will require more work to be done.

B. compresing the gas through adiabatic process will require more work to be more.

C. compressing the gas isothermally or adiabatically will require the same amount of work.

D. which of the case (whether compression through isothermal or through adiabatic process) require more work will depend upon the atmicity of the gas.

**Answer: B**

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**47.** One mole of an ideal monatomic gas undergoes a process described by the equation $PV^3$= constant. The heat capacity of the gas during this process is

A. $2R$

B. $R$

C. $\frac{3}{2}R$

D. $\frac{5}{2}R$

**Answer: B**

Watch Video Solution

**48.** The temperature inside a refrigerator is $t_2^\circ C$ . The amount of heat delivered to the room for each joule of electrical energy consumed ideally will be

A. $\dfrac{t_2+273}{t_1-t_2}$

B. $\dfrac{t_1+t_2}{t_1-273}$

C. $\dfrac{t_1}{t_1-t_2}$

D. $\dfrac{t_1+273}{t_1-t_2}$

**Answer: D**

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**49.** A sample of a perfect gas occupies a volume V at a pressure P and obsolete temperature T. The mass of each molecules is m, which of the following expression given the number of molecules in the sample?

A. $\frac{P}{kTV}$

B. $mkT$

C. $\frac{P}{kT}$

D. $\frac{Pm}{kT}$

**Answer: D**

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**50.** A Carnot engine, having an efficiency of $\eta = 1/10$ as heat engine, is used as a refrigerator. If the work done on the system is 10J, the amount of energy absorbed from the reservoir at lower temperature is

A. $90J$

B. $99J$

C. $100J$

D. $1J$

**Answer: A**

Watch Video Solution

**51.** A gas mixture consists of 2 moles of oxygen and 4 moles of argon at temperature T. Neglecting all vibrational modes, the total internal energy of the system is

A. $15RT$

B. $9RT$

C. $11RT$

D. $4RT$

**Answer: C**

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**52.** At what temperature , will the rms speed of oxygen molecules be sufficient for escaping from the earth ? Take $m = 2.76 \times 10^{-26} kg, k = 1.38 \times 10^{-23} J/K$ and $v_e = 11.2 km/s$ .

A. $1.254 \times 10^4 K$

B. $2.508 \times 10^4 K$

C. $5.016 \times 10^4 K$

D. $8.360 \times 10^4 K$

**Answer: D**

Watch Video Solution

**53.** The efficiency of an ideal heat engine working between the freezing point and boiling point of water , is

A. $12.5\ \%$

B. $26.8\ \%$

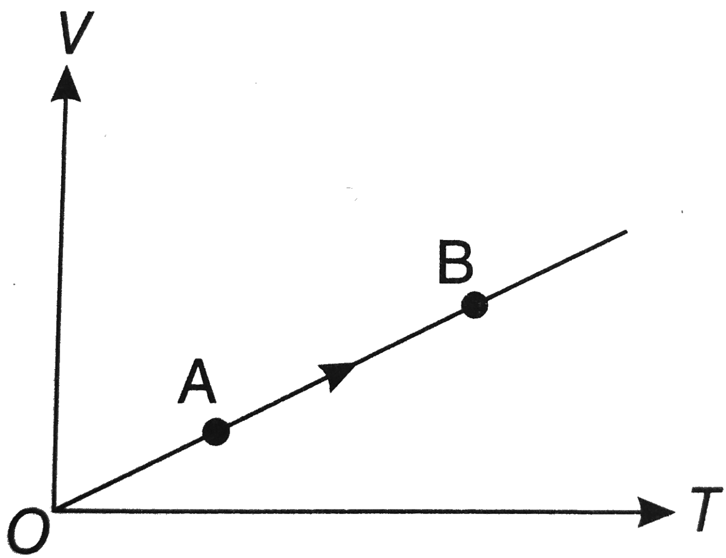
C. $6.25\ \%$

D. $20\ \%$

**Answer: B**

Watch Video Solution

**54.** The volume $(V)$ of a manatomic gas varies with its temperature $(T)$ , as shown in the graph. The ratio of work done by the gas, to the heat absorbed by it, when it undergoes a change from state $A$ to $B$ , is




