PHYSICS

BOOKS - MTG GUIDE PHYSICS (HINGLISH)

THERMODYNAMICS

Illustration

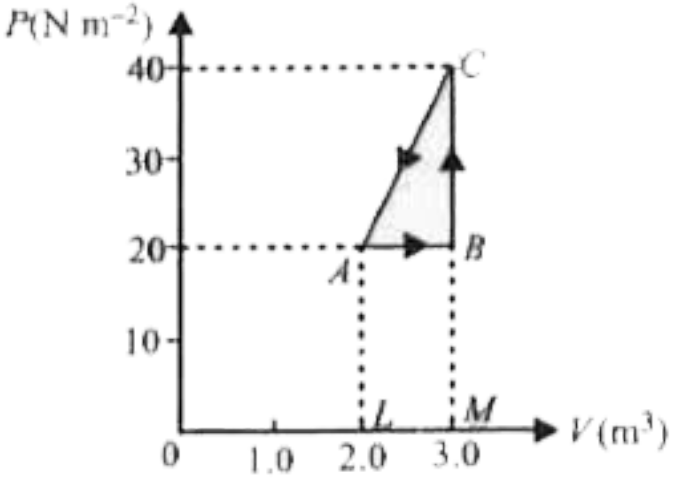
1. Calculate the work done.

(a) Along path AB (b) Along path BC

(c) Along path CA

(d) For the whole cycle.

The indicator diagram, between P and V, is as shown.



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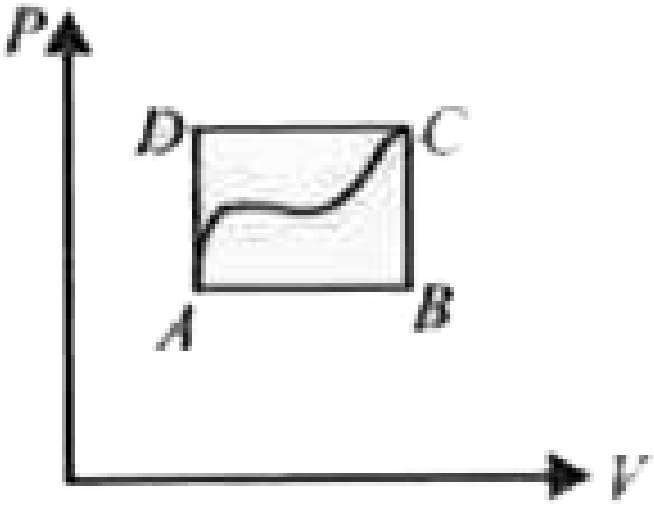
2. In the indicator diagram, we have

(a) Change in internal energy along ABC is 10 J.

(b) Work done along path AB = 20 J.

$U_C = 5J.$

(d) Heat absorbed by the system along path AD is 5J.



(i) Change in internal energy along the path CDA.

(ii) Heat given to the system along path ABC.

(iii) Value of U_A.

(iv) change in internal energy along AD.

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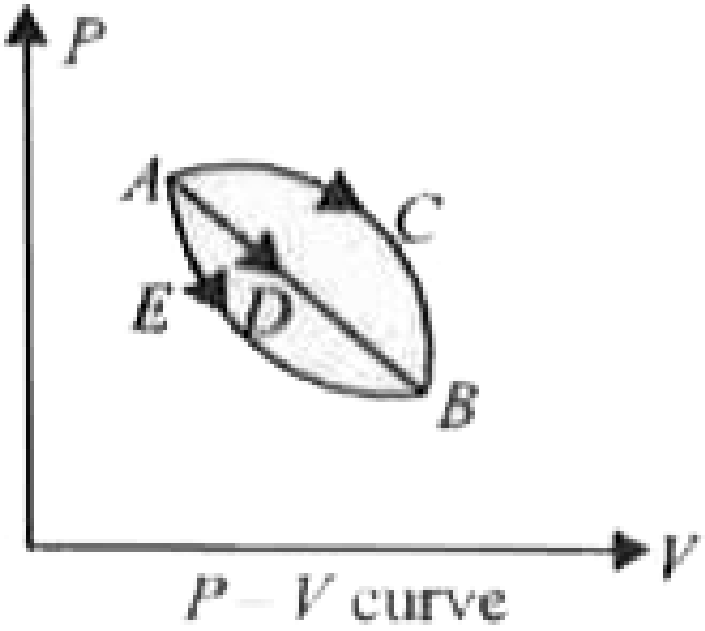
3. A certain mass of gas is carried from A to B, along three paths via ACB, ADB and AEB. Indicate the path along which the work done is

(a) Maximum

(b) Minimum.



