PHYSICS

AIMED AT STUDENTS PREPARING FOR IIT JEE EXAMS

THERMODYNAMICS

Exercise

1. An amount Q of heat is added to a mono atomic ideal gas in a process in which the gas performs a work $Q/2$ on its surrounding. Find equation of the process.

A. $TV^{1/3} =$ constant

B. $TV^{-1/4} =$ constant

C. $TV^{1/4} =$ constant

D. $TV^{-1/3} =$ constant

Answer: A

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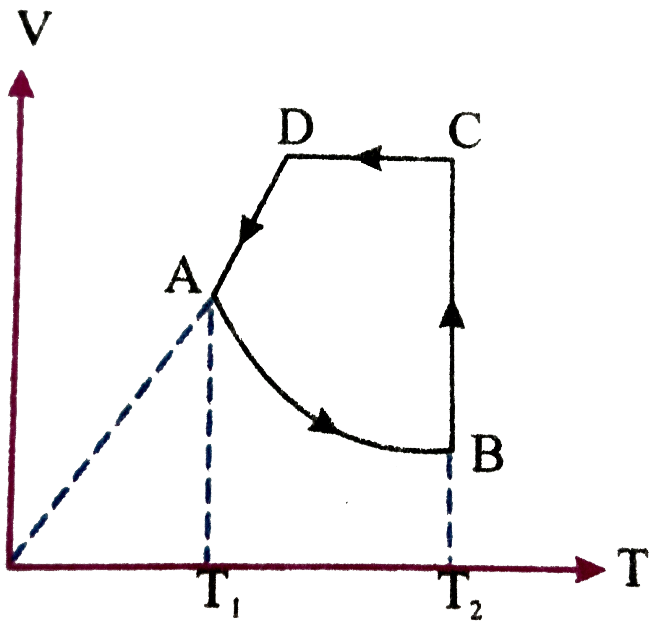
2. Figure shows a cycle $ABCDA$ undergone by 2 moles of an ideal diatomic gas. The curve AB is a rectangular hyperbola and $T_1 = 300K$ and $T_2 = 500K$. Determine the work done by the gas in the process $A \to B$.



A. $-3.320kJ$

B. $4.326kJ$

C. $2.326kJ$

D. $3.326kJ$

Answer: A

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3. One mole of an ideal monoatmic gas undergoes a process defined y $U = a\sqrt{V}$ where U is internal energy and V is its volume.The molar specific heat of the gas for this process is found to be $\frac{*}{12}R$. The number in the numerator is not readable.What may be this number ?

A. 25

B. 21

C. 41

D. 42

Answer: D

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4. An ideal gas can be expanded from an initial state to a certain volume through two different processes,

(I) $PV^2 = K$ and (II) $P = KV^2$, where K is a positive constant. Then, choose the correct option from the following.

A. Final temperature in (I) will be greater than in (II)

B. Final temperature in (II) will be greater then in (I)

C. Work done by the gas in both the processes would be equal

D. Total heat given to the gas in (I) is greater then in (II)

Answer: B

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5. Monoatomic , diatomic and triatomic gases whose initial volume and pressure are same, each is compressed till their pressure becomes twice the initial pressure. Then:

A. if the compression is isothermal, then their volumes will be same

B. if the compression is adiabatic, then their final volumes will be different

C. if the compression is adiabatic , then monoatomic gas will have maximum final volume

D. All of these

Answer: D

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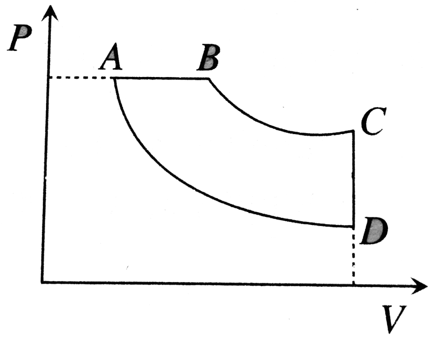
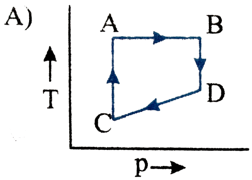
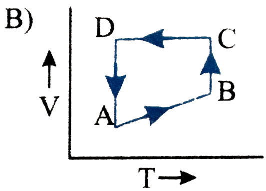
6. A cyclic process $ABCD$ is shown is shown in the following $P-V$ diagram. Which of the following curves represent the same process ?

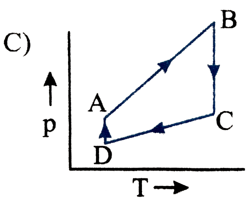




A.

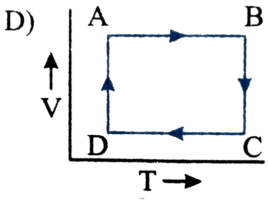


B.



C.

D.



Answer: B

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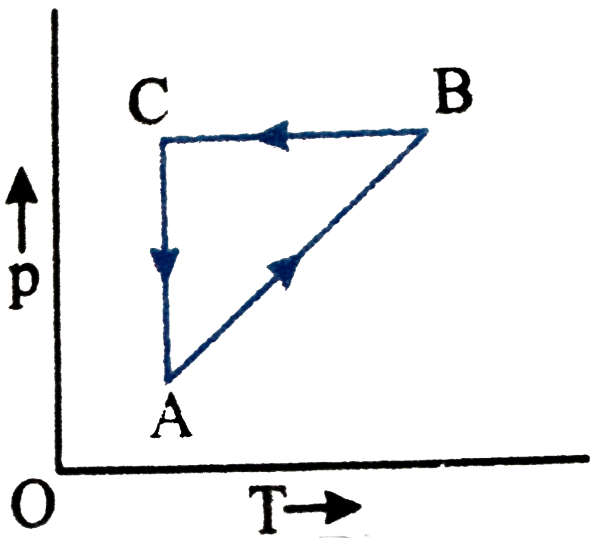
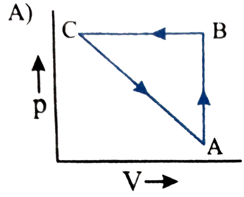
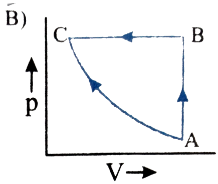
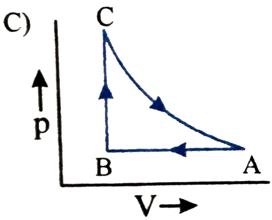
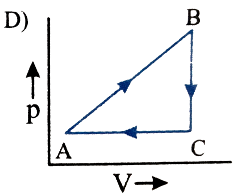
7. A cyclic process is shown in the $P - T$ diagram. Which of the curves show the same process on a $P - V$ diagram ?



A. 

B. 

C. 

D. 

Answer: B

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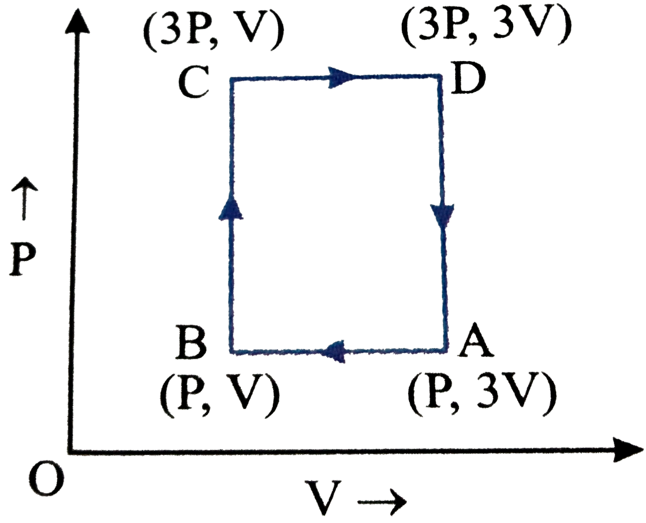
8. An ideal monoatomic gas is taken the cycle $ABCDA$ as shown in following $P-V$ diagram. The work done during the cycle is



A. PV

B. $2PV$

C. $4PV$

D. $3PV$

Answer: C

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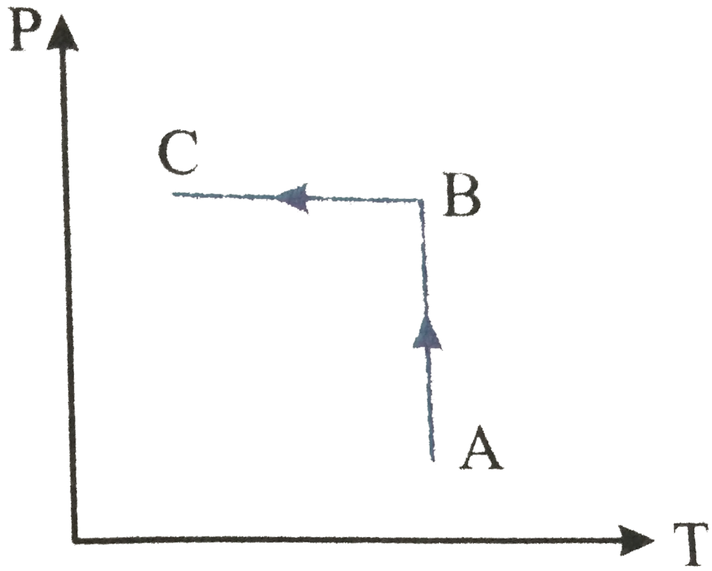
9. Ideal gas is taken through the process shown in the figure :



A. in process AB, work done by system is positive

B. in process AB, heat is rejected

C. in process AB, internal energy increases

D. in process AB internal energy decreases and in process BC, internal energy increases.

Answer: B

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10. The specific heat of solids at low temperatures varies with absolute temperature T according to the relation $S = AT^3$, where A is a constant. The heat energy required to raise the temperature of a mass m of such a solid from $T = 0$ to $T = 20K$ is:

A. $4 \times 10^4 mA$

B. $2 \times 10^4 mA$

C. $8 \times 10^6 mA$

D. $2 \times 10^6 mA.$

Answer: A

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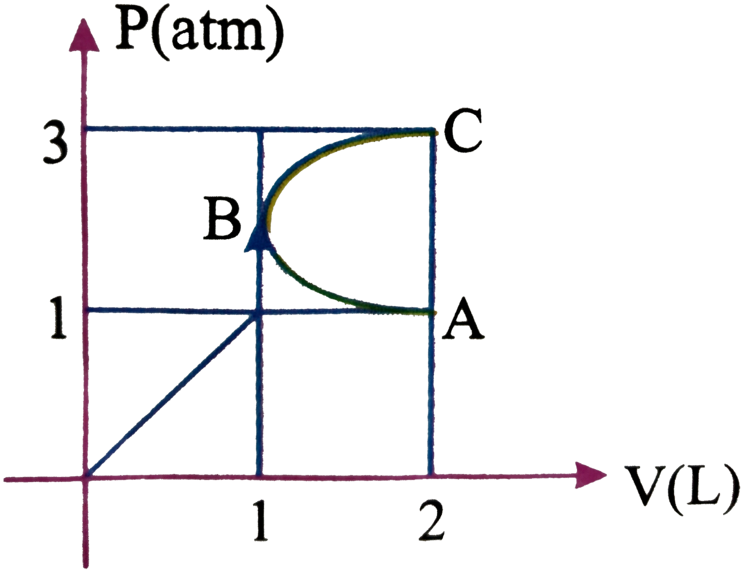
11. In the $P - V$ diagram shown shown in figure ABC is a semicircle.The work done in the process ABC is



A. $zero$

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

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

D. $4atm - L.$

Answer: B

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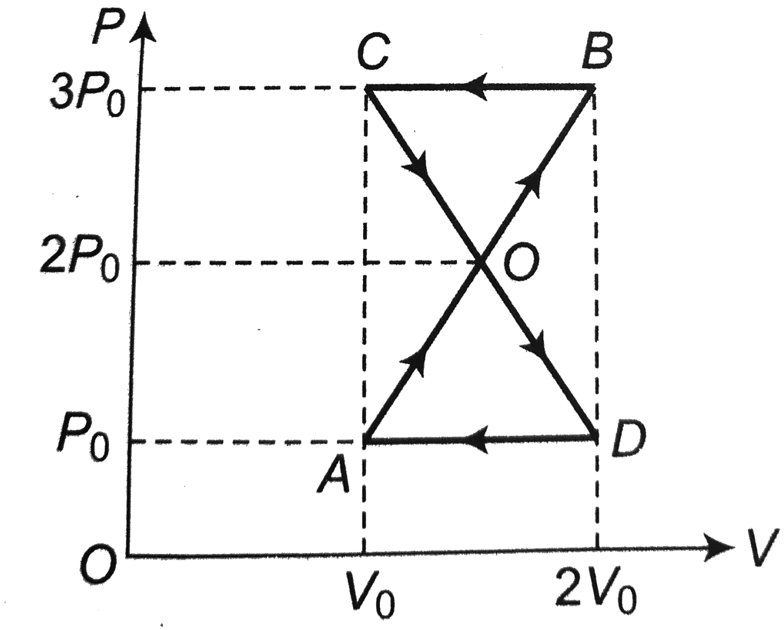
12. A thermodynamic system undergoes cyclic process $ABCDA$ as shown in figure. The work done by the system is



A. P_0V_0

B. $2P_0V_0$

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

D. zero

Answer: D

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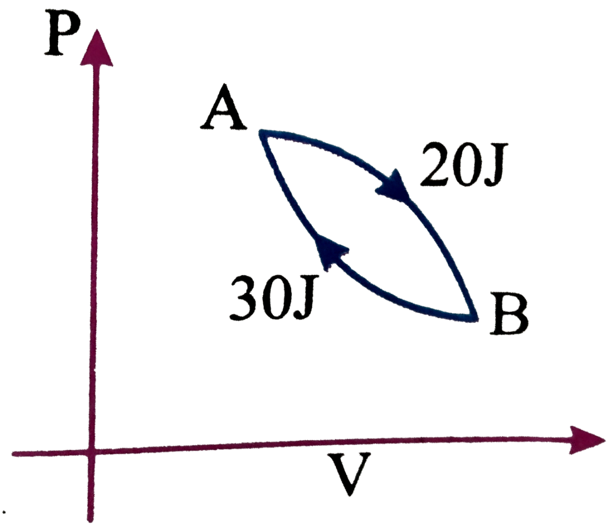
13. In a cyclic process shown in the figure an ideal gas is adial gas is adiabatically taken from $B \text{to} A$, the work done on the gas during the process $B \text{to} A$ is $30, J$ when the gas is taken from A to B the heat absorbed by the gas is $20J$ Then change in internat energy of the gas in the process A to B is :



A. $20J$

B. $-30J$

C. $50J$

D. $-10J$

Answer: B

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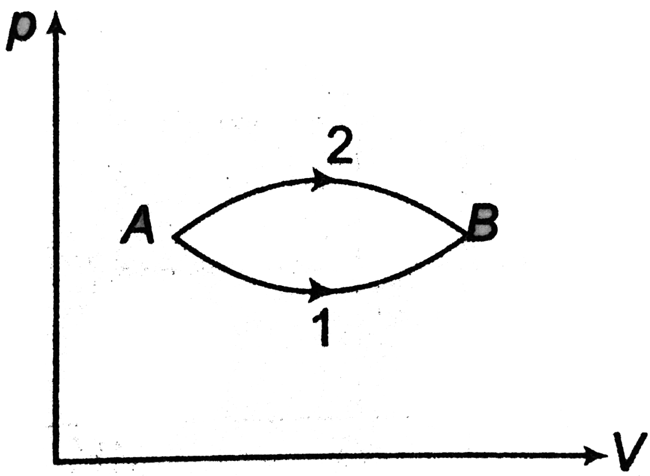
14. The figure shows two paths for the change of state of a gas from A to B. The ratio of molar heat capacities in path 1 and path 2 is

is



A. >1

B. <1

C. 1

D. data insufficient

Answer: B

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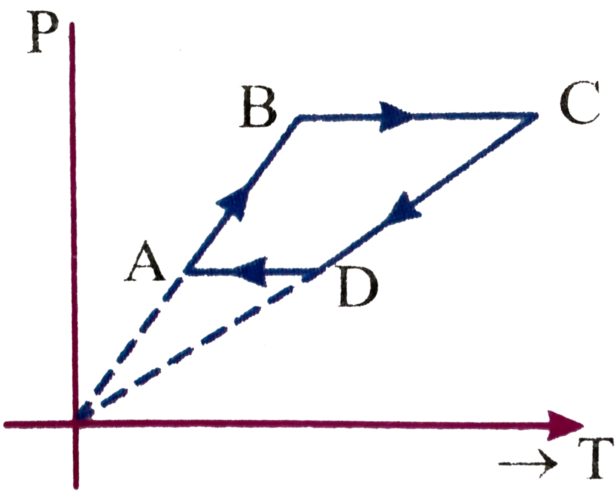
15. 3 moles of an ideal mono atomic gas performs a cycle as shown in fig. If gas temperature $T_A = 400K$ $T_B = 800K, T_C = 2400K,$ and $T_D = 1200K$. Then total work done by gas is



A. $2400R$

B. $1200R$

C. $2000R$

D. Zero

Answer: A

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16. A metal block of density $5000kg/m^3$ and mass $2kg$ in suspended by a spring of force constant $200N/m$. The spring block system is submerged in water vessel. Total mass of water in vessel is $300gm$ and in equilibrium the block is at a height 40 cm above the bottom of vessel. The specific heat of material of block is $250J/kg/k$ and that of water is $4200J/kg/k$. Neglect the heat capacities of vessel and the spring. If the support is broken the rise in temperature of water, when block reaches botton of vessel is

A. $0.0012^\circ C$

B. $0.0049^\circ C$

C. $0.0028^{\circ} C$

D. $0.0^{\circ} C$

Answer: B

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17. One mole of Argon undergoes a process given by $PV^{3/2}$= const. If heat obtained by gas is Q and molar specific of the following in the process is C then which of the following is correct if temperature of gas changes by $-26K$ (assusme Argon as an ideal gas)

A. $C = 0.5R, Q = 13R$

B. $C = -0.5R, Q = 1.3R$

C. $C = -0.5R, Q = 13R$

D. $C = 0, Q = 13R$

Answer: C

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18. 2kg of ice at $20^{\circ}C$ is mixed with 5kg of water at $20^{\circ}C$ in an insulating vessel having a negligible heat capacity. Calculate the final mass of water remaining in the container. It is given that the specific heats of water & ice are $1kcal/kg/^{\circ}C$ and 0.5

$kcal/kg/^{\circ}C$ while the latent heat of fusion of ice is $80kcal/kg$

A. $7kg$

B. $6kg$

C. $4kg$

D. $2kg$

Answer: B

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19. Steam at $100^{\circ}C$ is passed into 1.1 kg of water contained in a calorimeter of water equivalent 0.02 kg at $15^{\circ}C$till the temperature of the calorimeter and its contents rises to $80^{\circ}C$. The mass of the steam condensed in kilogram is

A. 0.130

B. 0.065

C. 0.260

D. 0.135

Answer: A

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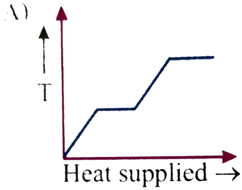
20. A block of ice at $-10^{\circ}C$ is slowly heated and converted to steam at $100^{\circ}C$. Which of the following curves represents the phenomenon qualitatively?