A. $\frac{2}{7}$

B. $\frac{2}{5}$

C. $\frac{1}{3}$

D. $\frac{2}{3}$

**Answer: B**

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**55.** A sample of $0.1g$ of water of $100^\circ C$ and normal pressure $(1.013 \times 10^5 Nm^{-2})$ requires 54 cal of heat energy to convert to steam at $100^\circ C$. If the volume of the steam produced is 167.1 cc, the change in internal energy of the sample is

A. $84.5J$

B. $104.3J$

C. $42.2J$

D. $208.7J$

**Answer: D**

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## AIIMS Questions

**1.** In an adiabatic change, the pressure and temperature of a monoatomic gas are related with relation as $P \propto T^C$, Where $C$ is equal to:

A. $\frac{5}{4}$

B. $\frac{5}{3}$

C. $\frac{3}{5}$

D. $\frac{5}{2}$

**Answer: D**

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**2.** Which one of the following is not a thermodynamical coordinate ?

A. $R$

B. $V$

C. $T$

D. $P$

**Answer: A**

Watch Video Solution

**3.** The volume of a gas is reduced adibatically to $(1/4)$ of its volume at $27^{\circ}C$. if $\gamma = 1.4$ . The new temperature will be

A. $150 \times (4)^{0.4}K$

B. $300 \times (4)^{0.4} K$

C. $250 \times (4)^{0.4} K$

D. None of these

**Answer: B**

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**4.** When an ideal monoatomic gas is heated at constant pressure, fraction of heat energy supplied which increases the internal energy of gas, is

A. $\frac{2}{5}$

B. $\frac{3}{5}$

C. $\frac{3}{7}$

D. $\frac{3}{4}$

**Answer: B**

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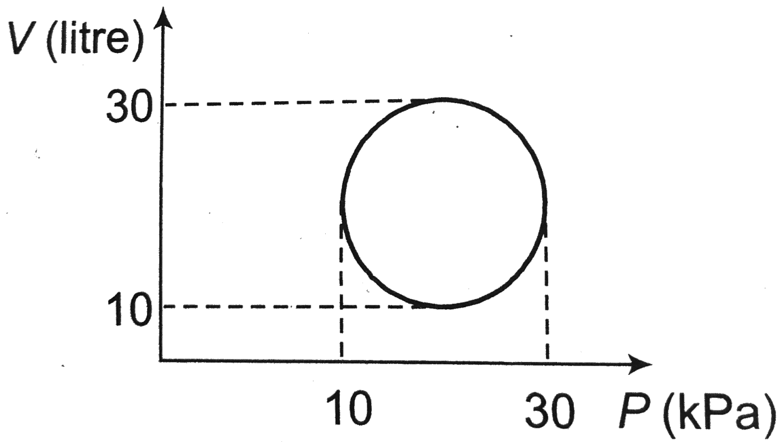
**5.** Heat energy abosrbed by a system in going through a cyclic process shown in figure is




A. $10^7 \pi J$

B. $10^4 \pi J$

C. $10^2 \pi J$

D. $10^{-3}\pi J$

**Answer: C**

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6. When the temperature of a gas is raised from $27^\circ C$ to $90^\circ C$, the percentage increase in the rms velocity of the molecules will be

A. $10\%$

B. $15\%$

C. $20\%$

D. $17.5\%$

**Answer: A**

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**7.** A gas is enclosed in a closed pot. On keeping this pot in a train moving with high speed , the temperature of the gas

A. will increase

B. will decrease

C. will remain the same

D. will change according to the nature of the gas.

**Answer: C**

Watch Video Solution

**8.** Two ballons are filled, one with pure He gas and other by air, repectively. If the pressure and temperature of these ballons are same then the number of molecules per unit volume is:

A. more in the He filled balloon

B. more in the filled ba

C.

D.