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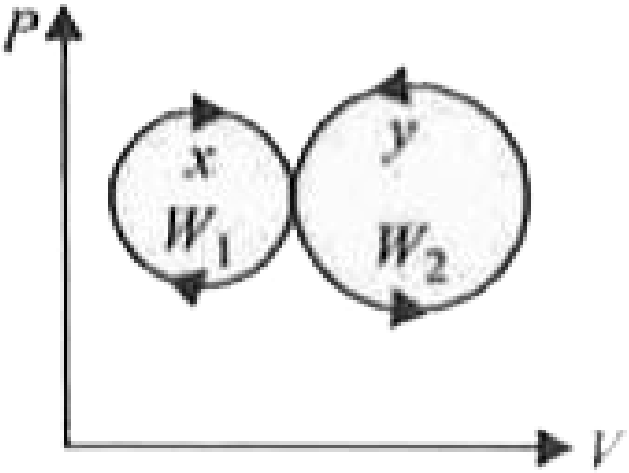
4. The P-V curves in two cases are shown as a smaller circle x and a bigger circle y, in the figure, Indicate whether the net work done is

positive or negative.



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5. If heat given to a system is 6 kcal and work done is 6kj, then calculate the change in internal energy.

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6. Two gram-moles of a gas are compressed isothermally at 273 K from $10m^3$ to $1m^3$. Calculate the work done during compression.

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7. Which of the following is correct for the case of isothermal expansion of an ideal gas ?

A. Q = 0

B. W = 0

C. $\Delta U = 0$

D. $\Delta U \neq 0$

Answer: C

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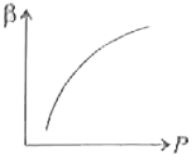
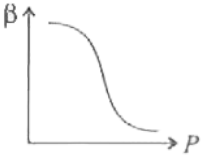
8. Which of the following graphs correctly represents the variation of $\beta = -\left(\frac{dV}{dP}\right)\frac{1}{V}$ with P for an ideal gas at constant temperature ?

A. 

B. 

C. 

D. 

Answer: A

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9. The pressure P_1 and density d_1 of a diatomic gas $(\gamma = 7/5)$ change to P_2 and d_2 during an adiabatic opertation. If $\frac{d_2}{d_1} = 32$, find $\frac{P_2}{P_1}$.

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10. The volume of air increases by 2% in its adiabatic expansion. Calculate the percentage decrease in pressure.

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11. Two moles of an ideal monoatomic gas occupy a volume V at $27^\circ C$. The gas expands adiabatically to a volume 8V. Find the change in internal energy of the system.

[Given $C_V = \frac{3R}{2} Jmol^{-1}.^\circ C^{-1}$]

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12. Ten moles of N_2, contained at constant pressure, is heated from $27^\circ C$ to $527^\circ C$. Calculate the amount of heat required. R - 2 cal /(mol $\times .^\circ C$).

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13. The pressure of a gas during an adiabatic operation, is found to be proportional to the cube of its absolute temperature. Calculate the ratio of specific heats of the gas.

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14. A monoatomic ideal gas, initially at temperature T_1 is enclosed in a cylinder fitted with a frictionless piston. The gas is allowed to expand adiabatically to a temperature T_2 by releasing the piston

suddenly. If L_1 and L_2 are the lengths of the gas column. before and after expansion respectively, then $\frac{T_1}{T_2}$ is given by

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15. A carnot engine maintains constant efficiency between 27 K and 527 K and between T K and 1054 K. Determine the unknown temperature.

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16. A Carnot's engine extract 1.5×10^3 kilocalorie of heat from a reservoir at $627^\circ C$ and exhaust it to a sink maintained at $27^\circ C$. How much work is performed by the engine ?

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17. A reversible heat engine converts one-sixth of heat, which it extracts from source, into work. When the temperature of the sink is reduce by $40^{\circ} C$, its efficiency is doubled. Find the temperature of source.