A. 

B. `##NAR_PHY_XI_V06_C02_E01_020_O02.png" width="30%">

C. `##NAR_PHY_XI_V06_C02_E01_020_O03.png" width="30%">

D. `##NAR_PHY_XI_V06_C02_E01_020_O04.png" width="30%">

Answer: A

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21. Pressure P, Volume V and temperature T of a certain material are related by the $P = \frac{\alpha T^2}{V}$. Here α is constant. Work done by the material when temparature changes from T_0 to $2T_0$ while pressure remains constant is :

A. $6\alpha T_0^3$

B. $\frac{3}{2}\alpha T_0^3$

C. $2\alpha T_0^2$

D. $3\alpha T_0^2$

Answer: D

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22. A closed container of volume $0.02m^3$contains a mixture of neon and argon gases, at a temperature of $27^\circ C$ and pressure of $1 \times 10^5 Nm^{-2}$. The total mass of the mixture is 28g. If the molar masses of neon and argon are 20 and $40gmol^{-1}$ respectively, find the masses of the individual gasses in the container assuming them to be ideal (Universal gas constant $R = 8.314J/mol - K$).

A. $4g, 24g$

B. $8g, 20g$

C. $12, 16g$

D. $6g, 22g$

Answer: A

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23. 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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24. 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. $PV =$ constant

B. $P/V =$ constant

C. $V/P =$ constant

D. $PV^2 =$ constant

Answer: B

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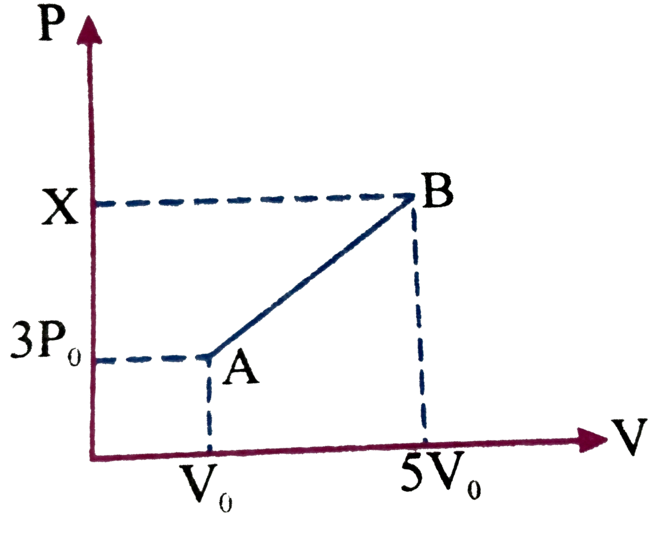
25. One mole of monoatomic ideal gas follows a proces AB, as shown. The specific heat of the process is $\frac{13R}{6}$. Find the value of x on P-axis.



A. $4P_0$

B. $5P_0$

C. $6P_0$

D. $8P_0$

Answer: C

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26. N moles of an ideal diatomic gas is contained in a cylinder at temparature T. On supplying some heat to cylinder, $\frac{N}{3}$ moles of gas dissociated into atoms while temparature remaind constant. Heat supplied to the gas is

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

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

C. $\frac{8NRT}{3}$

D. $\frac{NRT}{6}$

Answer: D

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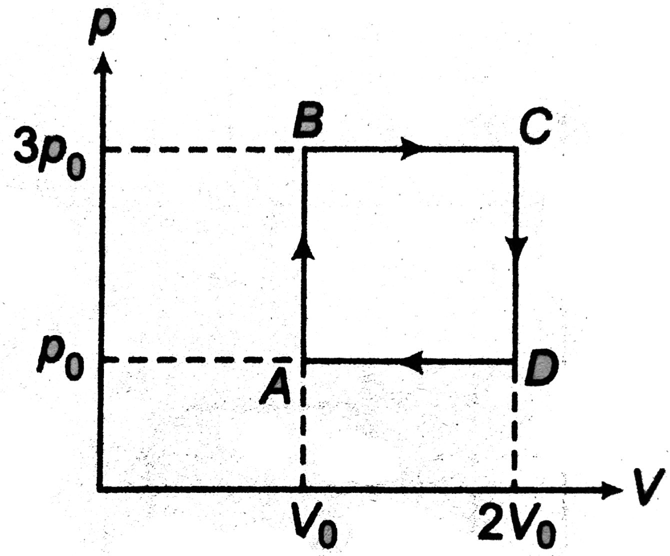
27. An ideal monoatomic gas is carried around the cycle ABCDA as shown in the figure. The efficiency of the gas cycle is



A. $\frac{4}{21}$

B. $\frac{2}{21}$

C. $\frac{4}{31}$

D. $\frac{2}{31}$

Answer: A

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28. 5.6 liter of helium gas at STP is adiabatically compressed to 0.7 liter. Taking the initial temperature to be T_1, the work done in the process is

A. $\frac{9}{8}RT_1$

B. $\frac{3}{2}RT_1$

C. $\frac{15}{8}RT_1$

D. $\frac{9}{2}RT_1$

Answer: A

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29. Two moles of ideal helium gas are in a rubber balloon at $30^\circ C$. The balloon is fully expandable and can be assumed to require no energy in its expansion. The temperature of the gas in the balloon is slowly changed to $35^\circ C$. The amount of heat required in raising the temperature is nearly (take R

$= 8.31 J / mol. K$)

A. $62J$

B. $104J$

C. $124J$

D. $208J$

Answer: D

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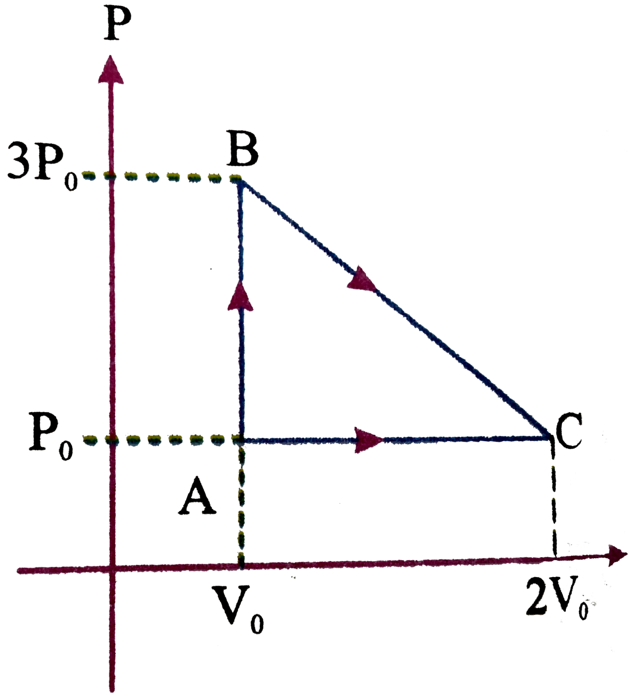
30. One mole of an ideal monoatomic gas is taken round the cylic process $ABCA$ as shown Then



A. Work done by the gas $P_0 V_0$

B. Heat rejected in the process CA is $\frac{5P_0V_0}{2}$ and absorbed in the process AB is $3P_0V_0$

C. Heat absorbed in the process BC is $\frac{P_0V_0}{2}$

D. $\frac{25}{8}\frac{P_0V_0}{R}$ is the maximu temperature attained by the gas during the cycle

Answer: A::B::C

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31. Molar heat capacity of an ideal gas varies as $C = C_v + \alpha T, C = C_v + \beta V$

and $C = C_v + ap$, where α, β and a are constant. For an ideal gas in terms of the variables T and V.

A. $Ve^{(\alpha T/R)} = const$

B. $T. e^{(R/\beta V)} = const$

C. $V = anT$

D. $Va = nT$

Answer: A::B::C

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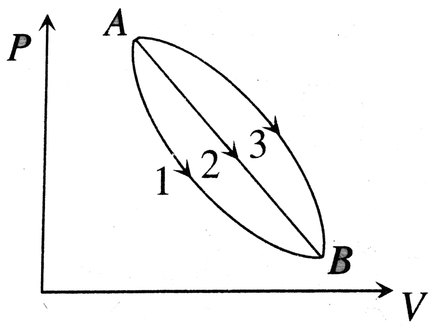
32. An ideal gas of mass m in a state A goes to another state B via three different processes as shown in Fig. If Q_1, Q_2 and Q_3 denote the heat absorbed by the gas along the three paths, then



A. Change in internal energy in all the three paths is equal.

B. In all the three paths heat is absorbed by the gas.

C. Heat absorbed/released by the gas is maximum in path (1).

D. Temperature ot the gas first increases and then decreases continously in path (1).

Answer: A::B::C

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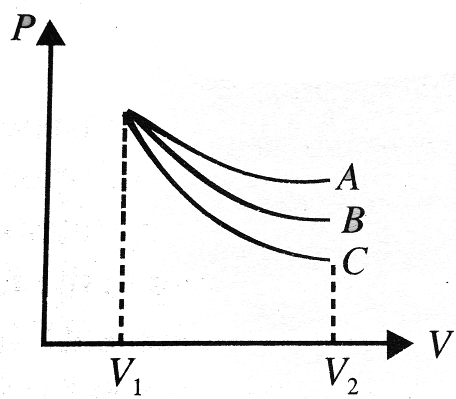
33. An ideal gas undergoes an expansion from a state with temperature T_1 and volume V_1 through three different polytropic processes A, B and C as shown in the $P - V$ diagram. If $|\Delta E_A|$, $|\Delta E_B|$ and $|\Delta E_C|$ be the magnitude of changes in internal energy along the three paths respectively, then :



A. $|\Delta E_A| < |\Delta E_B| < |\Delta E_C|$ if temperature in every process decreases

B. $|\Delta E_A| > |\Delta E_B| > |\Delta E_C|$ if temperature in every process decreases

C. $|\Delta E_A| > |\Delta E_B| > |\Delta E_C|$ if temperature in every process increases

D. $|\Delta E_B| < |\Delta E_A| < |\Delta E_C|$ if temperature in every process increases

Answer: A::C

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34. Select the correct alternatives for an ideal gas :

A. The change in internal energy un a constant pressure process from temperature $T_1 \rightarrow T_2$ is equal to $nC_v(T_2 - T_1), whereC_v$ is the molar specific heat at constant volume and n the number of moles of the gas.

B. The change in internal energy of the gas and the work done by the gas are equal in magnitude in an adiabatic process.

C. The internal energy dose not change in an isothermal process.

D. No heat is added or removed in an asiabatic process.

Answer: A::B::C::D

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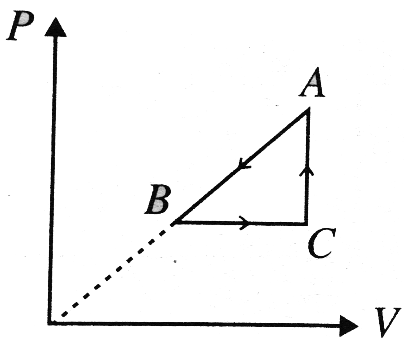
35. $P - V$ diagram of a cyclic process $ABCA$ is as shown in Fig. Choose the correct alternative



A. $\Delta Q_A \rightarrow_B$ is negative

B. $\Delta U_B \rightarrow_C$ is positive

C. $\Delta U_{C} \rightarrow_{A}$ is negative

D. ΔW_{CAB} is negative

Answer: A::B::D

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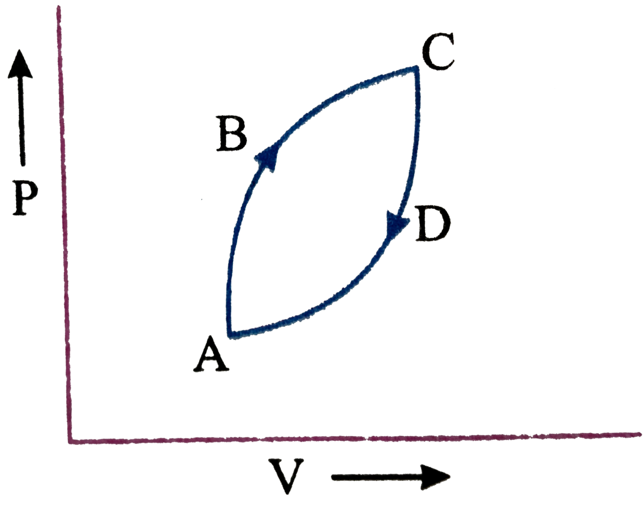
36. Figure shows the $P - V$ siagram of a cyclic process. If dQ is the heat energy supplied to the system, dU is change in the internal energy of the system and dW is the work done by the system, then which of the following relations is/are correct



A. $dQ = dU - dW$

B. $dU = 0$

C. $dQ = dW$

D. $dQ = -dW$

Answer: B::C

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37. Two gases have the same initial pressure, volume and temperature. They expand to the same final volume, one adiabatically and the other isothermally

A. the final temperature is greater for the isothermal process

B. the final pressure is greater for the isothermal process

C. the work done by the gas in greater for the isothermal process

D. all the above options are incorrect

Answer: A::B::C

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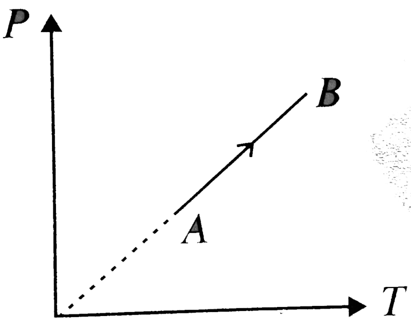
38. During the process AB of an ideal gas



A. work done on the gas Is zero

B. density of the gas is constant

C. slope of line $AB$from the T-axis is inversely proportional to the number of moles of the gas

D. slope of line AB form the T-axis is directy proportional to the number of moles of the gas.

Answer: A::B::D

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39. 1 kg of ice at $0^{\circ} C$ is mixed with 1.5 kg of water at $45^{\circ} C$ [latent heat of fusion = 80 cal//gl. Then

A. the temperature of the mixture is $0_{\circ} C$

B. mixture contains 156.25 g of ice

C. mixture contains 843.75 g of ice

D. the temperature of the mixture is $15^{\circ} C$.

Answer: A::B

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40. In a thermodynamic process helium gas obeys the law $TP^{2/5}$ = constant,If temperature of 2 moles of the gas is raised from T to $3T$, then

A. heat given to the gas is $9RT$

B. heat given to the is zero

C. increase in internal energy is $6RT$

D. work done by the gas is $-6RT$.

Answer: B::C::D

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41. A gas is found to obey the law P^2V= constant. The initial temperature and volume are T_0 and V_{0° If the gas expands to a volume $3V_0$, then

A. final temperature become $\sqrt{3}T_0$

B. internal energy of the gas will increase

C. final temperature becomes $\frac{T_0}{\sqrt{3}}$

D. internal energy of the gas decrease.

Answer: A::B

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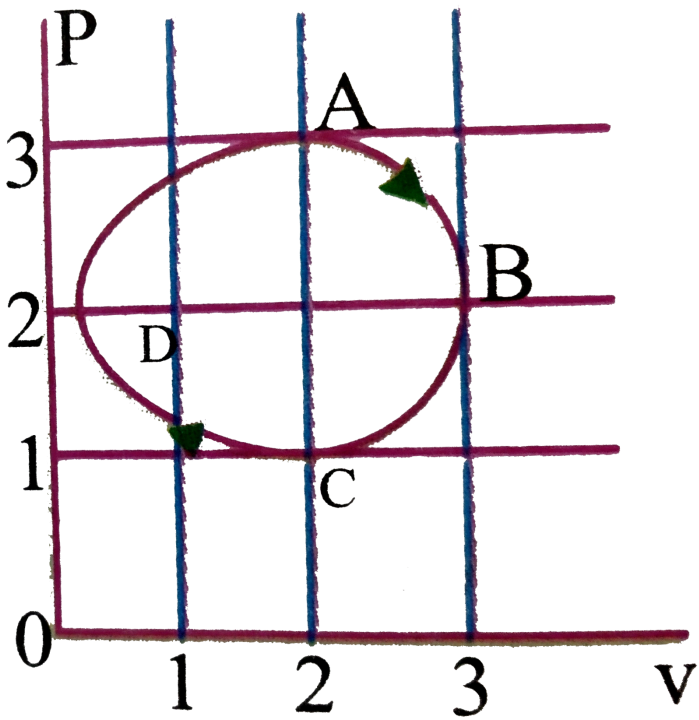
42. The figure shows the $P-V$ plot of an ideal gas taken through a cycle $ABCDA$. The part ABC is a semi-circle and CDA is half of an ellipseThen



A. The process during the path $A \rightarrow B$ is isthermal

B. Heat flows out of the gas during then path $B \rightarrow C \rightarrow D$

C. Work done during the path $A \rightarrow B \rightarrow C$ is zero

D. Positive work is done by the gas in cycle $ABCDA$

Answer: B::D

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43. C_v and C_p denote the molar specific heat capacities of a gas at constant volume and constant pressure, respectively. Then

A. $C_P - C_V$ is larger for a diatomic edeal gas then for a monoatomic ideal gas

B. $C_P + C_V$ is larger for a diatomic ideal gas then for a monoatomic ideal gas

C. $C_P / C_V$is larger for a diatomic ideal gas then for a monoatomic ideal gas

D. $C_P . C_V$is larger for a diatomic ideal gas then for a monoatomic ideal gas

Answer: B::D

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44. An ideal gas is taken from the state A (pressure p, volume V) to the state B (pressure $\frac{p}{2}$, volume 2V) along a straight line path in the p-V diagram. Select the correct statement(s) from the following.