**Answer: B**

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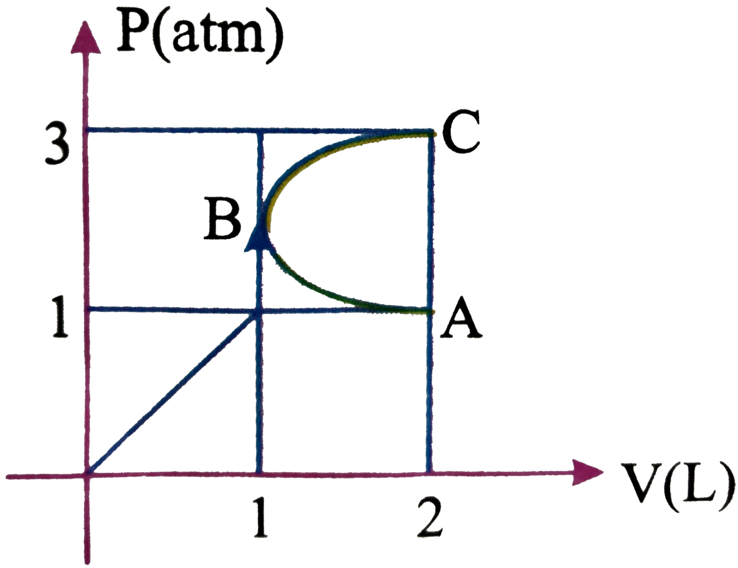
**9.** In the $P-V$ diagram shown shown in figure $ABC$ is a semicircle.The work done in the process $ABC$ is




A. zero

B. $\frac{\pi}{2}atm - it$

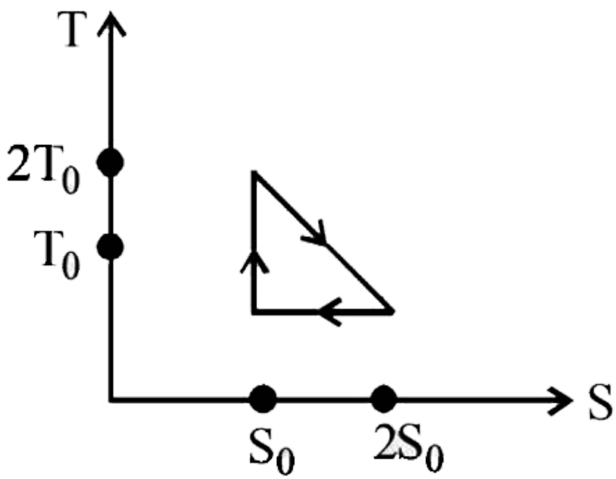
C. $-\frac{\pi}{2}atm - it$

D. $4atm - it$

**Answer: B**

Watch Video Solution

**10.** The temperature -entropy diagram of a reversible engine cycle is given in the figure. Its efficiency is




A. $1/3$

B. 2//3`

C. $1/2$

D. $1/4$

**Answer: C**

Watch Video Solution

**11.** A gas is compressed adiabatically till its temperature is doubled. The ratio of its final volume to initial volume will be

A. $1/2$

B. more than $1/2$

C. less than $1/2$

D. between 1 and 2

**Answer: C**

Watch Video Solution

**12.** A reversible engine converts one-sixth of the heat input into work. When the temperature of the sink is reduced by $62^{\circ}C$, the efficiency of the engine is doubled. The temperatures of the source and sink are

A. $80^{\circ} C, 37^{\circ} C$

B. $95^{\circ} C, 28^{\circ} C$

C. $90^{\circ} C, 37^{\circ} C$

D. $99^{\circ} C, 37^{\circ} C$

**Answer: D**

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**13.** A gas expands adiabatically at constant pressure such that its temperature $T \propto \frac{1}{\sqrt{V}}$, the value of $C_P / C_V$ of gas is

A. $1.30$

B. $1.50$

C. $1.67$

D. $2.00$

**Answer: B**

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**14.** A system is provided with 200 cal of heat and the work done by the system on the surrounding is $40J$. Then its internal energy

A. increases by $600J$

B. decreases by $800J$

C. increases by $800J$

D. decreases by $50J$

**Answer: C**

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15. Two cylinder having $m_1 g$ and $m_2 g$ of a gas at pressure $P_1$ and $P_2$ respectively are put in cummunication with each other, temperature remaining constant. The common pressure reached will be