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18. Four engines are working between

Which one has maximum efficiency ?

A. 100 K and 80 K

B. 40 K and 20 K

C. 60 K and 40 K

D. 120 K and 100 K

Answer:

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19. A refrigerator whose coefficient of performance is 5 extracts heat from the cooling compartment at the rate of 250 J per cycle. How mush electric energy is spend per cycle ? How much heat per cycle is discharged to the room ?

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20. The coeffcient of performance of a refrigerator working between $10^{\circ} C$ and $20^{\circ} C$ is

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Neet Cafe Topicwise Practice Questions

1. Zeroth law of thermodynamics is related to

A. work

B. temperature

C. heat

D. internal energy

Answer: B

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2. Which of the following is not a state function ?

A. Temperature

B. Entropy

C. Pressure

D. Work

Answer: D

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3. Which of the following is not a thermodyanmic coordinate ?

A. Gas constant (R)

B. Pressure (P)

C. Volume (V)

D. Temperature (T)

Answer: A

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4. The first law of thermodynamics is concerned with conservation of

A. number of molecules

B. number of moles

C. energy

D. temperature

Answer: C

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5. γ represents the ratio of two specific heats of a gas. For a given mass of the gas, the change in internal energy when the volume expands from V to 3V to constant pressure P is

A. $\frac{3PV}{(\gamma-1)}$

B. $\frac{3PV}{(\gamma+1)}$

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

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

Answer: D

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

A. 30 K

B. 18 K

C. 50 K

D. 42 K

Answer: D

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7. If a gas (γ=4/3) is heated at constant pressure then what percentage of total heat supplied is used of external work ?

A. 0.25

B. 0.5

C. 0.75

D. 0.8

Answer: A

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8. A sample of ideal gas $(\gamma = 1.4)$ is heated at constant pressure. If 100 J of heat is supplied to the gas the work done by the gas is

A. 28.57 J

B. 56.54 J

C. 38.92 J

D. 65.38 J

Answer: A

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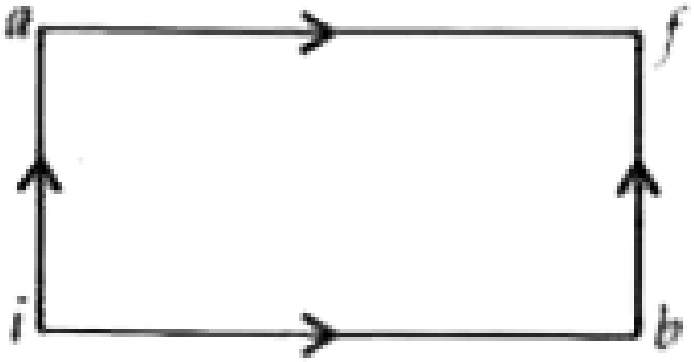
9. When a system is taken from state I to state f along the path iaf, it is found that Q = 50 cal and W = 20 cal. Along the path ibf, Q = 36 cal. W along the path ibf is



A. 14 cal

B. 6 cal

C. 16 cal

D. 66 cal

Answer: B

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

A. $6.75 \times 10^5 J$

B. $5.25 \times 10^5 J$

C. $3.25 \times 10^5 j$

D. $1.25 \times 10^5 J$

Answer: D

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11. A system is taken from state A to state N along two different paths 1 and 2. The heat absorbed and work done by system along these two paths are Q_1 and Q_2, and W_1 and W_2 respectively. Then

A. $Q_1 = Q_2$

B. $W_1 = W_2$

C. $Q_1 - W_1 = Q_2 - W_2$

D. $Q_1 + W_1 = Q_2 + W_2$

Answer: C

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12. For a diatomic gas change in internal energy for unit change in temperature for constant pressure and constant volume is ΔU_1 and ΔU_2 respectively. The ratio of $\Delta U_1 : \Delta U_2$ is