A. The work done by the gas in the process $A \rightarrow B$ exceeds the work that would be done by it if the system were taken from $A \rightarrow B$ along an isotherm

B. In $T - V$ diagram, the path AB becomes a part of a parabola

C. In $P - T$ diagram, path AB becomes a part of a hyperbola

D. In going from $A \rightarrow B$, the temeparature T of the firsrt increases to a maximum value and then decrases

Answer: A::B::C

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45. During the melting of a slab of ice at 273K at atmospheric pressure,

A. positive work is done by ice-water system on the atmosphere

B. positive work is done on ice-water system by the atmosphere

C. the internal energy of the ice-water system increases

D. the internal energy of the ice-water system decreases

Answer: B::C

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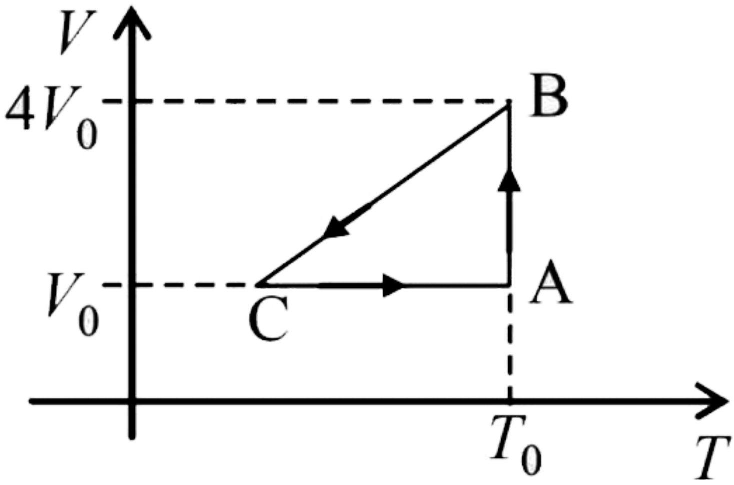
46. One mole of an ideal gas in initial state A undergoes a cyclic process ABCA, as shown in the figure. Its pressure at A is P_0. Choose the correct option (s) from the following



A. internal energies at A and B are the same

B. work done by the gas in process AB is $P_0V_0 \ln 4$

C. pressure at C is $\frac{P_0}{4}$

D. temperature at C is $\frac{T_0}{4}$

Answer: A::B::C::D

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47. A closed and isolated cylinder contains ideal gas. An adiabatic separator of mass m, cross sectional area A divides the cylinder into two equal parts each with volume V_0 and pressure P_0 in equilibrium Assume the sepatator to move without friction.

If the piston is slightly displaced by x, the net force acting on the piston is

A. $\dfrac{P_0 \gamma A^2 x}{V_0}$

B. $\dfrac{2P_0 \gamma A^2 x}{V_0}$

C. $\dfrac{3P_0 \gamma A^2 x}{V_0}$

D. $\dfrac{P_0 \gamma A^2 x}{(\gamma - 1)V_0}$

Answer: B

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48. A closed and isolated cylinder contains ideal gas. An adiabatic separator of mass m, cross sectional area A divides the cylinder into two equal parts each with volume V_0 and pressure P_0 in equilibrium Assume the sepatator to move without friction.

Identify the correct statement

A. The process is adiabatic only when the piston is displaced suddenly

B. The process is isothermal when the piston is moved slowly

C. The motion is periodic for any displacement of the piston

D. The motion is SHM for any displacement of the piston

Answer: A,B,D

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49. A closed and isolated cylinder contains ideal gas. An adiabatic separator of mass m, cross sectional area A divides the cylinder into two equal parts each with volume V_0 and pressure P_0 in equilibrium Assume the sepatator to move without friction.

The time period of oscillation for small displacements of the piston is

A. $2\pi\sqrt{\frac{mV_0}{2P_0\gamma A^2}}$

B. $2\pi\sqrt{\frac{mV_0}{4P_0\gamma A^2}}$

C. $2\pi\sqrt{\frac{mV_0(\gamma-1)}{2P_0\gamma A^2}}$

D. none of these

Answer: A

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50. A calorimeter of mass m contains an equal mass of water in it. The temperature of the water and clorimeter is t_2. A block of ice of mass m and temperature $t_3 < 0^\circ C$ is gently dropped into the calorimeter. Let C_1, C_2 and C_3 be the specific heats of calorimeter, water and ice respectively and L be the latent heat of ice.

The whole maxture in the calorimeter becomes ice if

A. $C_1t_2 + C_2t_2 + L + C_3t_3 > 0$

B. $C_1t_2 + C_2t_2 + L + C_3t_3 < 0$

C. $C_1t_2 + C_2t_2 - L - C_3t_3 > 0$

D. $C_1t_2 + C_2t_2 - L - C_3t_3 < 0$

Answer: B

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51. A calorimeter of mass m contains an equal mass of water in it. The temperature of the water and clorimeter is t_2. A block of ice of mass m and temperature $t_3 < 0^\circ C$ is gently dropped into the calorimeter. Let C_1, C_2 and C_3 be the specific heats of calorimeter, water and ice respectively and L be the latent heat of ice.

The whole mixture in the calorimeter becomes water if

A. $(C_1 + C_2)t_2 - C_3t_3 + L > 0$

B. $(C_1 + C_2)t_2 + C_3t_3 + L > 0$

C. $(C_1 + C_2)t_2 - C_3t_3 - L > 0$

D. $(C_1 + C_2)t_2 + C_3t_3 - L > 0$

Answer: D

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52. A calorimeter of mass m contains an equal mass of water in it. The temperature of the water and clorimeter is t_2. A block of ice of mass m and temperature $t_3 < 0^\circ C$ is gently dropped into the calorimeter. Let C_1, C_2 and C_3 be the specific heats of calorimeter, water and ice respectively and L be the latent heat of ice.

Water equivalent of calorimeter is

A. mC_1

B. $\frac{mC_1}{C_2}$

C. $\frac{mC_2}{C_1}$

D. None of these

Answer: B

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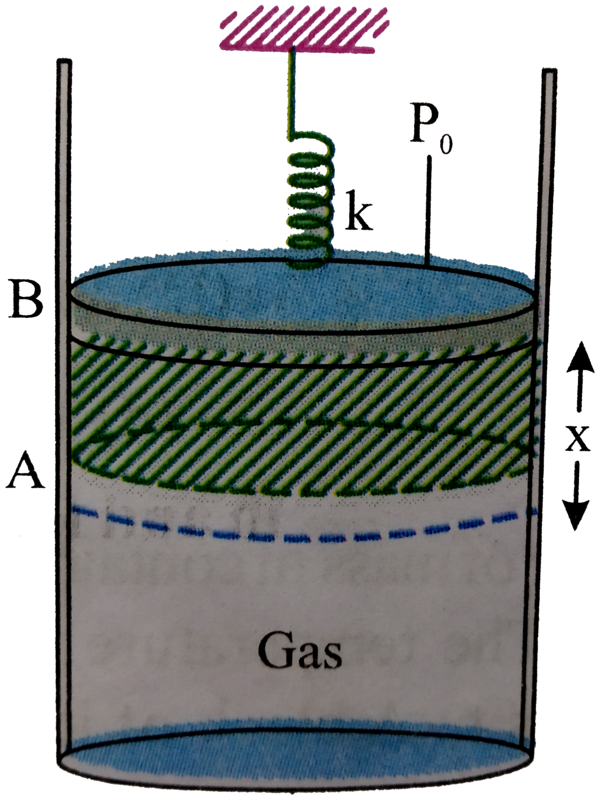
53. Two mole of an ideal monatomic gas are confined within a cylinder by a mass less spring loaded with a frictionless piston of negligible mass and crossectional area $4 \times 10^{-3} m^2$. The gas is heated by a heater for some time. During this time the gas expands and does $50 J$ of work in moving the piston through a distance of 0.01m. The temperature of gas increases by 50k.



The force constant of spring is

A. $189.6 Nm^{-1}$

B. $18.96 Nm^{-1}$

C. $1896 Nm^{-1}$

D. $2896 Nm^{-1}$

Answer: C

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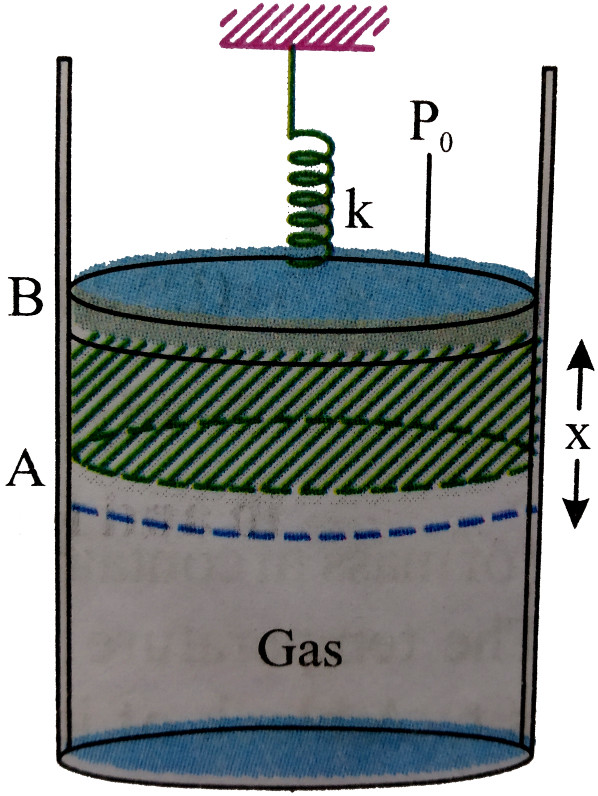
54. Two mole of an ideal monatomic gas are confined within a cylinder by a mass less spring loaded with a frictionless piston of negligible mass and crossectional area $4 \times 10^{-3} m^2$. The gas is heated by a heater for some time. During this time the gas expands and does $50 J$ of work in moving the piston through a distance of 0.01m. The temperature of gas increases by 50k.



Change in internal energy of the gas is

A. $1246.5J$

B. $124.65J$

C. $200J$

D. $12.46J$

Answer: A

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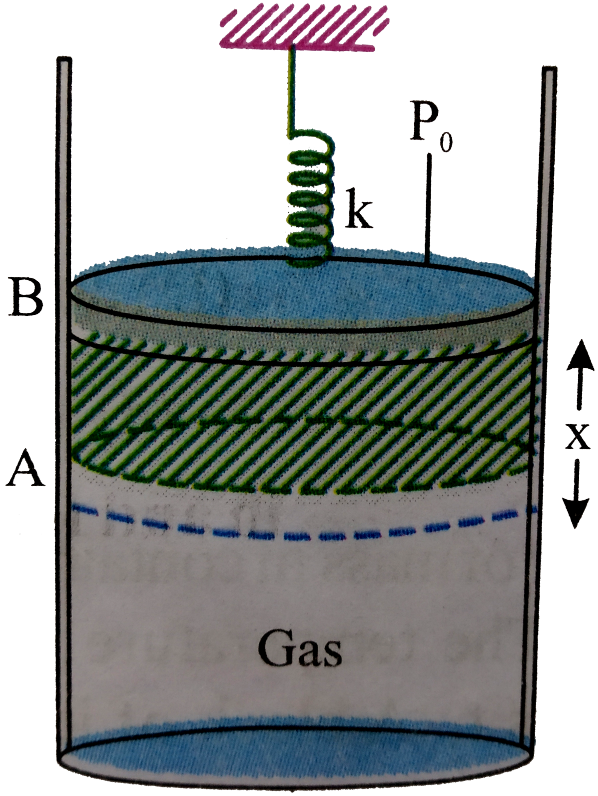
55. Two mole of an ideal monatomic gas are confined within a cylinder by a mass less spring loaded with a frictionless piston of negligible mass and crossectional area $4 \times 10^{-3} m^2$. The gas is heated by a heater for some time. During this time the gas expands and does $50J$ of work in moving the piston through a distance of 0.01m. The temperature of gas increases by 50k.



Heat supplied by heater during this process is

A. $129.65 J$

B. $1296.5 J$

C. $12.96 J$

D. $250 J$

Answer: B

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56. A mercury barometer is defective. When an accurate barometer reads 770 mn, the defective one reads 760 mn. When the accurate one reads 750 mn, the defective one reads 742 mn. Then

The length of air coloumn when accurate barometer reads 770mm is

A. $76mm$

B. $74mm$

C. $72mm$

D. $70mm$

Answer: C

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57. A mercury barometer is defective. When an accurate barometer reads 770 mn, the defective one reads 760 mn. When the accurate one reads 750 mn, the defective one reads 742 mn. Then

The reading of the accurate barometer, when defective are reads 752mm is

A. $760mm$

B. $764mm$

C. $758mm$

D. $761mm$

Answer: D

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58. $A50$ gm lead bullet $(sp. Heat0.020cal/g)$ is initially at $30^{\circ}C$. It is fired vertically upward with a speed $84m/s$ On returning to the starting level, it strikes a slab of ice at $0^{\circ} C$. $(A \times 100)$ mg of ice is melted. Find the value of $'A'$.

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59. An ideal gas $\left(\frac{C_p}{C_v} = \gamma\right)$ is taken through a process in which the pressure and volume vary as $\left(p = aV^b\right)$. Find the value of b for which the specific heat capacity in the process is zero.

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60. A Vessel contains helium, which expands at constant pressure when 15 kJ of heat is supplied to it. What will be the variation of the internal energy of the gas? What is the work performed in the expansion?

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61. When a quantity of liquid bismuth at its melting point is transferred to a calorimeter containimg oil, then the temerature of oil rises from $12.5^\circ C \rightarrow 27.6^\circ$. The expeiment is repeated under identical condition except that bismuth is solid, the temperature of the oil reses to $18.1^\circ C$. The specific heat of bismuth is $0.032 cal / g' C$ The latent heat of fusion of bismuth is $6.7 Kcal / g$ .Then determine the value of $K1$ Melting point of bismuth is $271^\circ C$.

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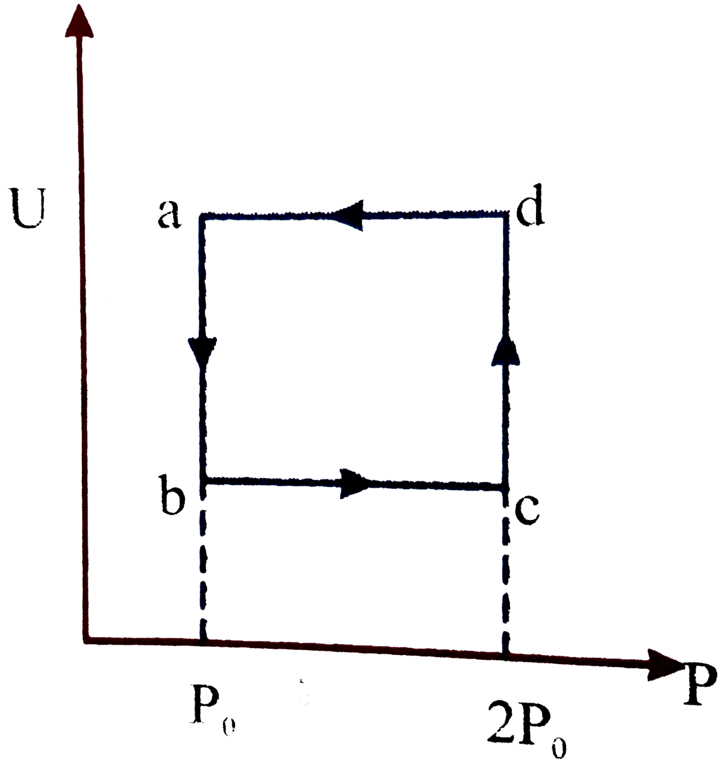
62. Figure shows the variation of internal energy (U) with the pressure (P) of 2.0 mole gas in cyclic process abcda.The temperature of gas at c and d are 300 and $500 K$ respectively. The heat absorbed by the gas during the process is $X \times 10R\ln 2$. Find the value of x.



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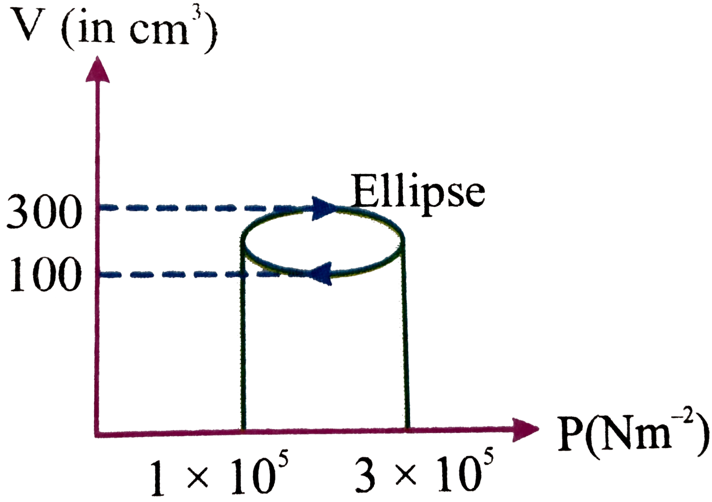
63. The heat absorbed by a system in going through the cyclic process shown shown in Fig is $\times x5\pi J$. Find the valur of x.



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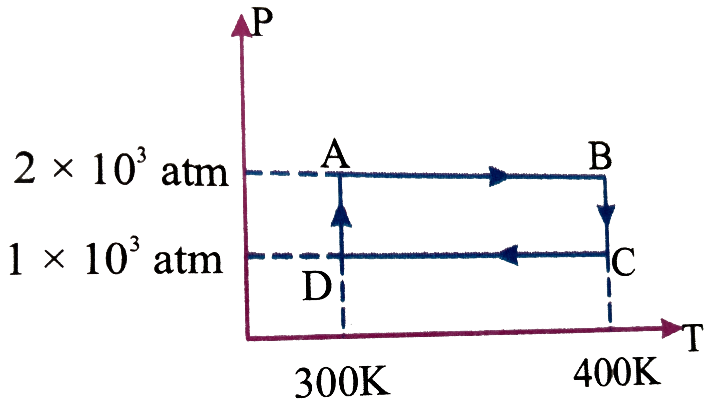
64. $1/R(R\text{is universal gas constant})$ moles of an ideal gas $(\gamma = 1.5)$ undergoes a cyclic process $(ABCDA)$ as shown in figure. Assuming the gas to be ideal. If the net heat exchange is $10x$ Joules, find the value of x ?

$[In2 = 0.7]$



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65. A metal rod AB of length 10x has its one end A in ice at $0^\circ C$, and the other end B in water at $100^\circ C$. If a point P one the rod is maintained at $400^\circ C$, then it is found that equal amounts of water and ice evaporate and melt per unit time. The latent heat of evaporation of water is $540cal/g$ and latent heat of melting of ice is $80cal/g$. If the point P is at a distance of λx from the ice end A, find the value λ. [Neglect any heat loss to the surrounding.]

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66. An ideal diatomic gas under goes a process in which its internal energy chnges with volume as given $U = cV^{2/5}$ where c is constant. Find the ratio of molar heat capacity to universal gas constant R ?