A. $\frac{m_1 m_2 P_2}{P_2 m_1 + P_1 m_2}$

B. $\frac{P_1 P_2 m_1}{P_2 m_1 + P_1 m_2}$

C. $\frac{m_1 m_2 (P_1 + P_2)}{P_2 m_1 + P_1 m_2}$

D. $\frac{P_1 P_2 (m_1 + m_2)}{P_2 m_1 + P_1 m_2}$

**Answer: D**

Watch Video Solution

**16.** When an ideal monoatomic gas is heated at constant pressure, fraction of heat energy supplied which increases the internal energy of gas , is

A. $3/7$

B. $5/7$

C. $2/5$

D. $3/5$

**Answer: D**

Watch Video Solution

**17.** A carnot engine operates with source at $127^{\circ}C$ and sink at $27^{\circ}C$. If the source supplies $40kJ$ of heat energy. The work done by the engine is

A. $30kJ$

B. $4kJ$

C. $10kJ$

D. $1kJ$

**Answer: C**

Watch Video Solution

**18.** Assertion: In adiabatic compression, the internal energy and temperature of the system get decreased.

Reason: The adiabatic compression is a slow process.

A. If both assertion and reason are true and reason is the correct explanation of assertion

B. If the assertion and reason are true but reason is not the correct explanation of assertion.

C. If assertion is true but reason is false.

D. If both assertion and reason are false

**Answer: D**

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**19.** Assertion: When a bottle of cold carbonated drink is opened, a slight fog forms around the opening.

Reason: Adiabatic expansion of the gas causes lowering of temperature and condersation of water vapours.

A. If both assertion and reason are true and reason is the correct explanation of assertion

B. If the assertion and reason are true but reason is not the correct explanation of assertion.

C. If assertion is true but reason is false.

D. If both assertion and reason are false

**Answer: A**

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**20.** Aseertion: Thermodynamics process in nature are irreversible.

Reason: Dissipactive effects cannot be eliminated.

A. If both assertion and reason are true and reason is the correct explanation of assertion

B. If the assertion and reason are true but reason is not the correct explanation of assertion.

C. If assertion is true but reason is false.

D. If both assertion and reason are false

**Answer: A**

Watch Video Solution

**21.** Assertion: Reversible systems are difficult to find in real world.

Reason: Most processes are dissipative in nature.

A. If both assertion and reason are true and reason is the correct explanation of assertion

B. If the assertion and reason are true but reason is not the correct explanation of assertion.

C. If assertion is true but reason is false.

D. If both assertion and reason are false

**Answer: A**

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**22.** Assertion: Air quickly leaking out of a balloon becomes coolers.

Reason: The leaking air undergoes adiabatic expansion.

A. If both assertion and reason are true and reason is the correct explanation of assertion

B. If the assertion and reason are true but reason is not the correct explanation of assertion.

C. If assertion is true but reason is false.

D. If both assertion and reason are false

**Answer: A**

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**23.** Assertion: In an isolated system the entropy increases.

Reason: The processes in an isolated system are adiabatic.

A. If both assertion and reason are true and reason is the correct explanation of assertion

B. If the assertion and reason are true but reason is not the correct explanation of assertion.

C. If assertion is true but reason is false.

D. If both assertion and reason are false

**Answer: B**

View Text Solution

**24.** Assertion: The carnot cycle is useful in understanding the performance of heat engine.

Reason: The carnot cycle provided a way of determining the maximum possible efficiency achievable with reservoirs of given temperature.

A. If both assertion and reason are true and reason is the correct explanation of assertion

B. If the assertion and reason are true but reason is not the correct explanation of assertion.

C. If assertion is true but reason is false.

D. If both assertion and reason are false

**Answer: A**

View Text Solution

**25.** Assertion: The isothermal curves intersect each other at a certain point.

Reason: The isothermal changes takes place rapidly, so the isothermal curves have very little slope.

A. If both assertion and reason are true and reason is the correct explanation of assertion

B. If the assertion and reason are true but reason is not the correct explanation of assertion.

C. If assertion is true but reason is false.

D. If both assertion and reason are false

**Answer: D**

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**26.** Assertion: The heat supplied to a system is always equal to the increase in its internal energy

Reason: when a system changes from one thermal equilibrium to another, some heat is absorbed by it.

A. If both assertion and reason are true and reason is the correct explanation of assertion

B. If the assertion and reason are true but reason is not the correct explanation of assertion.

C. If assertion is true but reason is false.

D. If both assertion and reason are false

**Answer: D**

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**27.** Statement-1 : In an adiabatic process, change in internal energy of a gas is equal to work done on/by the gas in the process.