A. $5:3$

B. $3:5$

C. $1:1$

D. $5:7$

Answer: C

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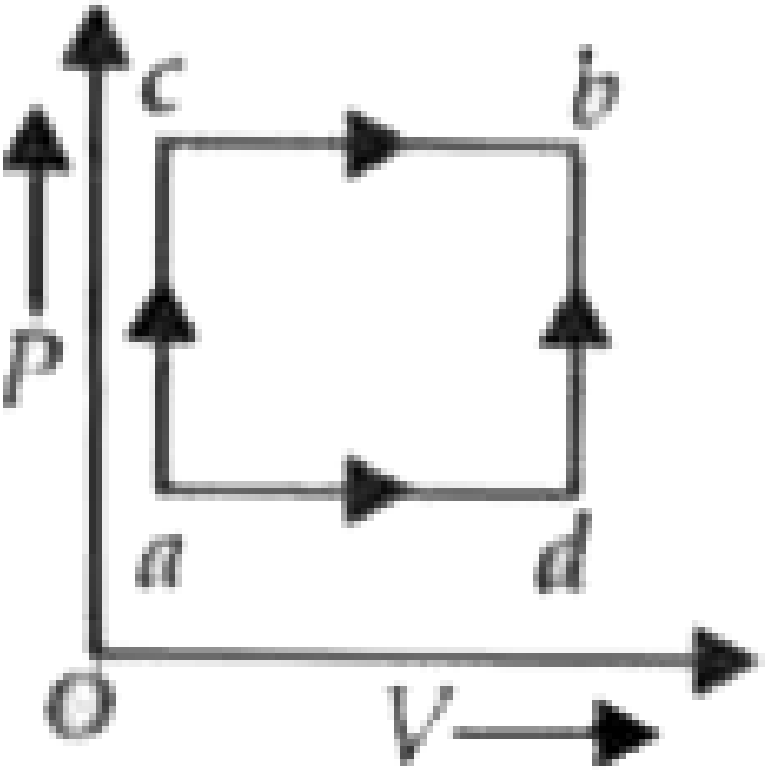
13. When a system is taken from stata a to state b along the path acb as shown in figure, 60 J of heat flows into the system and 30 J of work is done by the system. Along the path adb, if the work done by

the system is 10 J, heat flow into the system is



A. 100 J

B. 20 J

C. 80 J

D. 40 J

Answer: D

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14. Heat is supplied to a diatomic gas at constant pressure. The ratio of $\Delta Q : \Delta U : \Delta W$ is

A. $5:3:2$

B. $7:5:2$

C. $2:3:5$

D. $2:5:7$

Answer: B

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15. A system is taken from a given initial state to a given final state along various paths represented on a P-V diagram. The quantity that is independent of the path is

A. amount of heat transferred Q

B. amount of work done W

C. Q but not W

D. (Q-W)

Answer: D

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16. Which of the following is not a path function ?

A. ΔQ

B. $\Delta Q + \Delta W$

C. ΔW

D. $\Delta Q - \Delta W$

Answer: D

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17. If the amount of heat given to a system is 35 J and the amount of work done on the system is 15 J, then the change in internal energy of the system is

A. $-50J$

B. 20J

C. $-20J$

D. 50 J

Answer: D

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18. If a quantity of heat 1163.4 joule is suppled to one mole of nitrogen gas , at room temperature at constant pressure, then the rise in temperature is (Given $R = 8.31 J \text{mole}^{-1} K^{-1}$)

A. 54 K

B. 28 K

C. 65 K

D. 40 K

Answer: D

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19. During an adiabatic process, the pressure of a gas is found to be proportional to the cube of its absolute temperature. The ratio

C_P / C_V for gas is

A. $4/3$

B. 2

C. $5/3$

D. $3/2$

Answer: D

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

A. zero

B. more than the heat given to the system

C. equal to heat given to the system

D. inedpendent of heat given to the system

Answer: C

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21. One mole of an ideal gas $(\gamma = 1.4)$ is adiabatically compressed so that its temperature rises from $27^\circ C$ to $35^\circ C$. The change in the internal energy of the gas is (given R = 8.3 J/mole K)