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67. An ideal gas is taken through a cyclic thermodynamic process through four steps. The amount of heat involved in four steps are $Q_1 = 6000J, Q_2 = -5000J, Q_3 = 5000J$ and $Q_4 = 4000J$ and $W = 200$ respectively. If efficincy of cycle is $10x\%$ then find value of x?

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68. A piece of ice (heat capacity $= 2100 Jkg^{-1}.^{\circ}C^{-1}$ and latent heat $= 3.36 \times 10^5 Jkg^{-1}$) of mass m grams is at $-5.^{\circ}C$ at atmospheric pressure. It is given 420 J of heat so that the ice starts melting. Finally when the ice . Water mixture is in equilibrium, it is found that 1 gm of ice has melted. Assuming there is no other heat exchange in the process, the value of m in gram is

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69. A diatomic ideal gas is compressed adiabatically to 1/32 of its initial volume. If the initial temperature of the gas is T_i (in Kelvin) and the final temperature is a T_i, the value of a is

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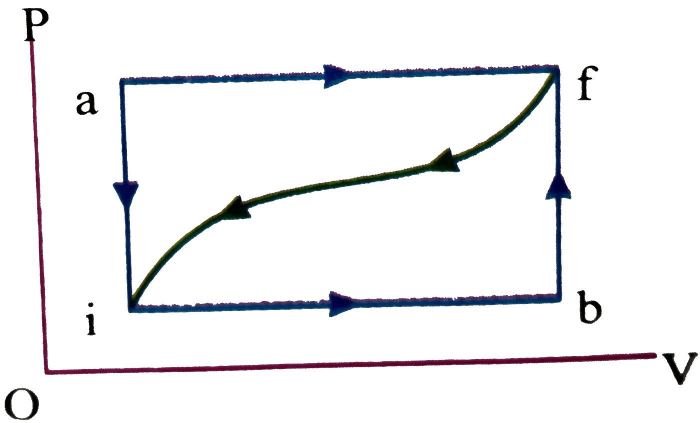
70. When a system is taken from state i to state f alone the path iaf, it is found that $Q = 50$ cal and $W = 20$ cal. Along the path ibf, $Q = 36$ cal (figure) (a) What is W along the path ibf ? (b) If $W = -13$ cal for the curved return path fi, what is Q for this path ? (c) Take $U_i = 10$ cal. What is U_f? (d) If $U_b = 22$ cal, what is Q for the process in and for the process bf ?



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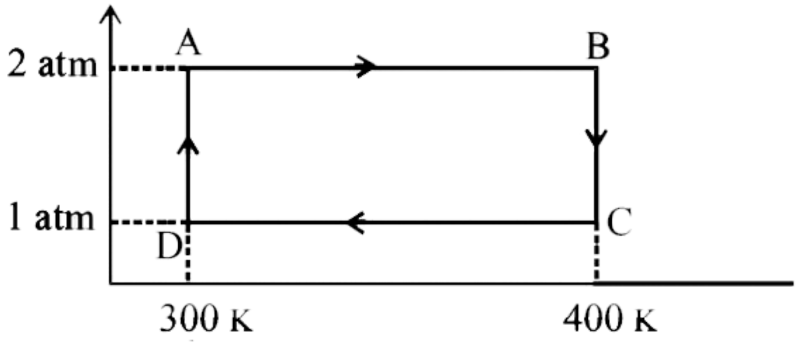
71. Two moles of helium gas undergo a cyclic process as shown in Fig. Assuming the gas to be ideal, calculate the following quantities in this process



(a) The net change in the heat energy

(b) The net work done

(c) The net change in internal energy

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72. In a insulated vessel, 0.05 kg steam at 373 K and 0.45 kg of ice at 253 K are mixed. Find the final temperature of the mixture (in kelvin.)

Given, $L_{fusion} = 80cal/g = 336J/g$

$L_{\text{vaporization}} = 540cal/g = 2268J/g$

$s_{ice} = 2100J/kg.\,K = 0.5cal/g.\,K$

and $s_{\text{water}} = 4200J/kg.\,K = 1cal/g.\,K$.

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73. An ice cube of mass 0.1 kg at $0^\circ C$ is placed in an isolated container which is at $227^\circ C$. The specific heat s of the container varies with temperature T according to the empirical relation $s = A + BT$, where $A = 100 cal / kg. K$ and $B = 2 \times 10^{-2} cal / kg. K^2$. If the final temperature of the container is $27^\circ C$, determine the mass of the container.

(Latent heat of fusion for water = $8 \times 10^4 cal / kg$, specific heat of water $= 10^3 cal / kg. K$).

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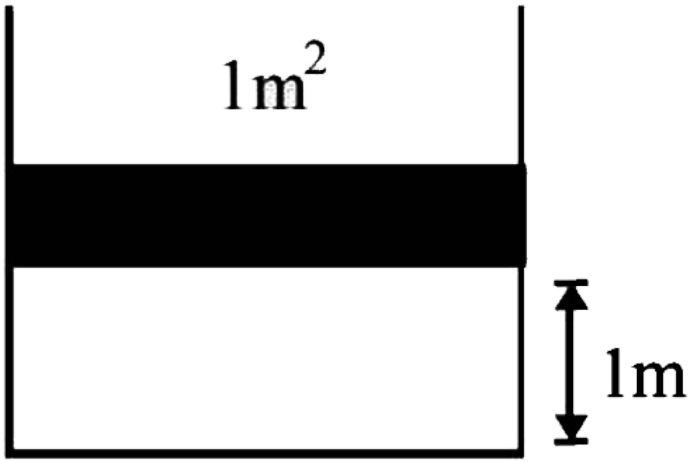
74. A diatomic gas is enclosed in a vessel fitted with massless movable piston. Area of cross section of vessel is $1m^2$. Initial height of the piston is 1m (see the figure). The initial temperature of the gas is 300K. The temperature of the gas is increased to 400K, keeping pressure constant, calculate the new height of the piston. The piston is brought to its initial position with no heat exchange. Calculate the final temperature of the gas. You can leave answer in fraction.



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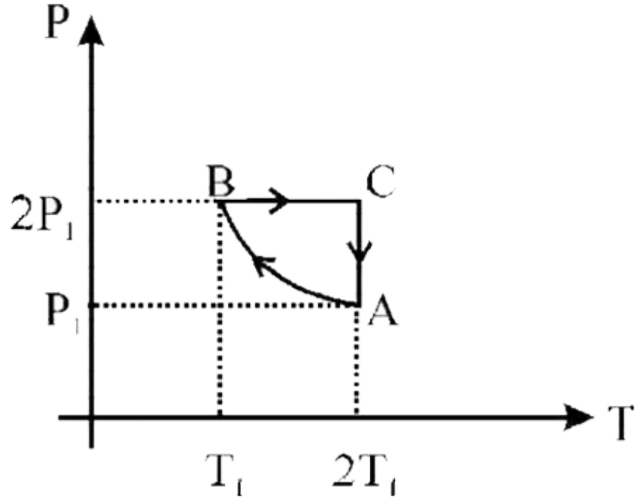
75. Two moles of an ideal monoatomic gas is taken through a cycle ABCA as shown in the P-T diagram. During the process AB , pressure and temperature of the gas very such that $PT = Constant$. It $T_1 = 300K$, calculate



(a) the work done on the gas in the process AB and

(b) the heat absorbed or released by the gas in each of the processes.

Give answer in terms of the gas constant R.

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76. Molar specific heat at constant volume for an ideal gas is given by $C_v = a + bT$ (a and b are constant), T is temperature in Kelvin, then equation for adiabatic process is ($R$is universal gas constant)

A. $T^a e^{bT} V^R$=constant

B. $T^R e^{bT} V^R$=constant

C. $T^{b}e^{aT}V^{R}$=constant

D. $T^{a}e^{R}V^{bT}$=constant

Answer: A

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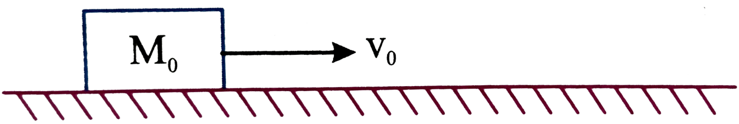
77. An ice cube of mass M_0 is given a velocity v_0 on a round horizontal surface with coefficient of friction μ. The block is at its melting point and latent heat of fusion of ice is L . The block receive heat only due to the friction forces and all work is converted into heat. Find the mass of the remaining ice block after time t.



A. $m = m_0 e^{-\frac{2\mu g}{L}\left(V_0 t + \frac{1}{2}\mu g t^2\right)}$

B. $m = m_0 e^{-\frac{2\mu}{L}\left(V_0 t - \frac{1}{2}\mu g t^2\right)}$

C. $m = m_0 e^{-\frac{3\mu}{L}\left(V_0 t - \frac{1}{2}\mu g t^2\right)}$

D. $m = m_0 e^{-\frac{2\mu}{L}\left(V_0 t - \mu g t^2\right)}$

Answer: B

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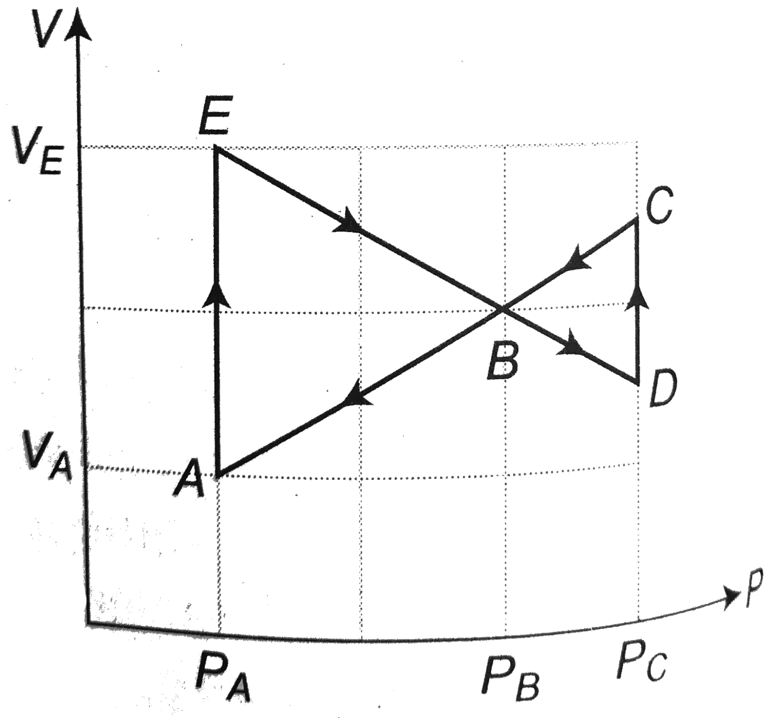
78. Figure shows a cyclic process $ABCDBEA$ performed on an ideal cycle. If $P_A = 2atm, P_B = 5atm$ and $P_6 = 6atm. V_E - V_A = 20\text{litre},$ find the work done by the gas in the complete, process (

$1 atm$. Pressure $= 1 \times 10^5 Pa$)



A. $4.67 kJ$

B. $3.67 kJ$

C. $2.67 kJ$

D. $1.67 kJ$

Answer: C

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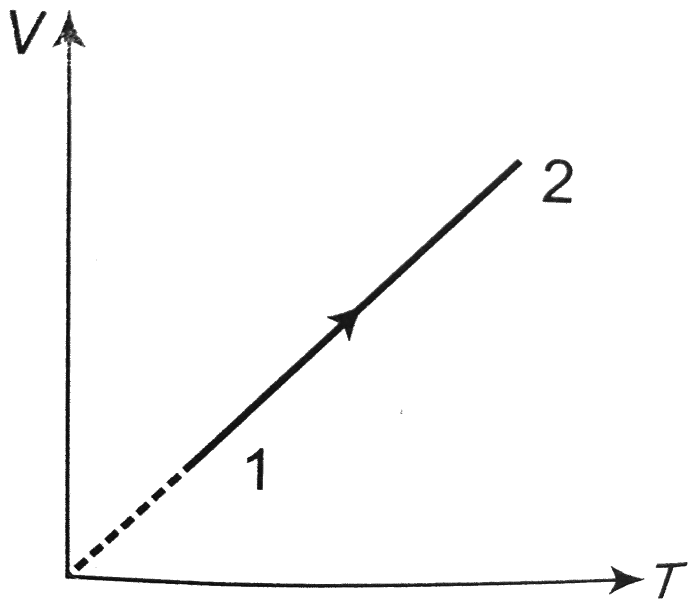
79. Volume versus temperature graph of two moles of helium gas is as shown in figure. The ratio of heat absorbed and the work done by the gas in process $1-2$ is



A. 3

B. $5/2$

C. $5/3$

D. $7/2$

Answer: B

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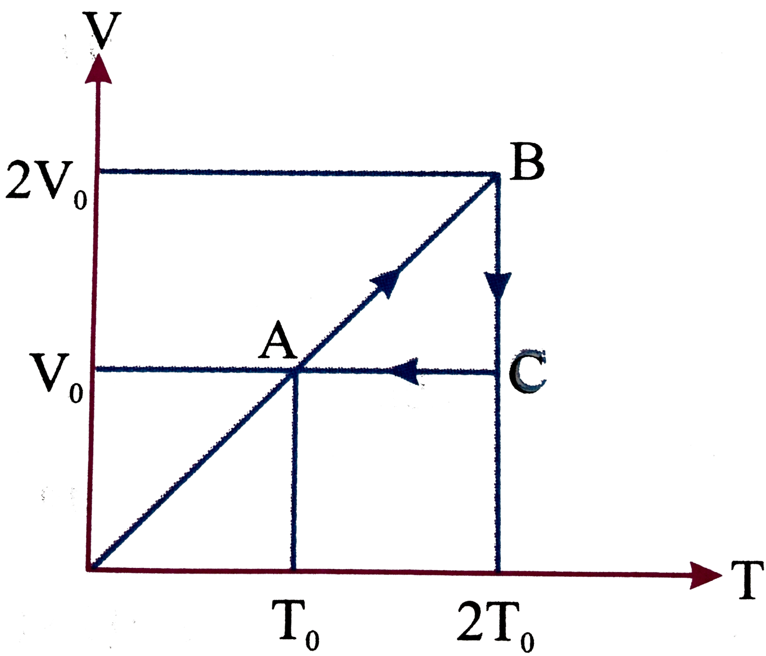
80. An ideal monoatomic gas undergoes a cyclic process $ABCA$ as shown in the figure. The ratio of heat absorbed during AB to the work done on the gas during BC id



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

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

C. $\frac{5}{4\ln 2}$

D. $\frac{5}{6}$

Answer: C

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81. A vessel of water eqivalent W kg contains m kg of water of specific heat S. When water evaporates at the vessel and water of $\alpha kg S^{-1}$, the temprature of the vessel and water and in it falls from $T_1^\circ C$ to T_2° in t s. If $m > > \alpha$ t and a fracrtion E of the heat vessel and the water then average rate of fall of temprature is

($L =$ average latent heat of vapourisation in Jkg^{-1})

A. $\frac{\in \alpha L}{ms + w}.^\circ C/S$

B. $\frac{\in \alpha}{L(ms + w)}.^\circ C/s$

C. $\frac{\in \alpha L}{w}.^\circ C/s$

D. $\frac{\in \alpha L}{ms} . ^{\circ} C / s$

Answer: A

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82. 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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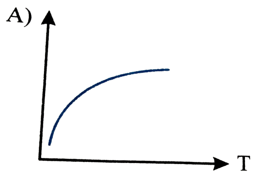
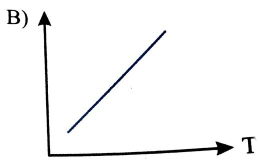
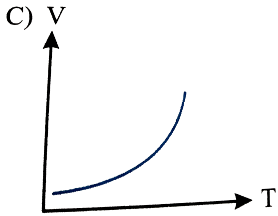
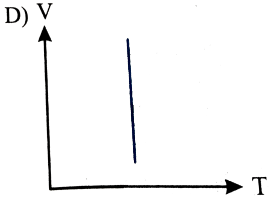
83. The work done by a cretain material when temprature changes from T_0 to $2T_0$ m while pressure remains constant is $3\beta T_0^2$ where β is a canstant. Draw curve between volume (V) and temeprature (T) of the material.

A. 

B. 

C. 

D. 

Answer: C

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84. An ideal gas is made to undergo a termodynamic process given by $V \propto T^2$, find the molar heat capacity of the gas for the above process.

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

B. $\frac{\gamma R}{(\gamma - 1)}$

C. $\left(\frac{2\gamma - 1}{\gamma - 1}\right)R$

D. $\left(\frac{2\gamma - 1}{\gamma + 1}\right)R$

Answer: C

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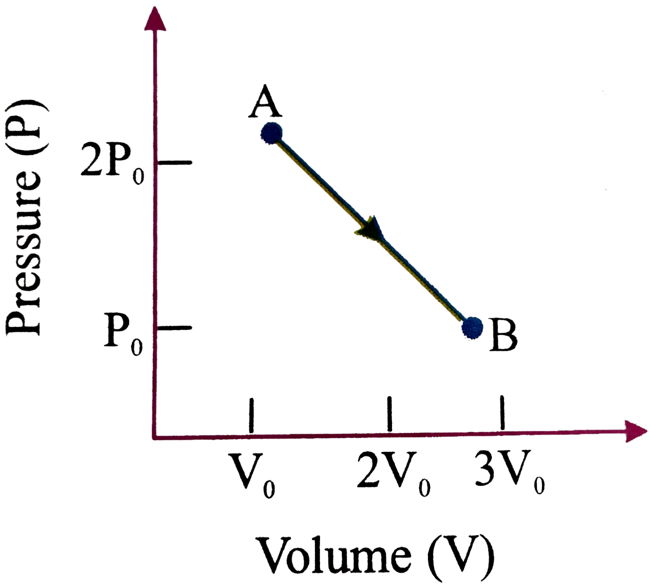
85. Determine the average molar heat capacity of an ideal gas under going a process shown in fig.