Statement-2 : This is because temp.of gas remains constant in an adiabatic process.

A. If both assertion and reason are true and reason is the correct explanation of assertion

B. If the assertion and reason are true but reason is not the correct explanation of assertion.

C. If assertion is true but reason is false.

D. If both assertion and reason are false

**Answer: C**

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## Chapter Test

**1.** First law of thermodynamics is a special case of

A. Newton's law

B. Law of conservation of energy

C. Charles's law

D. Law of heat exchange

**Answer: B**

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**2.** A Carnot engine takes $3 \times 10^6 cal.$ of heat from a reservoir at $62^\circ C$, and gives it to a sink at $27^\circ C$. The work done by the engine is

A. $4.2 \times 10^6 J$

B. $8.4 \times 10^6 J$

C. $16.8 \times 10^6 J$

D. zero

**Answer: B**

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**3.** Which of the following statements is correct for any thermodynamic system?

A. The internal energy changes in all processes

B. internal energy and entropy are state functions

C. The change in entropy can never be zro

D. The work done in an adiabatic process is always zero.

**Answer: B**

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**4.** Which of the following is incorrect regarding the first law of thermodynamics?

A. It introduce the concept of the internal energy

B. it introduce the concept of the entropy

C. it is not applicable to any cyclic process

D. None of the above

**Answer: B**

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**5.** During an adiabatic process, the pressure of a gas is found to be proportional to the cube of its absolute temperature. The ratio $C_P / C_V$ for the gas is

A. $\frac{3}{2}$

B. $\frac{4}{3}$

C. $2$

D. $\frac{5}{3}$

**Answer: A**

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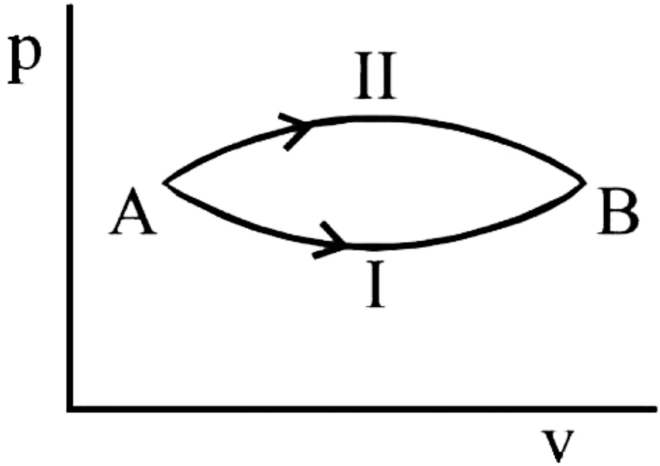
**6.** A system goes from A and B via two processes. I and II as shown in figure. If $\Delta U_1$ and $\Delta U_2$ are the changes in internal energies in the processes I and II respectively, then




A. $\Delta U_{||} < \Delta U_{|}$

B. $\Delta U_{||} < \Delta U_{|}$

C. $\Delta U_{||} = \Delta U_{|}$

D. Relation between $\Delta U_{|}$ and $\Delta U_{||}$ cannot be determined

**Answer: C**

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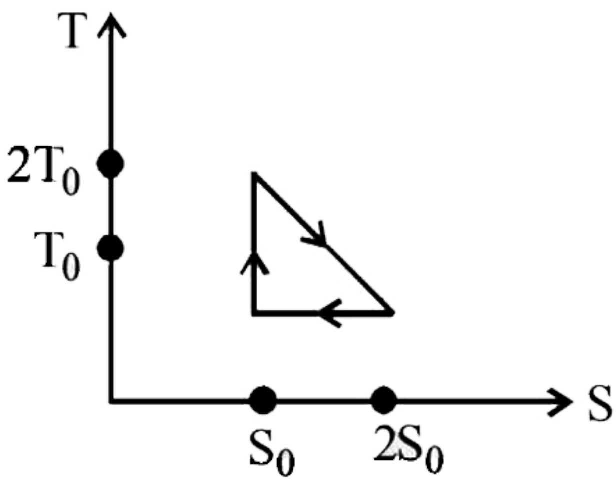
**7.** The temperature -entropy diagram of a reversible engine cycle is given in the figure. Its efficiency is