A. $-166J$

B. 166 J

C. $-168J$

D. 168 J

Answer: B

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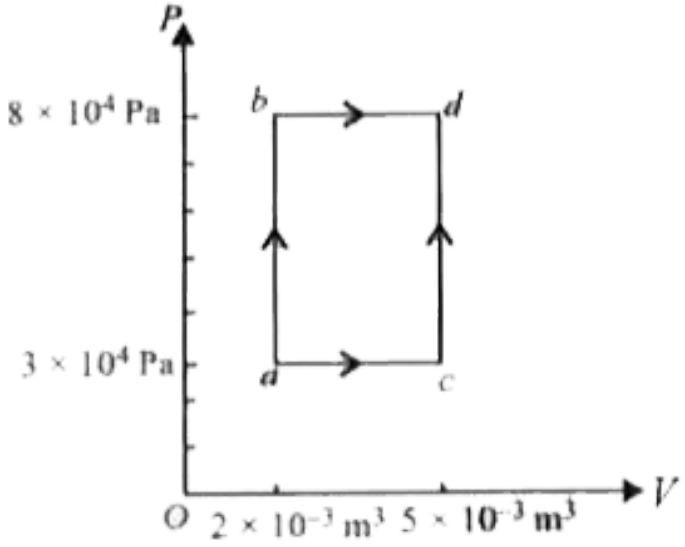
22. A thermodynamic process is shown in figure. In process ab, 600 J of heat is added, and in process bd 200 J of heat is added. The total heat added in process acd is



A. 550 J

B. 650 J

C. 750 J

D. 850 J

Answer: B

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23. Pressure P, volume V and temperature T of a certain material are related by $P = \alpha T^2 / V$ where α is contant. Work done by the material when temperature changes from T_0 to $2T_0$ and pressure remains constant is

A. $3\alpha T_0^2$

B. $5\alpha T_0^2$

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

D. $7\alpha T_0^2$

Answer: A

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24. In thermodynamic process which of the following statements is not true ?

A. In an isochoric process pressure remains constant.

B. In an isothermal process the temperature remains constant.

C. In an adiabatic process PV^{γ} = constant

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

Answer: A

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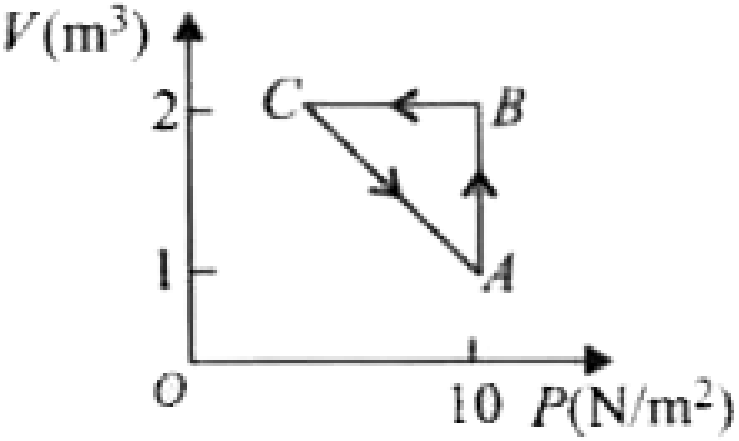
25. An ideal gas is taken through the cycle $A \rightarrow B \rightarrow C \rightarrow A$, as shown in figure. If the net heat supplied to the gas in the cycle is 5J,

the work done by the gas in the process $C \to A$ is



A. $-5J$

B. $-10J$

C. $-15J$

D. $-20J$

Answer: A

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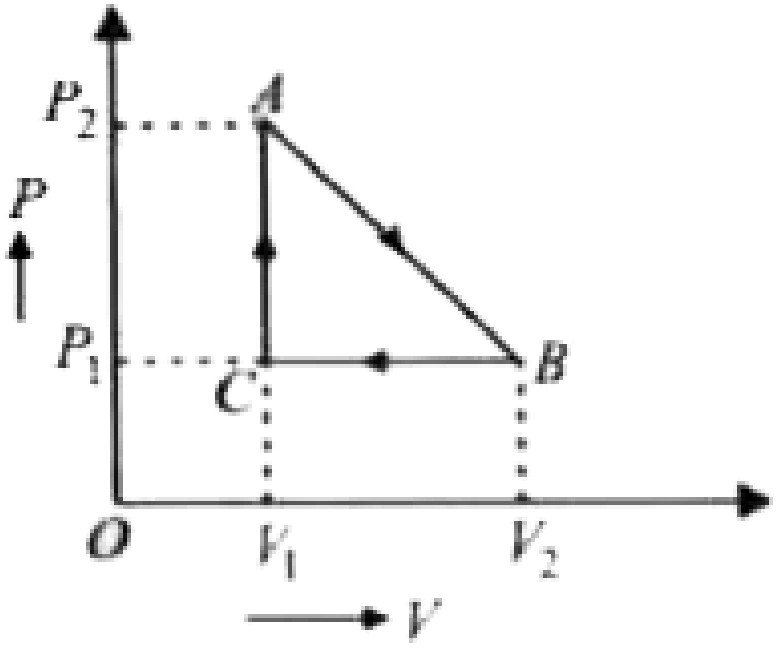
26. Work done by the system in closed path ABCA, as shown in figure is