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

B. $\left(\frac{3\gamma-2}{\gamma-1}\right)R$

C. $\left(\frac{\gamma-2}{\gamma-4}\right)R$

D. $\left(\frac{\gamma+1}{\gamma-1}\right)R$

Answer: B

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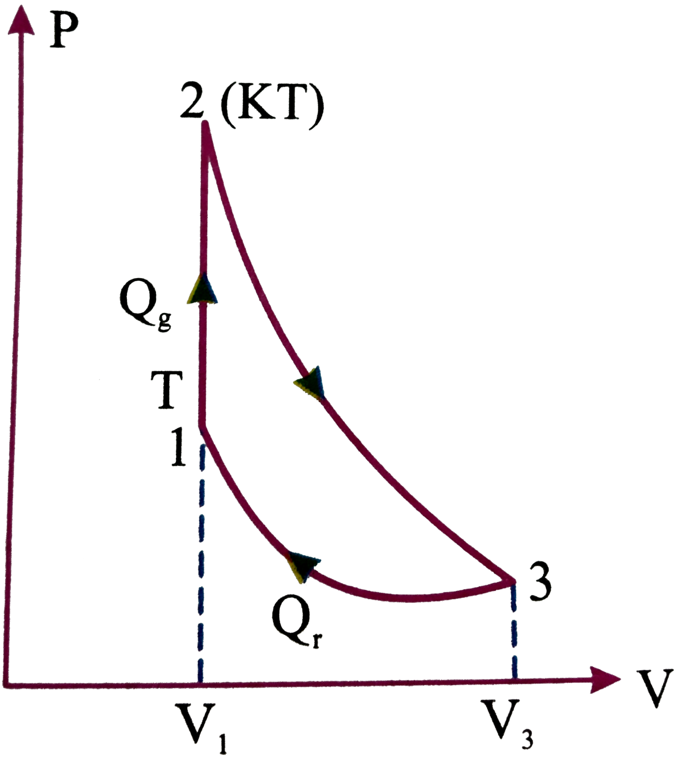
86. An ideal gas goes through a cycle consisting of ischoric adiabatic and isothermal lines. The isothermal process is perform at minimum temperature. If the absolute temperature varies K times with tn the cycle then find out its effcincy.



A. $1-\dfrac{\ln K}{l}$

B. $1+\dfrac{\ln K}{l}$

C. $\dfrac{\ln K}{l}$

D. $\frac{l}{\ln K}$

Answer: A

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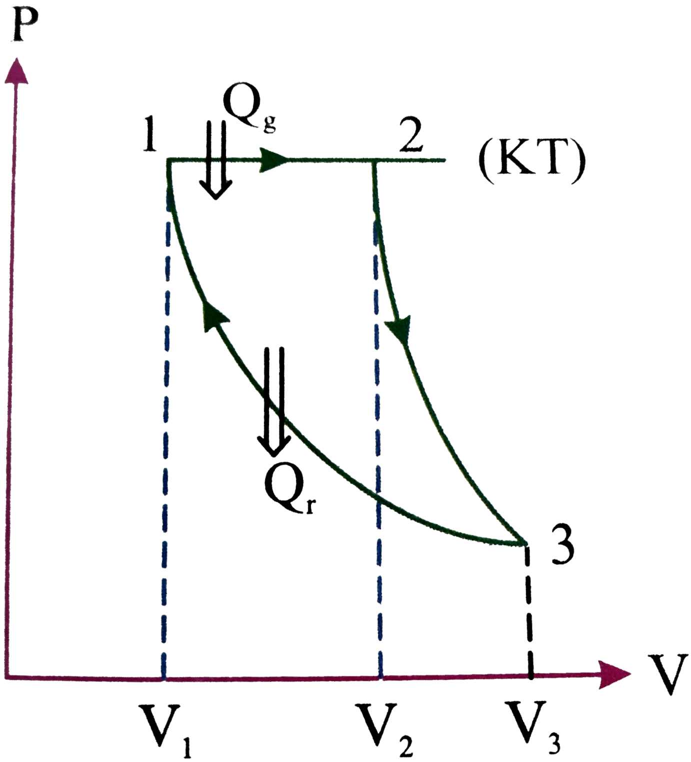
87. A cycle is made of three process is iso barie, adiabatic and isothermal. Isothermal process has minimum temperature. Absolute temperature charges by k times withing the cycle. Find out the efficiency.



A. $1-\frac{1nK}{(K-1)}$

B. $1+\frac{1nK}{(K-1)}$

C. $1+\frac{1nK}{(K+1)}$

D. none of these

Answer: A

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88. A calorimeter contains 4.00 kg of water at $20.0^{\circ} C$. What amount of ice at $-10^{\circ} C$, must be added to cause the resulting mixture to rach thermal equilibruim at $5.0^{\circ} C$. Asuume that heat transfer occurs only between the water and ice.

A. $0.55 kg$

B. $0.66 kg$

C. $2.51 kg$

D. $0.25 kg$

Answer: B

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89. A 0.50 kg ice cube at $-10^{\circ} C$ is placed in 3.0 kg of coffce at $20^{\circ} C$. What will be the final temperature of mixture? Assume that specifec heat of tea is same as that of water.

A. $5.1^{\circ} C$

B. $8^{\circ} C$

C. $10^{\circ} C$

D. $6^{\circ} C$

Answer: A

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90. A thermal insulated vessel contains some water at $0^{\circ} C$. The vessel is connected to a vaccum pump to pum out water vapour. This results in some water getting frozen. It is given latent heat of vaporization of water at $0^{\circ} C = 21 \times 10^{5} J / kg$ and latent heat of freezing of water $= 3.36 \times 10^{5} J / kg$. the maximum percentage amount of water vapour that will be solidified in this manner will be:

A. 12%

B. 18%

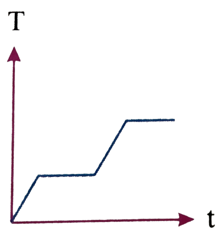
C. 88 %

D. 100 %

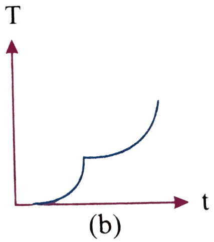
Answer: C

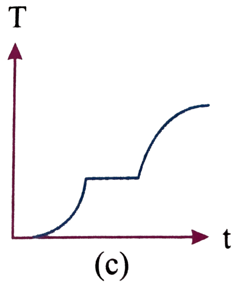
Watch Video Solution

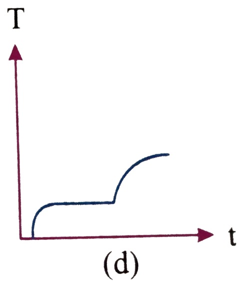
91. If specific heat capacity of a substance in solid and liquid is proportional to the temperature of substance, then temperature Vs time plot for the substance is best present by [Assume heat is supplied to substance at constant rate and initial temperature is less than melthing pint of substance.

A. 

(a)

B. 

C. 

D. 

Answer: D

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92. 450 g water at $40^\circ C$ was kept in a calorimeter of water equivalent $50g25giceat0^\circ C$ is added and simultaneously 5 g steam at $100^\circ C$ was passed to the calorimeter. The final temperature of the calorimeter. Will be

$(L_{ice} = 80 cal / g. L_{steam} = 540 cal / g)$

A. $0^\circ C$

B. $100^\circ C$

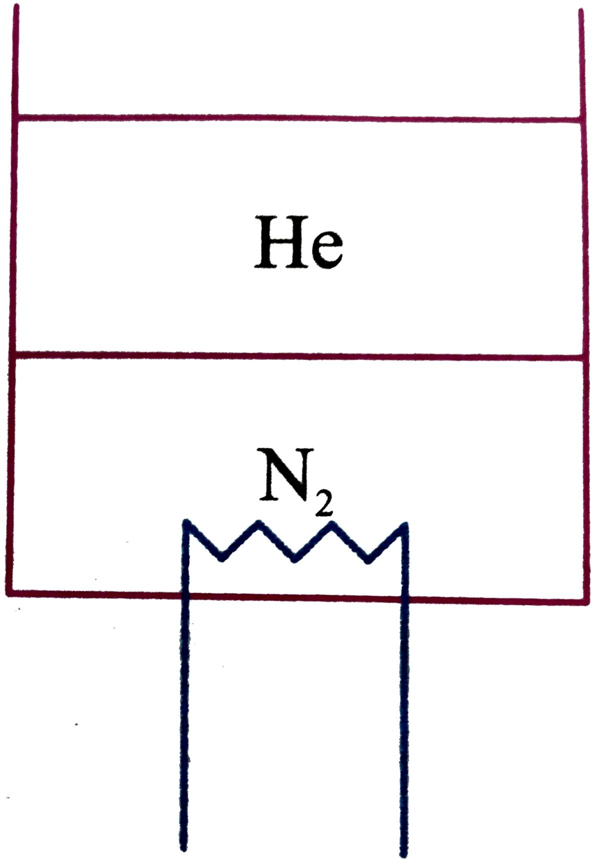
C. $40^\circ C$

D. none of these

Answer: C

Watch Video Solution

93. 5 moles of nitrogen gas are enclosed in an adiabatic cylindrical vessel. Thel piston itself is a rigid light cylindrical container containing 3 moles of helium gas. There is a heater which given out a power of 30 cal is transferred to helium through the batton surface of the piston. The rate of incremnt of temperature of the nitrogen gas assuming that the piston moves slowly, is



A. $2K/s$

B. $4K/s$

C. $6K/s$

D. $8K/s$

Answer: A

Watch Video Solution

94. When water is boiled at 2 atm pressure the latent heat of vapourization is $2.2 \times 10^6 J / kg$ and the boiling point is $120^\circ C$ At 2 atm pressure 1 kg of water has a volume of $10^{-3} m^{-3}$ and 1 kg of steam has volume of $0.824 m^3$. The increase in internal energy of 1 kg of water when it is converted into steam at 2 atm pressure and $120^\circ C$ is [1 atm pressure $= 1.013 \times 10^5 N / m^2$]

A. $2.033 J$

B. $2.033 \times 10^6 J$

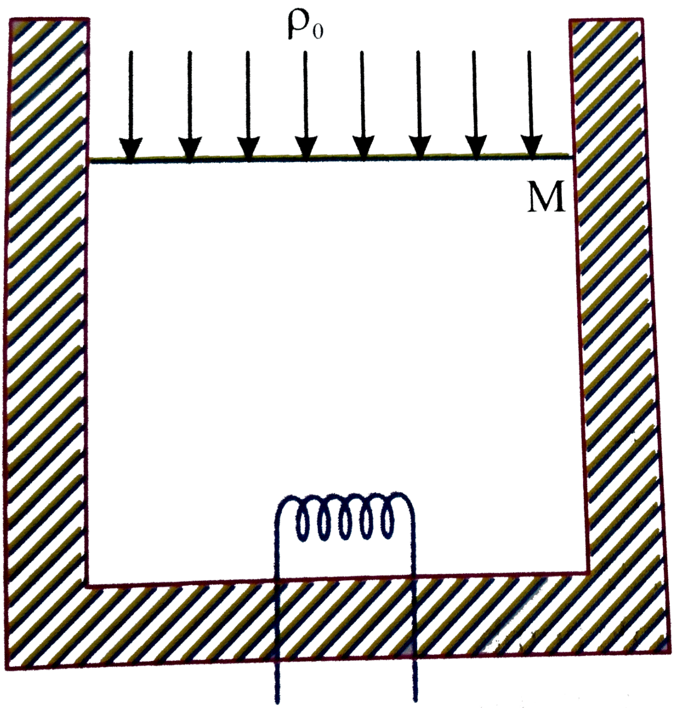
C. $0.167 \times 10^6 J$

D. $2.267 \times 10^6 J$

Answer: B

Watch Video Solution

95. A vertical cylinder of cross-section area A contains one mole of an ideal mono-atmic gas under a piston of mass M At a certain instant a heater which supplies heat at the rate q J/s is switched ON under the piston. The velocity with which the piston moves upward under the condition that pressure of gas remains constant is [Assume on heat transfer through walls of cylinder]



A. constant and equal to $\frac{2}{5} \times \frac{q}{p_0 A + Mg}$

B. constant and equal to $\frac{3}{5} \times \frac{q}{p_0 A + Mg}$

C. varying

D. constant but can't be determined from given information.

Answer: A

Watch Video Solution

96. A gas is enclosed in a cylinder with a movable frictionless piston. Its initial thermodynamic state at pressure $P_i = 10^5$ Pa and volume $V_i = 10^{-3} m^3$ changes to a final state at $P_f = (1/32) \times 10^5 Pa$ and $V_f = 8 \times 10^{-3} m^3$ in an adiabatic quasi-static process, such that $P^3 V^3 = cons\tan t$. Consider another thermodynamic process that brings the system form the same initial state to the same final state in two steps: an isobaric expansion at P_i followed by an isochoric (isovolumetric) process at volume V_r. The amount of heat supplied to the system i the two-step process is approximately

A. $122J$

B. $294J$

C. $588J$

D. $813J$

Answer: C

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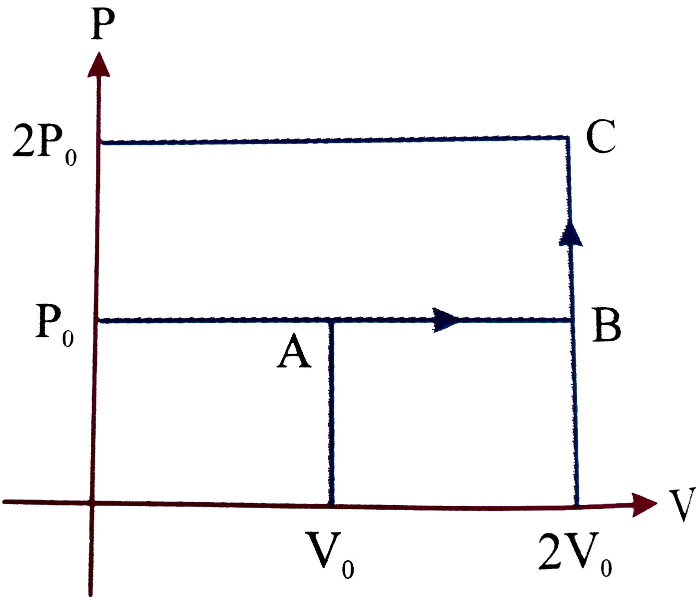
97. One mole of an ideal monoatomic gas is taken from A to C along the path ABC . The temperature of the gas at A is T_0 . For the process ABC

:



A. work done by the gas is RT_0

B. change in internal energy of the gas is $\frac{11}{2}RT_0$

C. heat absorbed by the gas is $\frac{11}{2}RT_0$

D. heat sbsorbed by the gas is $\frac{13}{2}RT_0$.

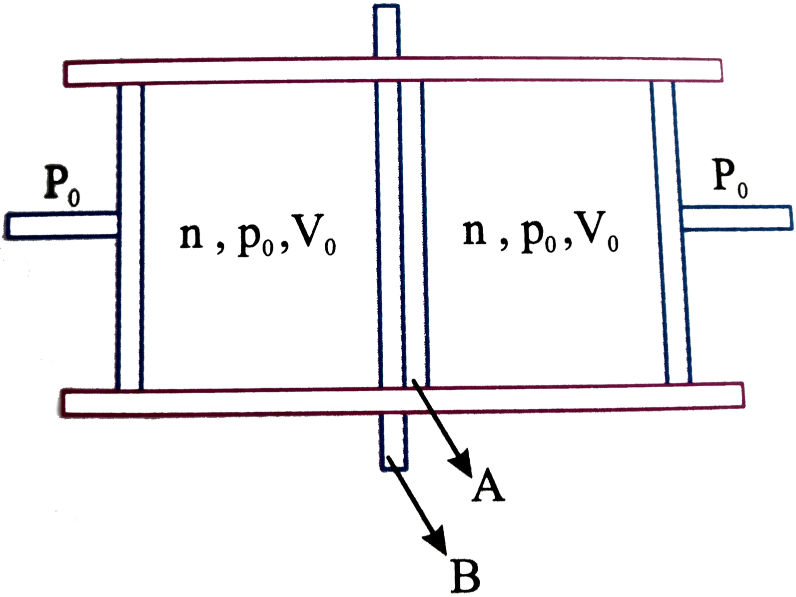
(R=uniyersal gas constant)

Answer: A::C

Watch Video Solution

98. Two cylinders are connected by a fixed diathermic partition A and a removable adiabatic partition B is placed adjacent to A as shown in the figure. Inititally n moles of an ideal monoatomic gas in present in both the cylinders an normal atmospheric pressure p_0 . Both the gases occupy same volume V_0 , initially.

Now the piston of the left cylinder is compressed in adiabatic manner so that volume of the lift portion becomes $\frac{V_0}{2}$ and then the left piston clamped. Again the adiabatic slider B is removed so equilibrium. Assume all other surfaces except A to be adiabatic. For this situation, mark out the correct statement (s).



A. Just after the removal of adiabatic separator B , the pressure in the lift and right chambers are $2^{\gamma} p_0$ and p_0 , respectively.

B. A fter the removal of adiabatic separtor B , the gas in right chamber expands under constant pressure process.

C. Workdone by the gas of the right chamber on surroundings during its expansion is $0.22 p_0 V_0$.

D. During the expansion of gas in right chamber, the energy transferred from the left chamber to right chamber is $0.55 p_0 V_0$ where $\gamma = \frac{5}{3}$.