A. $1/3$

B. $2/3$

C. $1/2$

D. $1/4$

**Answer: A**

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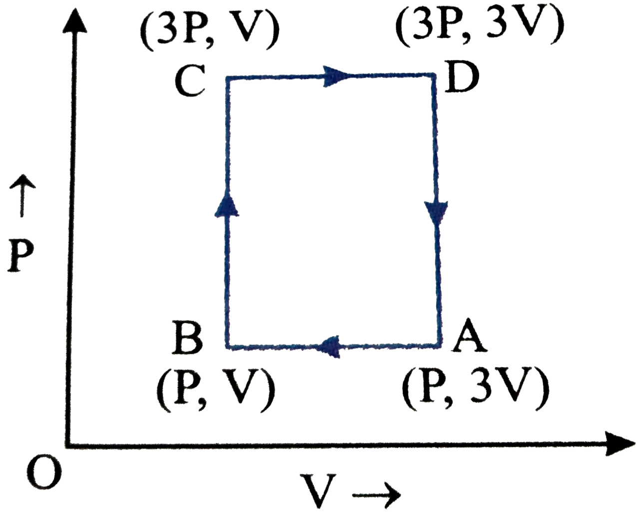
**8.** An ideal monoatomic gas is taken the cycle $ABCDA$ as shown in following $P-V$ diagram. The work done during the cycle is




A. $PV$

B. $2PV$

C. $4PV$

D. zero

**Answer: C**

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**9.** When an ideal diatomic gas is heated at constant pressure, the fraction of the heat energy supplied which increases the internal energy of the gas is

A. $\frac{2}{5}$

B. $\frac{3}{5}$

C. $\frac{3}{7}$

D. $\frac{5}{7}$

**Answer: D**

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**10.** Two identical containers A and B with frictionless pistons contain the same ideal gas at the same temperature and the same velocity V. The mass of the gas in A is $m_A$, and that in B is

$m_B$. The gas in each cylinder is now allowed to expand isothermally to the same final volume 2V. The changes in the pressure in A and B are found to be $\Delta P$ and $1.5\Delta P$ respectively. Then

A. $4m_A = 9m_B$

B. $2m_A = 3m_B$

C. $3m_A = 2m_B$

D. $9m_A = 3m_B$

**Answer: C**

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**11.** Two cylinders A and B fitted with pistons contain equal amounts of an ideal diatomic gas at 300K. The piston of A is free to move, while that B is held fixed. The same amount of heat is given to the gas in each cylinder. If the rise in temperature of the gas in A is 30K, then the rise in temperature of the gas in B is

A. $30K$

B. $18K$

C. $50K$

D. $42K$

**Answer: D**

Watch Video Solution

**12.** A gas mixture consists of 2 moles of oxygen and 4 moles of argon at temperature T. Neglecting all vibrational modes, the total internal energy of the system is

A. $4RT$

B. $15RT$

C. $9RT$

D. $11RT$

**Answer: D**

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**13.** A monoatomic ideal gas, initially at temperature $T_1$, is enclosed in a cylinder fitted with a friction less piston. The gas is allowed to expand adiabatically to a temperature $T_2$ by releasing the piston suddenly. If $L_1$ and $L_2$ are the length of the gas column before expansion respectively, then $\frac{T_1}{T_2}$ is given by

A. $\left(\frac{L_1}{L_2}\right)^{2/3}$

B. $\frac{L_1}{L_2}$

C. $\frac{L_2}{L_1}$

D. $\left(\frac{L_2}{L_1}\right)^{2/3}$

**Answer: D**

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**14.** In a given process on an ideal gas, $dW = 0$ and $dQ < 0$. Then for the gas

A. The temperature will decrease

B. The volume will increase

C. The pressure will remain constant

D. The temperature will increase

**Answer: A**

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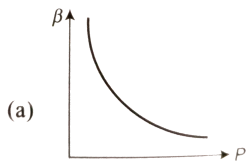
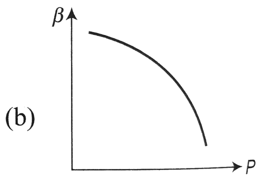
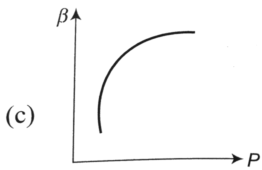
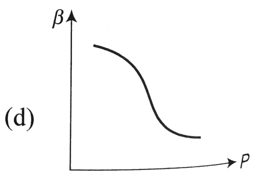
15. Which of the following graphs correctly represents the variation of $\beta = -\frac{dV/dP}{V}$ with P for an ideal gas at constant temperature?