A. zero

B. $(V_1 - V_2)(P_1 - P_2)$

C. $\frac{(P_2 - P_1)(V_2 - V_1)}{2}$

D. $\frac{(P_2 + P_1)(V_2 - V_1)}{2}$

Answer: C

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27. The relation between internal energy U, pressure P and volume V of a gas in an adiabatic process is

$U = a + bPV$

where a and b are positive constants. What is the value of γ ?

A. $\frac{a}{b}$

B. $\frac{b+1}{b}$

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

D. $\frac{b}{a}$

Answer: B

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28. Three samples of the same gas A, B and C $(\gamma = 3/2)$ have equal volume initially. Now, the volume of each sample is doubled. For A, the process is adiabatic , for B, it is isobaric and for C, the process is isothermal. If the final pressures are equal for all the three samples, the ratio of their initial pressures is

A. $2:1:\sqrt{2}$

B. $2\sqrt{2}:1:2$

C. $\sqrt{2}:1:2$

D. $\sqrt{2}:2:1$

Answer: B

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29. A one mole of an an ideal gas expands adiabatically at constant pressure such that its temperature $T \propto \frac{1}{\sqrt{V}}$.

A. 1.3

B. 1.5

C. 1.4

D. 2.0

Answer: B

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30. A motor car type has a pressure of 2 atmosphere at $27^{\circ} C$. It suddenly burts. If $C_P / C_V = 1.4$ for air, then the resulting temperature is

A. 27 K

B. $27^\circ C$

C. $-27^\circ C$

D. $246^\circ C$

Answer: C

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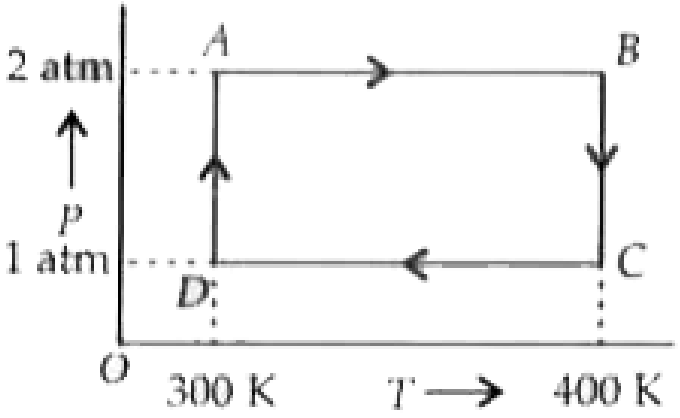
31. Two moles of helium gas undergo a cyclic process as shown in figure. Assuming the gas to be ideal. The net work done by the gas is



A. 200 Rln2

B. 100 Rln2

C. 300 Rln2

D. 400 Rln2

Answer: A

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32. Two identical containers A and B with frinctionless pistons contain the same ideal gas at the same temperature and the same volume V. The mass of gas A is m_A and that of B is m_B. The gas in each cylinder is now allowed to expand in the pressure in A and B are found to be ΔP and $1.5\Delta P$ respectively. Then