Answer: A::B::C::D

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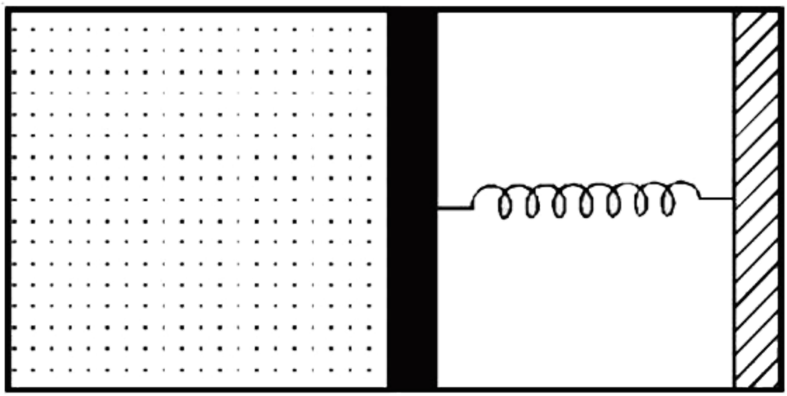
99. An ideal monoatomic gas is confined in a horizontal cylinder by a spring loaded piston (as shown in the figure). Initially the gas is at temperature T_1, pressure P_1 and volume $V_1$and the spring is in its relaxed state. The gas is then heated very slowly to temperature T_2 ,pressure $P_2$and volume V_2. During this process the piston moves out by a distance x. Ignoring the friction between the piston and the cylinder, the correct statement (s) is (are)



A. if $V_2 = 2V_1$ and $T_2 = 3T_1$, then the energy in the spring is $\frac{1}{4}P_1V_1$

B. if $V_2 = 2V_1$ and $T_2 = 3T_1$, then the change in internal energy is $3P_1V_1$

C. if $V_2 = 3V_1$ and $T_2 = 4T_1$, then the work done by the gas is $\frac{7}{3}P_1V_1$

D. if $V_2 = 3V_1$ and $T_2 = 4T_1$, then the heat supplied to the gas is $\frac{17}{6}P_1V_1$

Answer: A::B::C

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100. The molar specific heat of a gas is defined as $C = \frac{Dq}{ndT}$ Where dQ =heat absorbed

n = mole number dT = change in temperature

A gas with adiabatic exponent $'\gamma'$ is expanded accrding to the law $p = \alpha V$. The initial volume is V_0 . The final volume is ηV_0. ($\eta > 1$). The molar heat capacity of the gas in the process is

A. $\frac{R}{2}(\gamma + 1)$

B. $\frac{2}{2(\gamma - 1)}$

C. $\frac{R}{2}\frac{(\gamma + 1)}{(\gamma - 1)}$

D. $\frac{R}{2}\frac{(\gamma - 1)}{(\gamma + 1)}$

Answer: C

Watch Video Solution

101. The molar specific heat of a gas is defined as $C = \frac{Dq}{ndT}$ Where dQ =heat absorbed

n = mole number dT = change in temperature

An ideal gas whose adiabatic exponent is γ . Is expanded do that the heat transferred to the gas is equal to decrease in its internal energy. The molar heat capacity in this process is

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

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

C. $\frac{R}{\gamma + 1}$

D. $R(\gamma - 1)$

Answer: B

Watch Video Solution

102. The molar specific heat of a gas is defined as $C = \frac{Dq}{ndT}$ Where dQ =heat absorbed

n = mole number dT = change in temperature

The equation of the above process in the variables T, V is

A. $TV^{\gamma-1}$=constant

B. $TV^{\left(\frac{\gamma-1}{2}\right)}$=constant

C. $TV^{\left(\frac{\gamma}{\gamma-1}\right)}$=constant

D. $TV^{\left(\frac{\gamma-1}{\gamma}\right)}$=constant

Answer: B

Watch Video Solution

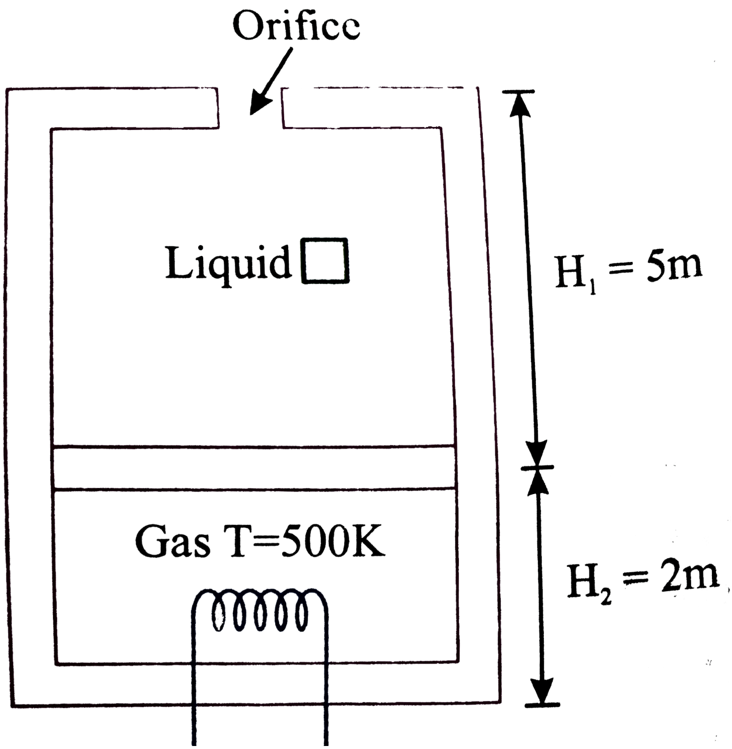
103. The system shown in the figure is in equilibrium. The piston is massless, frictionless and insulated. All walls of the chamber are also insulated. When heat is generated inside the lower chamber the piston slowly moves upwards by 2 m and the liquid comes out through an orifice so that it can rise to a maximum height of 5 m above the orifece level. The lower chamber contains 2 moles of an ideal monoatomic gas at $500k$.

Area of orifice a $= 0.05m^2$

Area of the piston $A = 1m^2$

Density of the liquid, $\rho = 10^3 kg/m^3$, $g = 10m/s^2$

Atmospheric pressure, $P_{atm} = 10^5 N/m^2$



The speed of piston is

A. $0.05m/s$

B. $0.5m/s$

C. $5m/s$

D. none of these

Answer: B

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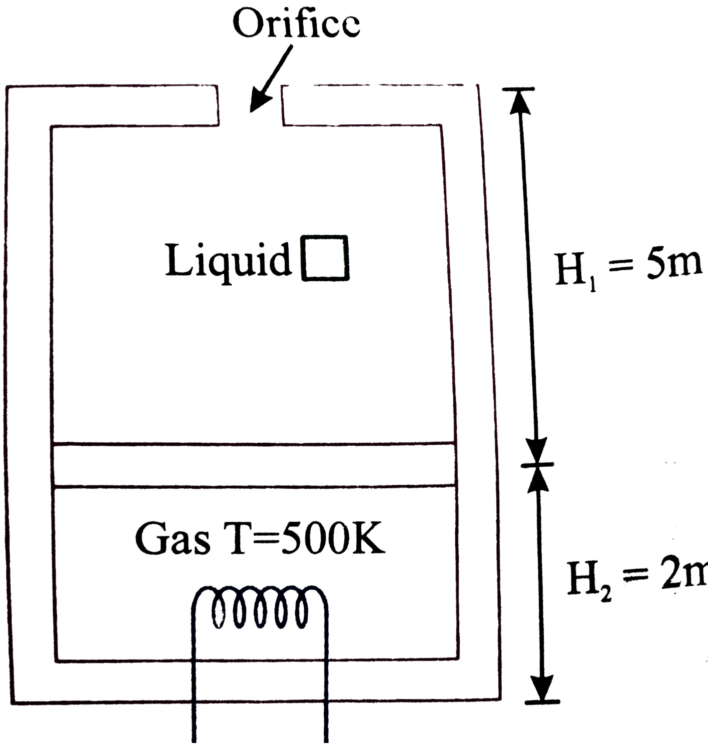
104. The system shown in the figure is in equilibrium. The piston is massless, frictionless and insulated. All walls of the chamber are also insulated. When heat is generated inside the lower chamber the piston slowly moves upwards by 2 m and the liquid comes out through an orifice so that it can rise to a maximum height of 5 m above the orifece level. The lower chamber contains 2 moles of an ideal monoatomic gas at $500k$.

Area of orifice a $= 0.05m^2$

Area of the piston $A = 1m^2$

Density of the liquid, $\rho = 10^3 kg/m^3$, $g = 10m/s^2$

Atmospheric pressure, $P_{atm} = 10^5 N/m^2$



The final pressure of the gas is

A. $1.8atm$

B. $0.18atm$

C. $1.5atm$

D. none of these

Answer: A

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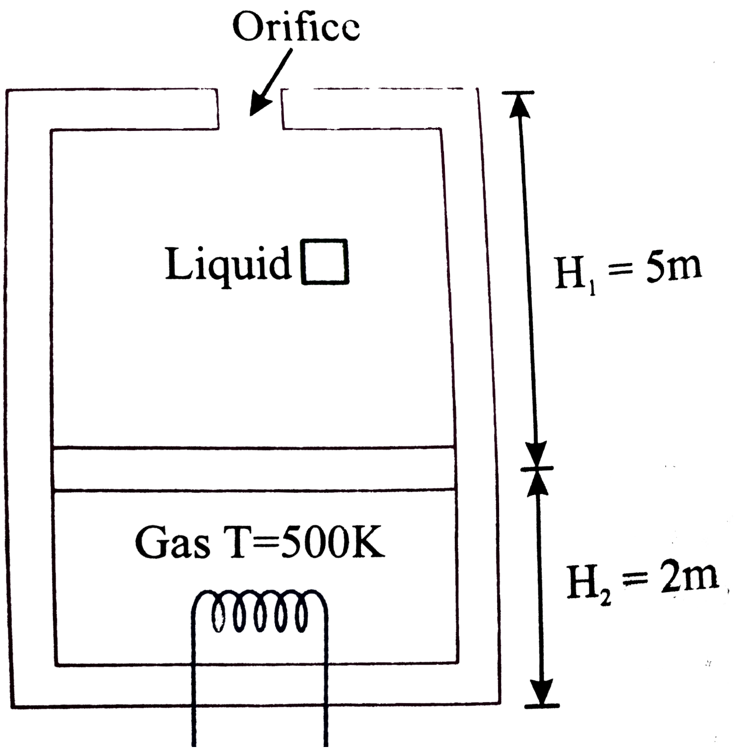
105. The system shown in the figure is in equilibrium. The piston is massless, frictionless and insulated. All walls of the chamber are also insulated. When heat is generated inside the lower chamber the piston slowly moves upwards by 2 m and the liquid comes out through an orifice so that it can rise to a maximum height of 5 m above the orifece level. The lower chamber contains 2 moles of an ideal monoatomic gas at $500k$.

Area of orifice a $= 0.05m^2$

Area of the piston $A = 1m^2$

Density of the liquid, $\rho = 10^3 kg/m^3$, $g = 10m/s^2$

Atmospheric pressure, $P_{atm} = 10^5 N/m^2$



The average power of the heater is

A. $49.36KW$

B. $48.36W$

C. $4.936KW$

D. none of these

Answer: A

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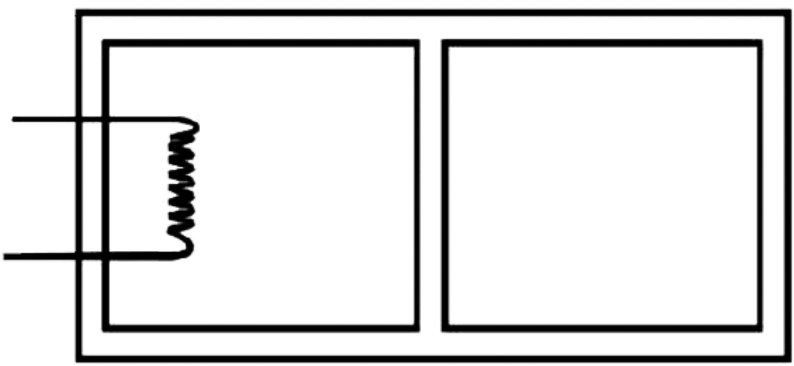
106. The rectangular box shown in Fig has partition which can slide without friction along the length of the box. Initially each of the two chambers of the box has one mole of a mono-atomic ideal gas $(\lambda = 5/3)$ at a pressure P_0, volume V_0 and temperature T_0. The chamber on the left is slowly heated by an electric heater. The walls of the box and the lead wires of the heater is negligible. The gas in the left chamber expands pushing the partition until the final pressure in both chambers becomes $243P_0/32$. Determine (i) the final temperature of the gas in each chamber and (ii) the work done by the gas in the right chamber.



A. $2.25T_0$

B. $4.5T_0$

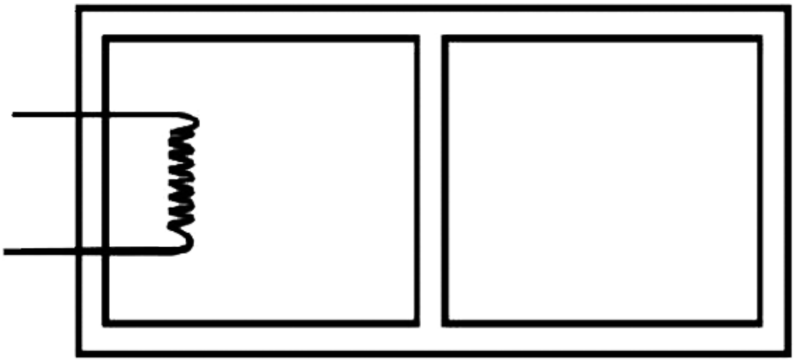
C. $8.75T_0$

D. $12.93T_0$

Answer: A

Watch Video Solution

107. The rectangular box shown in Fig has partition which can slide without friction along the length of the box. Initially each of the two chambers of the box has one mole of a mono-atomic ideal gas $(\lambda = 5/3)$ at a pressure P_0, volume V_0 and temperature T_0. The chamber on the left is slowly heated by an electric heater. The walls of the box and the lead wires of the heater is negligible. The gas in the left chamber expands pushing the partition until the final pressure in both chambers becomes $243P_0/32$. Determine (i) the final temperature of the gas in each chamber and (ii) the work done by the gas in the right chamber.



A. $2.25T_0$

B. $4.5T_0$

C. $8.75T_0$

D. $12.93T_0$

Answer: D

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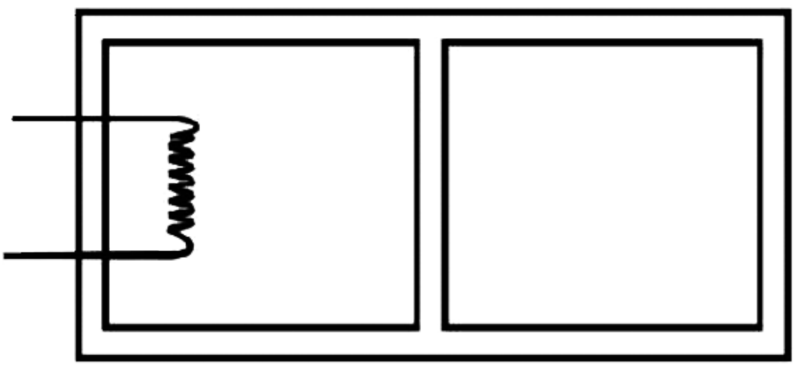
108. The rectangular box shown in Fig has partition which can slide without friction along the length of the box. Initially each of the two chambers of the box has one mole of a mono-atomic ideal gas $(\lambda = 5/3)$ at a pressure P_0, volume V_0 and temperature T_0. The chamber on the left is slowly heated by an electric heater. The walls of the box and the lead wires of the heater is negligible. The gas in the left chamber expands pushing the partition until the final pressure in both chambers becomes $243P_0/32$. Determine (i) the final temperature of the gas in each chamber and (ii) the work done by the gas in the right chamber.



A. $5.5T_0J$

B. $10.5T_0J$

C. $25.5T_0J$

D. none of these

Answer: D

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109. An ideal monoatomic gas indergoes a pressure pV_n=constant. The adiabatic constant for gas is y. During the process, volume of gas increases from V_0 to rV_0 and pressure decreases for p_0 to $\frac{p_0}{2r}$ Based on above information, answer the following questios :

The of n is

A. $\frac{2\log r}{\log 2r}$

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

C. $\frac{\log 2r}{\log r}$

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

Answer: C

Watch Video Solution

110. An ideal monoatomic gas indergoes a pressure pV_n=constant. The adiabatic constant for gas is y. During the process, volume of gas increases from V_0 to rV_0 and pressure decreases for p_0 to $\frac{p_0}{2r}$ Based on above information, answer the following questios :

The molar heat capacity of the gas for the process is

A. $\frac{R(n-\gamma)}{(n-1)(\gamma-1)}$

B. $\frac{R(n-1)}{(n-\gamma)(\gamma-1)}$

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

D. $\frac{R}{n-1}+\frac{R}{\gamma}$

Answer: A

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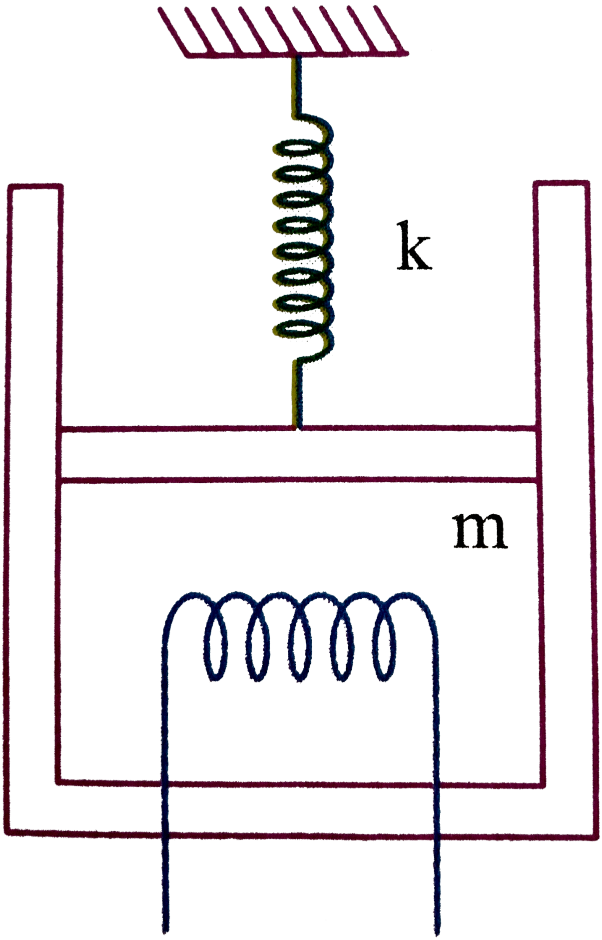
111. 2000 mole of an ideal diatmic gas is enclosed in a vertica cylinder fitted with a piston and spring and spering as shown in the figeur. Initially, the spring is compressed by 5 cm and then the electric heater stats supplying energy to the gas at constant rate of $100 J / s$ and due to conduction through walls of cylinder and radiation, $20 J / s$ has been lost to surrounding.

$\left[k = 1000 N / m, g = 10 m / s^2\right.$, Atmospheric pressure, $p_0 = 10^5 N / m^2$, Cross-section area of piston $A = 50 cm^2$ Mass of piston m $= 1 kg, R = 8.3 kJ / mol - K]$ Based on above information, answer the following question :



The initial pressure of the gas is

A. $1N/m^2$

B. $1.02N/m^2$

C. $1.10N/m^2$

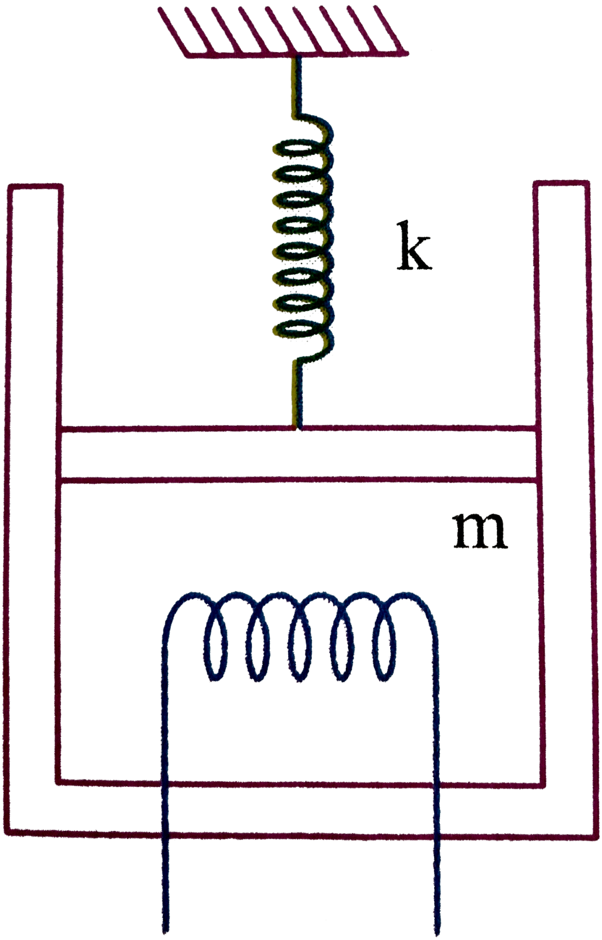
D. $1.12N/m^2$

Answer: D

Watch Video Solution

112. 2000 mole of an ideal diatmic gas is enclosed in a vertica cylinder fitted with a piston and spring and spering as shown in the figeur. Initially, the spring is compressed by 5 cm and then the electric heater stats supplying energy to the gas at constant rate of $100J/s$ and due to conduction through walls of cylinder and radiation, $20J/s$ has been lost to surrounding.