A. 


B. 


C. 


D. 

**Answer: A**

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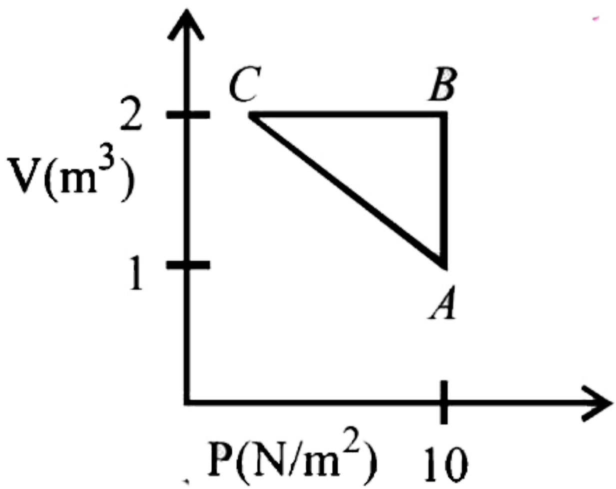
**16.** An ideal gas is taken through the cycle $A \rightarrow B \rightarrow C \rightarrow A$, as shown in the figure, If the net heat supplied to the gas in the cycle is 5J, the work done by the gas in the process $C \rightarrow A$ is




A. $-5J$

B. $-10J$

C. $-15J$

D. $-20J$

**Answer: A**

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**17.** An ideal gas expands isothermally from volume $V_1$ to $V_2$ and is then compressed to original volume $V_1$ adiabatically. Initialy pressure is $P_1$ and final pressure is $P_3$. The total work done is $W$. Then

A. $P_3 > P_1, W > 0$

B. $P_3 < P_1, W < 0$

C. $P_3 < P_1, W < 0$

D. $P_3 = P_1, W = 0$

**Answer: C**

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**18.** An ideal gas is filled in a closed rigid and thermally insulated container. A coil of $100\Omega$ resistor carrying current 1 A for 5 minutes supplies heat to the gas. The change in internal energy of the gas is

A. $0kJ$

B. $10kJ$

C. $20kJ$

D. $30kJ$

**Answer: D**

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**19.** A Carnot engine operates between $327^\circ C$ and $27^\circ C$ How much heat (in joules) does it take from the $327^\circ C$ reservoir for every $100J$ of work done?

A. $100J$

B. $200J$

C. $300J$

D. $400J$

**Answer: B**

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**20.** One mole of gas having $\gamma = 7/5$ is mixed with 1 mole of a gas having $\gamma = 4/3$. What will be $\gamma$ for the mixture ?

A. $\frac{5}{11}$

B. $\frac{15}{13}$

C. $\frac{15}{11}$

D. $\frac{5}{13}$

**Answer: C**

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**21.** Two cylinders A and B fitted with pistons contain equal amounts of an ideal diatomic gas at 300K. The piston of A is free to move, while that B is held fixed. The same amount of heat is given to the gas in each cylinder. If the rise in temperature of the gas in A is 30K, then the rise in temperature of the gas in B is

A. $30K$

B. $18K$

C. $50K$

D. $42K$

**Answer: D**

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**22.** Internal energy of $n_1$ mol of hydrogen of temperature $T$ is equal to the internal energy of $n_2$ mol of helium at temperature $2T$. The ratio $n_1 / n_2$ is

A. $\frac{3}{5}$

B. $\frac{2}{3}$

C. $\frac{6}{5}$

D. $\frac{3}{7}$

**Answer: C**

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**23.** An ideal gas $(\gamma = 1.5)$ is expanded adiabatically. How many times has the gas to be expanded to reduce the roo-mean-square velocity of molecules becomes half ?