$[k=1000N/m, g=10m/s^2$, Atmospheric pressure, $p_0=10^5N/m^2$, Cross-section area of piston $A=50cm^2$ Mass of piston m $=1kg, R=8.3kJ/mol-K]$ Based on above information, answer the following question :



Work done by the gas in $t = 5$ s is

A. $300J$

B. $400J$

C. $114.3J$

D. $153.6J$

Answer: C

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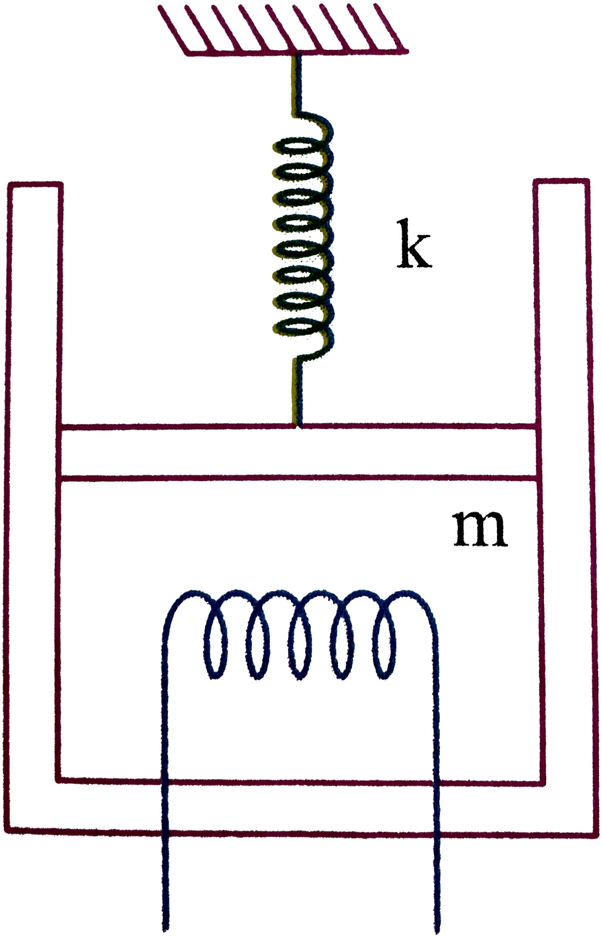
113. 2000 mole of an ideal diatmic gas is enclosed in a vertica cylinder fitted with a piston and spring and spering as shown in the figeur. Initially, the spring is compressed by 5 cm and then the electric heater stats supplying energy to the gas at constant rate of $100J/s$ and due to conduction through walls of cylinder and radiation, $20J/s$ has been lost to surrounding.

$[k = 1000N/m, g = 10m/s^2$, Atmospheric pressure, $p_0 = 10^5 N/m^2$, Cross-section area of piston $A = 50cm^2$ Mass of piston m $= 1kg, R = 8.3kJ/mol - K$] Based on above information, answer the following question :



Increase in temperature of gas in 5 s is

A. $6.9 \times 10^{-2} K$

B. $6.9 \times K$

C. $83 \times 10^{-4} K$

D. $96 \times 10^{-4} K$

Answer: A

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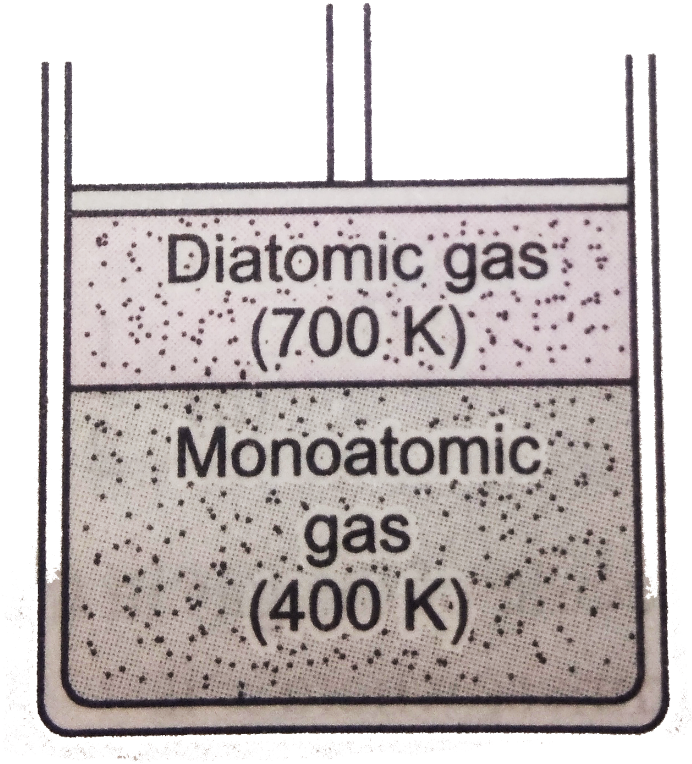
114. In Fig., a container is shown to have a movable (without friction) piston on top. The container and the piston are all made of perfectly insulating material allowing no heat transfer between outside and inside the container. The container is divided into two compartments by a rigid partition made of a thermally conducting material that allows slow transfer of heat. the lower compartment of the container is filled with 2 moles of an ideal monoatomic gas at 700 K and the upper compartment is filled with 2 moles of an ideal diatomic gas at 400 K. the heat capacities per mole of an ideal monoatomic gas are $C_v = \frac{3}{2}R$ and $C_P = \frac{5}{2}R$, and those for an ideal diatomic gas are $C_{ve} = \frac{5}{2}R$ and $C_P = \frac{7}{2}R$.

Consider the partition to be rigidly fixed so that it does not move. when equilibrium is achieved, the final temperature of the gases will be



A. $550K$

B. $525K$

C. $513K$

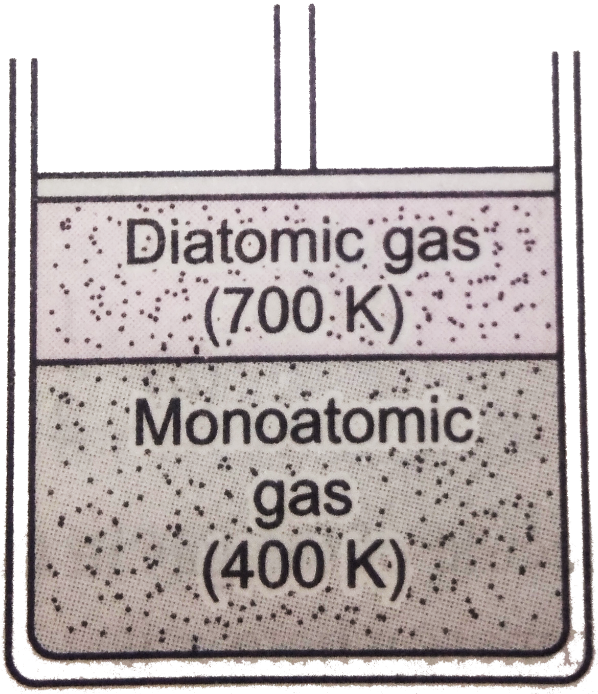
D. $490K$

Answer: D

Watch Video Solution

115. In Fig., a container is shown to have a movable (without friction) piston on top. The container and the piston are all made of perfectly insulating material allowing no heat transfer between outside and inside the container. The container is divided into two compartments by a rigid partition made of a thermally conducting material that allows slow transfer of heat. the lower compartment of the container is filled with 2 moles of an ideal monoatomic gas at 700 K and the upper compartment is filled with 2 moles of an ideal diatomic gas at 400 K. the heat capacities per mole of an ideal monoatomic gas are $C_v = \frac{3}{2}R$ and $C_P = \frac{5}{2}R$, and those for an ideal diatomic gas are $C_{ve} = \frac{5}{2}R$ and $C_P = \frac{7}{2}R$.

Now consider the partition to be free to move without friction so that the pressure of gases in both compartments is the same. the total work done by the gases till the time they achieve equilibrium will be



A. $250R$

B. $200R$

C. $100R$

D. $-100R$

Answer: D

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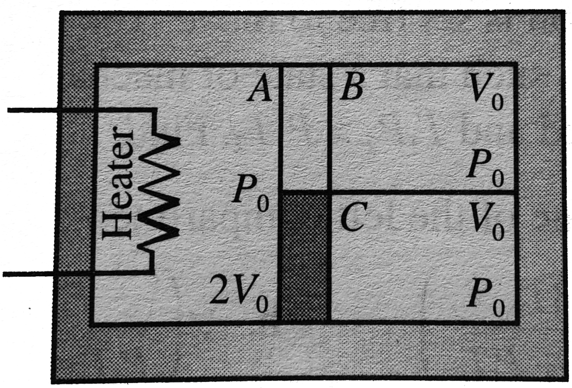
116. A container of volume $4V_0$ made of a perfectly non $-$ conducting material is divided into two equal parts by a fixed rigid wall whose lower half is non $-$ conducting and upper half is purely conducting. The right side of the wall is divided into equal parts (initially 0 by means of a massless non $-$ conducting piston free to move as shown . Section A constains $2mol$ of a gas while the section B and C contain $1mol$ each of the same gas $(\gamma = 15.)$ at pressure P_0 . The heater in left part is switched on till the final pressure in section C becomes $125/27P_0$. Calculate



Final temperature in part A.

A. $\dfrac{12P_0V_0}{13R}$

B. $\dfrac{P_0V_0}{R}$

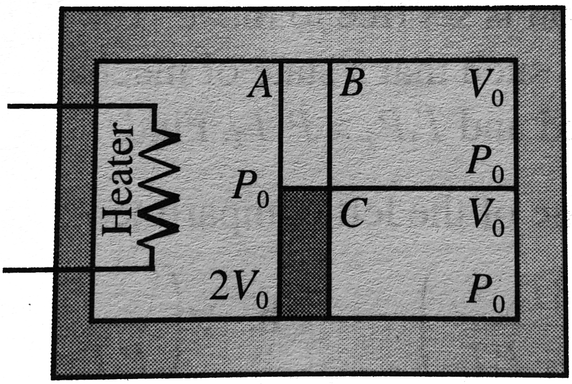
C. $\dfrac{105P_0V_0}{13R}$

D. $\dfrac{205P_0V_0}{27R}$

Answer: D

Watch Video Solution

117. A container of volume $4V_0$ made of a perfectly non $-$ conducting material is divided into two equal parts by a fixed rigid wall whose lower half is non $-$ conducting and upper half is purely conducting. The right side of the wall is divided into equal parts (initially 0 by means of a massless non $-$ conducting piston free to move as shown . Section A constains $2mol$ of a gas while the section B and C contain $1mol$ each of the same gas $(\gamma = 15.)$ at pressure P_0 . The heater in left part is switched on till the final pressure in section C becomes $125/27P_0$. Calculate



Final temperature in part C.

A. $\frac{p_0v_0}{R}$

B. $\frac{p_0v_0}{3R}$

C. $\frac{5p_0v_0}{3R}$

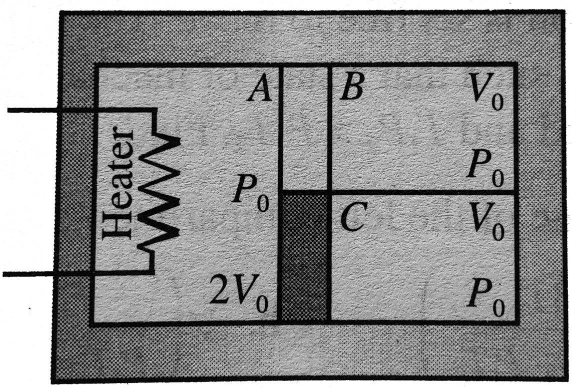
D. $\frac{5p_0v_0}{R}$

Answer: C

Watch Video Solution

118. A container of volume $4V_0$ made of a perfectly non – conducting material is divided into two equal parts by a fixed rigid wall whose lower half is non $-$ conducting and upper half is purely conducting. The right side of the wall is divided into equal parts (initially 0 by means of a massless non $-$ conducting piston free to move as shown . Section A constains $2mol$ of a gas while the section B and C contain $1mol$ each of the same gas $(\gamma = 15.)$ at pressure P_0 . The heater in left part is switched on till the final pressure in section C becomes $125/27P_0$.

Calculate



The heat supplied by the heater.

A. $\dfrac{400p_0v_0}{8}$

B. $\dfrac{113}{5}p_0v_0$

C. $\dfrac{315}{9}p_0v_0$

D. $\dfrac{368}{9}p_0v_0$

Answer: D

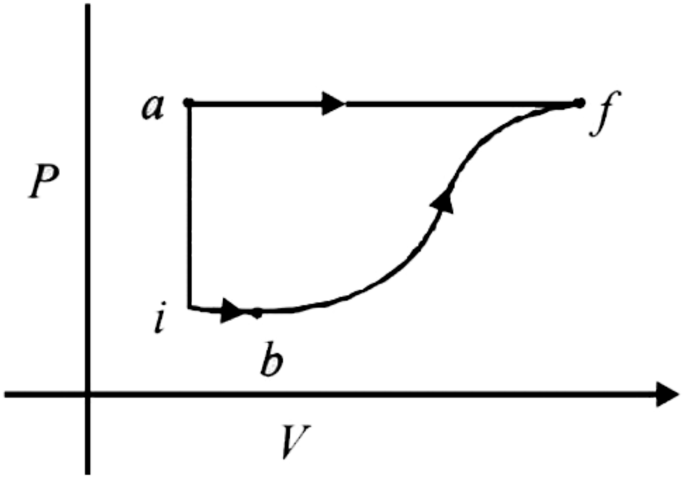
Watch Video Solution

119. One mole of an ideal monatomic gas undergoes the process $p = \alpha T^{1/2}$, whwre a is a constant. The work done by the gas if its temperature increases by $50K$ is $\frac{50R}{x}$. Find the value of x.

Watch Video Solution

120. A thermodynamic system is taken from an initial state I with internal energy $U_i = -100J$ to the final state f along two different paths iaf and ibf, as schematically shown in the figure. The work done by the system along the pat af, ib and bf are $W_{af} = 200J, W_{ib} = 50J$ and $W_{bf} = 100J$ respectively. The heat supplied to the system along the path iaf, ib and bf are Q_{iaf}, Q_{ib}, Q_{bf} respectively. If the internal energy of the system in the state b is

$U_b = 200J$ and $Q_{iaf} = 500J$, The ratio $\frac{Q_{bf}}{Q_{ib}}$ is



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121. 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 γ for the gaseous mixture is $\left(\frac{19}{13}\right)$.

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122. A lead ball at $30^{\circ} C$ is dropped from a height h. The ball is heated due to the air resistance and it completely melts just before reaching the ground, The molten substance falls slowly on the ground. Latent heat of fusion of lead is $22200 Jk / g$. Specific heat capacity of lead $= 126 J / kg - ^{\circ} C$ and melting point of lead $= 330^{\circ} C$, Assume that all mechanical energy lost is used to heat the ball.

Find the value of h in km ? $(\text{Use} g = 10 m / s2)$

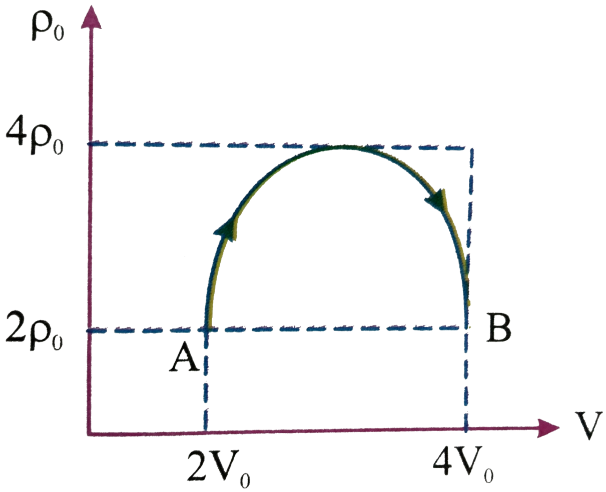
Watch Video Solution

123. One mole of a uniform rod of length 1 m is placed in boiling water while its other end is placed in melting ice A point P on the rod is maintained at a constant temperature of $800^{\circ} C$. The mass of steam produced per second. Is equal to the mass of ice melted per second. If specific latent heat of steam is 7 times the specific latent heat of ice, then distance of P from the steam chamber is $n / 18 m$. Find the value if n ?

Watch Video Solution

124. One mole of an ideal Po monoatomic gas is taken $4op$ through a thermo dynamic process shown in the $p - V$ diagram. The heat supplied to $2po$ the system in this process is

$K \times (\pi + 10)p_0 V_0$. Determine the value of K



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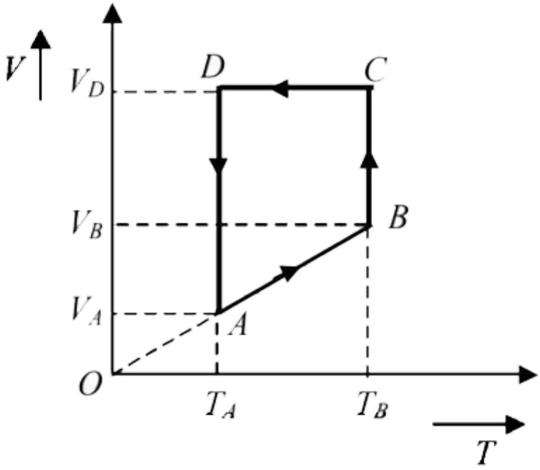
125. One mole of an ideal gas whose pressure changes with volume as $P = \alpha V$, where α is a constant, is expanded so that its volume increase η times. Find the change in internal energy and heat capacity of the gas.