A. 4 times

B. 16 times

C. 8 times

D. 2 times

**Answer: B**

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**24.** If 2 mol of an ideal monatomic gas at temperature $T_0$ are mixed with 4 mol of another ideal monatomic gas at temperature $2T_0$ then the temperature of the mixture is

A. $\frac{5}{3}T_0$

B. $\frac{3}{2}T_0$

C. $\frac{4}{3}T_0$

D. $\frac{5}{4}T_0$

**Answer: A**

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**25.** Three samples $A$, $B$ and $C$ of the same gas $(\gamma = 1.5)$ have equal volumes and temperatures. The volume of each sample is doubled, the process being isothermal for $A$, adiabatic for $B$ and isobaric for $C$. If the final pressures are equal for the three samples, Find the ratio of the initial pressures.

A. $2\sqrt{2} : 2 : 1$

B. $2\sqrt{2} : 1 : 2$

C. $\sqrt{2} : 1 : 2$

D. $2 : 1 : \sqrt{2}$

**Answer: B**

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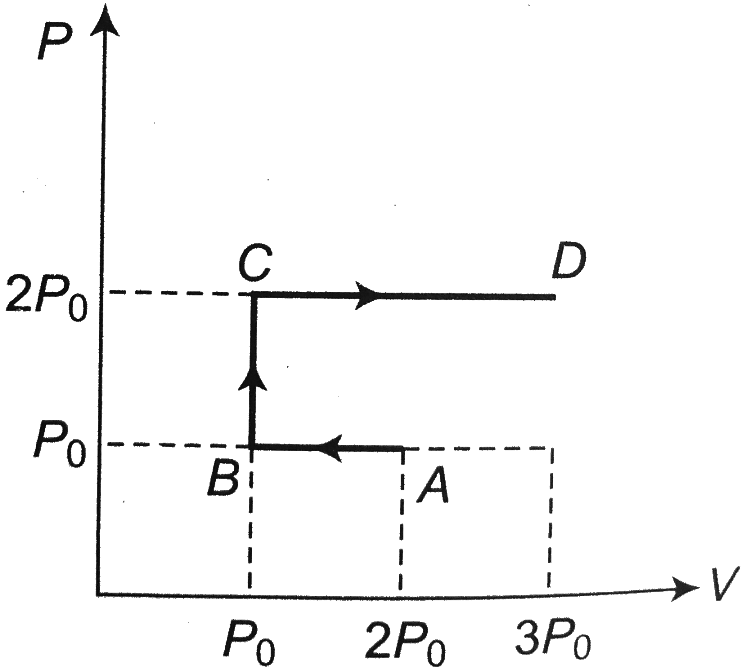
**26.** $P - V$ diagram of an ideal gas is as shown in figure. Work done by the gas in process $ABCD$ is




A. $P_0V_0$

B. $2P_0V_0$

C. $3P_0V_0$

D. $P_0V_0$

**Answer: C**

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**27.** Statement I: The specific heat of a gas in an adiabatic process is zwero but it is infinite in an isothermal process.

Statement II: Specific heat of a gas is directly proportional to heat exchanged with the system and inversely proportional to change in termperature.

A. If both assertion and reason are true and reason is the correct explanation of assertion

B. If the assertion and reason are true but reason is not the correct explanation of assertion.

C. If assertion is true but reason is false.

D. If both assertion and reason are false

**Answer: A**

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**28.** Asssertion: It is not possible for a system, unaided by an external agency to transfer heat from a body at lower temp. to another at a higher temp.

Reason: It is not possible to violate the second law of thermodynamics.

A. If both assertion and reason are true and reason is the correct explanation of assertion

B. If the assertion and reason are true but reason is not the correct explanation of assertion.

C. If assertion is true but reason is false.

D. If both assertion and reason are false

**Answer: A**

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**29.** Assertion : First law of thermodynamics is a restatement of the principle of conservation.

Reason : Energy is fundamental quantity.

A. If both assertion and reason are true and reason is the correct explanation of assertion

B. If the assertion and reason are true but reason is not the correct explanation of assertion.

C. If assertion is true but reason is false.

D. If both assertion and reason are false

**Answer: C**

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