Watch Video Solution

126. A piston can freely move inside a horizontal cylinder closed from both ends. Initially, the piston separates the inside space of the cylinder into two equal parts each of volmek V_0 in which an ideal gas is contained under the same pressure p_0 and at the same temperature. What work has to be performed in order to increase isothermally the volume of one part of gas η times compared to that of the other by slowly moving the piston ?

Watch Video Solution

127. A monoatomic ideal gas of two moles is taken through a cyclic process starting from A as shown in figure. The volume ratios are $\frac{V_B}{V_A} = 2$ and $\frac{V_D}{V_A} = 4$. If the temperature T_A at A is $27^\circ C$.



Calculate,

(a) the temperature of the gas at point B,

(b) heat absorbed or released by the gas in each process,

(c) the total work done by the gas during the complete cycle. Express your answer in terms of the gas constant R.

Watch Video Solution

128. A piece of aluminium falls from a height of 200m on a fixed non conductig slab which brings it to rest. If the specific heat of aluminium is $210 Cal / kg^{\circ} C$. The increase in temperature of the slab immediately after collision (assume that there is no loss of heat) is

A. $2.2^{\circ} C$

B. $3.3^{\circ} C$

C. $4.4^{\circ} C$

D. $5.5^{\circ} C$

Answer: A

Watch Video Solution

129. Hail stone fall from certain heigh. If only 2% of the mass of the hail stone melt on reaching the ground,, the height from which they fall is ($g = 10ms^{-2}, L = 80call / gm$ and $J = 4.2J / cal$)

A. $33.6km$

B. $67.2km$

C. $672m$

D. $336m$

Answer: C

Watch Video Solution

130. From what minimum height a block of ice has to be dropped in order that 0.5% of ice melts on hitting the ground ?

A. $171.43m$

B. $17.14m$

C. $161.43m$

D. $1.714km$

Answer: A

Watch Video Solution

131. Two spheres $'A'$ and $'B'$ of masses in the rario $1:2$ Specific heats in the ratio $2:3$ falls from heights $'h_1'$ and $'h_2'$ On reaching the ground rise in temperatures are equal, then $h_1 / h_2 =$

A. $3 : 2$

B. $2 : 9$

C. $2 : 3$

D. $2 : 1$

Answer: C

Watch Video Solution

132. 2kg ice block should be dropped form $'x'$ km' height to melt completely. The 8 kg ice should be dropped from a height of

A. $4xKm$

B. xKm

C. $2xKm$

D. $x / 2Km$

Answer: B

Watch Video Solution

133. Two metal balls having masses $50g$ and $100g$ collides with a target with same velocity. Then the ratio of their rise in temperature is

A. $1:2$

B. $4:1$

C. $2:1$

D. $1:1$

Answer: D

Watch Video Solution

134. A brick weighing $4.0kg$ is dropped into a $1.0m$ deep river from a height of $2.0m$. Assuming that 80% of the gravitational potential energy is finally converted into thermal energy, find this thermal energy in calorie.

A. 15

B. 17

C. 23

D. 27

Answer: C

Watch Video Solution

135. A man of 60 kg gains 1000 cal of heat by eating 5 mangoes. His efficiency is 29%. To what height he can jump by using this energy?

A. $2m$

B. $20m$

C. $28m$

D. $0.2m$

Answer: A

Watch Video Solution

136. $2kg$ of water is converted into steam by bolling at atmosperic pressure. The volume changes from $2 \times 10^{-3}m^{-3}$ to $3.34m^3$. The work done by the system is about

A. $-340kJ$

B. $-170kJ$

C. $170kJ$

D. $340kJ$

Answer: D

Watch Video Solution

137. Find the external workdone by the system in K cal, when $12.5k$ cal of heat is suppleid to the system and corresponding increasing in interanal enrgy is $10500\ J\ (J = 4200J / kcal)$

A. $15Kcal$

B. $12.5kcal$

C. $10.0kcal$

D. $7.5kcal$

Answer: C

Watch Video Solution

138. Heat of 20 K cal is supplied to the system and $8400J$ of external work is done on the system so that its volume decreases at constant pressure. The change in internal enregy is $(J = 4200J / kcal)$

A. $9.24 \times 10^4 J$

B. $7.56 \times 10^4 J$

C. $8.4 \times 10^4 J$

D. $10.5 \times 10^4 J$

Answer: A

Watch Video Solution

139. A gas expands from 40 liters to 90 liters at a constant pressure of 8 atmospheres. Work done by the gas during the expansion is

A. $4 \times 10^{-4} J$

B. $4 \times 10^4 J$

C. $4 \times 10^3 J$

D. $4 \times 10^2 J$

Answer: B

Watch Video Solution

140. To a system 300 joules od heat is given and it does 60 joules of work. How much does the internal energy of the system change in this process? (in joule)

A. 240

B. 156.5

C. -300

D. -528.2

Answer: A

Watch Video Solution

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

A. $6.75 \times 10^5 J$

B. $2.25 \times 10^5 J$

C. $3.25 \times 10^5 J$

D. $1.25 \times 10^5 J$

Answer: D

Watch Video Solution

142. Find the change in internal energy in joule when $20gm$ of a gas is heated from $20^\circ C$ to $30^\circ C$ $(c_v = 0.18kcal / kg\ K, J = 4200J / kcal)$`

A. $72.8J$

B. $151.2J$

C. $302J$

D. $450J$

Answer: B

Watch Video Solution

143. When two moles of a gas is heated from O^0 to 10^0C at constant volume, its internal enernal changes by $420J$. The moles specifie heat of the gas at constant volume

A. $5.75JK^{-1}\text{mole}^{-1}$

B. $10.55JK^{-1}\text{mole}^{-1}$

C. $21JK^{-1}\text{mole}^{-1}$

D. $42JK^{-1}\text{mole}^{-1}$

Answer: C

Watch Video Solution

144. A cylinder of fixed capacity 67.2 liters contains helium gas at STP . Calculate the amount of heat required to rise the temperature of the gas by $15^{\circ}C$? $\left(R = 8.314Jmol^{-1}k^{-1}\right)$

A. $561.19J$

B. $570.9J$

C. $580.9J$

D. $590.9J$

Answer: A

Watch Video Solution

145. When a diatomic gas expands at constant pressure, the precentage of heat supplied that increases temperature of the gas and in doing exteranl work in expansion at constant pressure is

A. $60\%, 40\%$

B. $40\%, 60\%$

C. $28.57\%, 71.42\%$

D. $71.42\%, 28.57$

Answer: D

Watch Video Solution

146. The molar specific heat of a gas at constant volume is 20 Joule $mol^{-1}K^{-1}$. The value of γ for it will be

A. $\frac{11}{10}$

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

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

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

Answer: B

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147. The specific heat of air at constant pressure is $1.005kJ/kg/K$ and the specific heat of air at constant volume is $0.718kJ/kg/K$. If the universal gas constant is $8.314 kJ / k$ mole K find the molecular weight of air ?

A. 28.97

B. 24.6

C. 22.8

D. 19.6

Answer: A

Watch Video Solution

148. Calculate the specific heat of a gas at constant volume from the following data. Desity of the gas at $N.T.P = 19 \times 10^{-2} kg / m^3$, $(C_p / C_v) = 1.4, J = 4.2 \times 10^3 J / kcal$: atmospheric pressure $= 1.013 \times 10^5 N / m^2$. $(\text{in} kcal / kgk)$

A. 2.162

B. 1.612

C. 1.192

D. 2.612

Answer: C

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149. If the ratio of specific heats of neon is 1.667 and $R = 8312 J / k$ mole K find the specific heats of neon at constant pressure and constant volume. (Molecular weight of neon $= 20.183$)

A. $1.029, 0.6174$

B. $1.831, 0.921$

C. $1.621, 0.421$

D. $0.862, 0.246$

Answer: A

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150. One mole of an ideal gas expands isothermally to double its volume at $27^\circ C$. The work done by the gas is nearly

A. $2760 cal$

B. $414 cal$

C. $1380 cal$

D. $600 cal$

Answer: B

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151. One mole of an ideal gas expands at a constant temperature of $300K$ from an initial volume of 10 litres to a final volume of 20 liters. The work done in expanding the gas is $(R = 8.31 J / \text{mole} - K)$ (in joules)

A. 750

B. 1728

C. 1500

D. 3456

Answer: B

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152. A given quantity of a ideal gas is at pressure P and absolute temperature T. The isothermal bulk modulus of the gas is

A. $1.013 \times 10^{5} N / m^{2}$

B. $1.013 \times 10^{6} N / m^{2}$

C. $1.013 \times 10^{-11} N / m^{2}$

D. $1.013 \times 10^{11} N / m^{2}$

Answer: A

Watch Video Solution

153. A gas for which $\gamma = 1.5$ is suddenly compressed to $1/4$ th of the initial volume. Then the ratio of the final to initial pressure is

A. $1:16$

B. $1:8$

C. $1:4$

D. $8:1$

Answer: D

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154. The pressure and density of a monoatmic gas $(\gamma = 5/3)$ change adiabatically from , (P_1, d_1) to (P_2, d_2).If $\dfrac{d_2}{d_1} = 8$ then $\dfrac{P_2}{P_1}$ should be

A. $\dfrac{1}{32}$

B. 32

C. 128

D. $\frac{1}{8}$

Answer: B

Watch Video Solution

155. Air is filled in a motor tube at $27^\circ C$ and at a pressure of 8 atmospheres.The tube suddenly bursts, then temperature of air is [Given γ of air $= 1.5$]

A. $27.5^\circ C$

B. $75^\circ C$

C. $150K$

D. $150^\circ C$

Answer: C

Watch Video Solution

156. A mono atomic gas initially at $27^{\circ} C$ is compressed adiabatically to one eighth of its original volume. The temperature after compression will be

A. $10^{\circ} C$

B. $887^{\circ} C$

C. $927^{\circ} C$

D. $144^{\circ} C$

Answer: C

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157. One gm mol of a diatomic gas $(\gamma = 1.4)$ is compressed adiabatically so that its temperature rises from $27^{\circ} C$ to $127^{\circ} C$. The work done will be

A. 2077.5 joules

B. 207.5 joules

C. 207.5 ergs

D. 205.5 joules

Answer: A

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158. A container of volume $2m^3$ is divided into two equal compartments, one of which contains an ideal gas at 400 K. The other compartment is vacuum. The whole system is thermally isolated from its surroundings. The partition is removed and the surrounding. The partition is removed and the gas expands to occupy the whole volume of the container.Its temperature now would be

A. $400K$

B. $250K$

C. $200K$

D. $100K$

Answer: A

Watch Video Solution

159. At $27^\circ C$ and pressure of 76 cm of Hg the volume of a diatomic gas is $2000cm^3$. If is compressed adiabatically to a volume $1000cm^3$, what are its pressure and temperature? $(\gamma = 1.4)$

A. 200.5 cm of Hg, $122.9^\circ C$

B. 180.4 cm of Hg,$84.2^\circ C$

C. 120 cm of Hg,$80.2^\circ C$

D. 162.4 cm of Hg, $92^\circ C$

Answer: A

Watch Video Solution

160. The work done on a gas when it is compressed isothermally at $27^{\circ} C$ to half of the initial volume is (nearly)

A. $3436 J$

B. $-1718 J$

C. $+1718 J$

D. $-3436 J$

Answer: B

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

A. $1000 K$

B. $960 K$

C. $846 K$

D. $754K$

Answer: B

Watch Video Solution

162. A Carnot's engine woeking between $27^{\circ} C$ and $127^{\circ} C$ takes up $800J$ of heat from the reservoir in one cycle. What is the work done by the engine

A. $100J$

B. $200J$

C. $300J$

D. $400J$

Answer: B

Watch Video Solution

163. A copper block of mass $5kg$ slides down along a rough inclined plane of inclination $30^{\circ}C$ with a constant speed. The increase in the temperature of the block as it slide down through $100cm$ assuming that the loss of mechanical energy goes into copper block as thermal energy. (specific heat of copper

$420Jkg^{-1}K^{-1}, g = 10ms^{-2}$)

A. $1.19 \times 10^{-3}.^{\circ}C$

B. $2.38 \times 10^{-3}.^{\circ}C$

C. $1.19 \times 10^{-2}.^{\circ}C$

D. $2.38 \times 10^{-2}.^{\circ}C$

Answer: C

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164. A brass sphere of mass $0.2kg$ falls freely from a height of $20m$ and bounces to a height of $8m$ from the ground. If the dissipated energy in this process is absorbed by the sphere the eise in its temperature is (specific heat of brass $= 360 Jkg^{-1} K^{-1}$, $g = 10 ms^{-2}$)

A. $0.33^{\circ} C$

B. $0.66^{\circ} C$

C. $0.77^{\circ} C$

D. $0.88^{\circ} C$

Answer: A

Watch Video Solution

165. A lead bullet of $10g$ travelling at $300 m / s$ strikes against a block of wood and comes to rest. Assuming 50% heat is absorbed by the bullet, the increase in its temperature is (sp-heat of lead is $150 J / Kg - K$)

A. $100^{\circ} C$

B. $125^{\circ} C$

C. $150^{\circ} C$

D. $200^{\circ} C$

Answer: C

Watch Video Solution

166. Water falls from a height $500m$, what is the rise in temperature of water at bottom if whole energy remains in the water ? $(J = 4.2)$

A. $0.96^{\circ} C$

B. $1.02^{\circ} C$

C. $1.16^{\circ} C$

D. $0.3^{\circ} C$

Answer: C

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167. A ball is dropped on a floor from a height of $2.0m$. After the collision it rises up to a height of $1.5m$. Assume that 40% of the mechanical energy lost goes as thermal energy into the ball.Calculate the rise in the temperature of the ball in the collision. Heat capacity of the ball is $800JK^{-1}$

A. $0.5 \times 10^3 . ^\circ C$

B. $1.0 \times 10^3 . ^\circ C$

C. $1.5 \times 10^3 . ^\circ C$

D. $2.5 \times 10^3 . ^\circ C$

Answer: D

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168. 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. $2J$

B. $42J$

C. $18J$

D. $58J$

Answer: C

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169. The density of a substance is $400 kgm^{-3}$ and that of another substance is $600 kgm^{-3}$. The heat capacity of $40cc$ of first substance is equal to that of $30cc$ of second substance. The ratio of their specific heats is

A. $1:6$

B. $6:1$

C. $9:8$

D. $8:9$

Answer: C

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170. 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: D

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171. 294 joules of heat is requied to rise the temperature of 2 mole of an ideal gas at constant pressure from $30^\circ C$ to $35^\circ C$. The amount of heat required to rise the temperature of the same gas through the same range of temperature at constant volume $(R = 8.3 \text{Joules/mole} - K)$ is

A. $12.6J$

B. $211J$

C. $29.4K$

D. $37.8J$

Answer: B

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172. $1672cal$ of heat is given to one mole of oxygen at $0^\circ C$ keeping the volume constant. Raise in temperature is

$\left(c_p = 0cal / gm^0 k \text{ and } R = 2cal / \text{mole} / K\right)$

A. $33.6^\circ C$

B. $36.3^\circ C$

C. $63.3^\circ C$

D. $334.4^\circ C$

Answer: D

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173. 0.5 mole of diatomic gas at $27^\circ C$ is heated at constant pressure so that its tripled. If $= 8.3J\text{mole}^{-1}k^{-1}$ then work done is

A. $4980J$

B. $2490J$

C. $630J$

D. $1345J$

Answer: B

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174. The volume of $1kg$ of oxygen gas at NPT is $0.7m^3$. Specific heat of oxygen at constant volume is $653Jkg^{-1}k^{-1}$. The specific heat of oxygen at constant pressure in $Jkg^{-1}k^{-1}$ is (atmospheric pressure 10^5Pa)

A. 713

B. 813

C. 913

D. 1013

Answer: C

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175. When an ideal diatomic gas is heated at constant pressure, its intenal energy is increased by $50cal$ then the work done by the gas is

A. $30cal$

B. $50cal$

C. $70cal$

D. $20cal$

Answer: D

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176. 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

Watch Video Solution

177. 0.1 moles of diatomic gas at $27^{\circ}C$ is heated at constant pressure, so that the volume is doubled. If $R = 2cal.\ mol^{-1}k^{-1}$, the work done is

A. $150cal$

B. $60cal$

C. $40cal$

D. $30cal$

Answer: B

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178. If a triatomic gas is heated at constant pressure, precentage of the heat energy which is used to increase the internal energy is

A. $75\ \%$

B. $14\ \%$

C. $60\ \%$

D. $100\ \%$

Answer: A

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179. At $27^\circ C$ two moles of an ideal monatomic gas occupy a volume V. The gas expands adiabatically to a volume $2V$. Calculate

(a) final temperature of the gas

(b) change in its internal energy and

(c) the work done by the gas during the process. [$R = 8.31 J/mol - K$]

A. $-2767.23J$

B. $2767.23J$

C. $2500J$

D. $-2500J$

Answer: B

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180. One mole of an ideal gas with $\gamma = 1.4$ is adiabatically compressed so that its temperature rises from $27^\circ C$ to $34^\circ C$. The change in the internal energy of the gas is $\left(R = 8.3Jmol^{-10k^{-1}}\right)$

A. $-166J$

B. $166J$

C. $168J$

D. $-168J$

Answer: B

Watch Video Solution

181. The volume of air increases by 5% in its adiabatic expansion. The precentage decrease in its pressure will be

A. 5%

B. 6%

C. 7%

D. 8%

Answer: C

Watch Video Solution

182. Certain perfect gas is found to obey the law $PV^{3/2}$= constant, during adiabatic process. If such a gas at initial temprerature T is adiabatically compressed to half of the initial volume, its final temperature will be

A. $\sqrt{2}T$

B. $2T$

C. $2\sqrt{2}T$

D. $4T$

Answer: A

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183. The coefficient of performance of a Carnot refrigerator working between $30^{\circ}C\&0^{\circ}C$ is

A. 10

B. 1

C. 9

D. 0

Answer: C

Watch Video Solution

184. A Carnot engine whose sinl 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. $2750K$

B. $3250K$

C. $3800K$

D. $2500K$

Answer: D

Watch Video Solution

185. A refrigerator works between $3^{\circ} C$ and $40^{\circ} C$. To keep the temperature of the refrigerator constant, 600 calories of heat is to be removed every second. The power required is

A. 33.78 Watt

B. 337.8 Watt

C. 7.77 Watt

D. 10.77 Watt

Answer: B

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186. 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

187. One of the most efficient engines ever developed operated 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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