A. $4m_A = 9m_B$

B. $3m_A = 3m_B$

C. $3m_A = 2m_B$

D. $9m_A = 4m_B$

Answer: C

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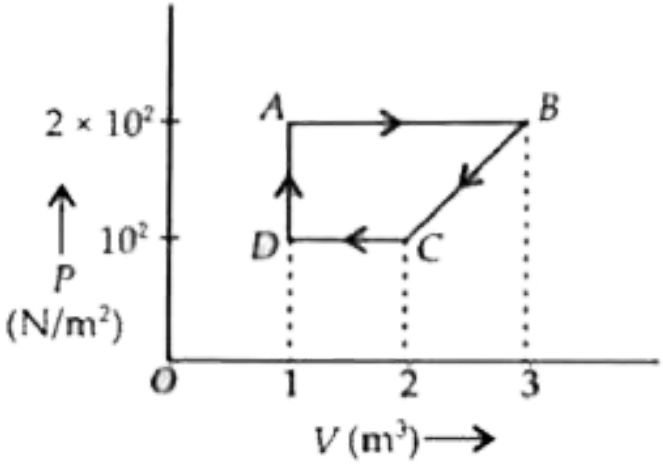
33. A cyclic process is shown in the figure. Work done during the cyclic process ABCDA is



A. 160 J

B. 150 J

C. 600 J

D. 900 J

Answer: B

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34. One mole of an ideal monatomic gas at temperature T_0 expands slowly according to the law $\frac{P}{V}$ = constant. If the final temperature is $2T_0$, heat supplied to the gas is

A. $2RT_0$

B. RT_0

C. $\frac{3}{2}RT_0$

D. $\frac{1}{2}RT_0$

Answer: A

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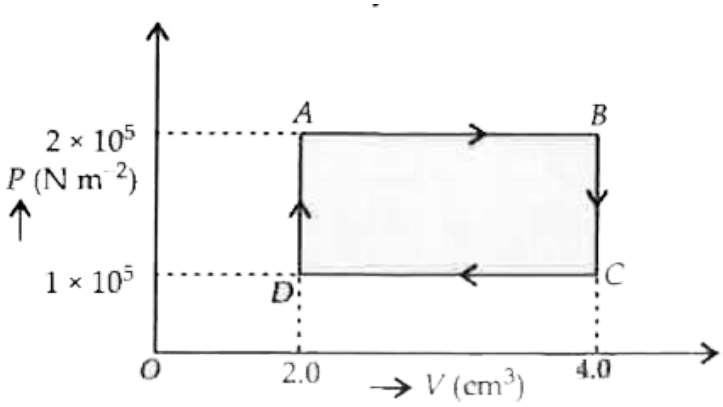
35. The P-V diagram of a gas undergoing a cyclic process (ABCDA) is shown in the graph, where P is in units of Nm^{-2} and V in cm^3. Identify the incorrect statement.



A. 0.4 J of work is done by the gas from A to B

B. 0.2 J of work is done on the gas from C to D.

C. No work is done by the gas from B to C.

D. Work is done by the gas from B to C and on the gas from D to A.

Answer: D

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36. 400 cc volume of a gas having $\gamma = 5/2$ is suddenly compressed to 100 cc. If the initial pressure is P, then the final pressure will be

A. P/32

B. 8P

C. 32P

D. 16 P

Answer: C

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37. A monoatomic gas initially at $17^{\circ}C$ is suddenly compressed to one eigth of its original volume. The temperature after compression is

A. 887 K

B. 36.25 K

C. 2320 K

D. 1160 K

Answer: D

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38. When a ideal gas with pressure P and volume V is compressed isothermally to one fourth of its volume, the pressure is P_1. When the same gas is compressed polytropically according to the

equation $PV^{1.5}$ = constant to one fourth of its initial volume, the pressure is P_2. THe ratio $\frac{P_1}{P_2}$ is

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

B. $\frac{1}{2^{1.5}}$

C. 2

D. $2^{1.5}$

Answer: A

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39. An ideal gas at pressure P and volume V is expanded to volume 2V. Column I represents the thermodynamic process used during expansion. Column II represents the work done during processes in

the random order.

Column I		Column II	
A.	Isobaric	P.	$PV\left(\frac{1-2^{1-\gamma}}{\gamma-1}\right)$
B.	Isothermal	Q.	PV
C.	Adiabatic	R.	$PV\ln 2$

A. $A \to Q, B \to R, C \to P$

B. $A \to Q, B \to P, C \to R$

C. $A \to P, B \to Q, C \to R$

D. $A \to R, B \to Q, C \to P$

Answer: A

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40. A gas expands with temperature according to the relation $V = KT^{2/3}$ where K is a constant. The work done by the gas when the temperature changes by 60 K is

A. 10 R

B. 30 R

C. 40 R

D. 20 R

Answer: C

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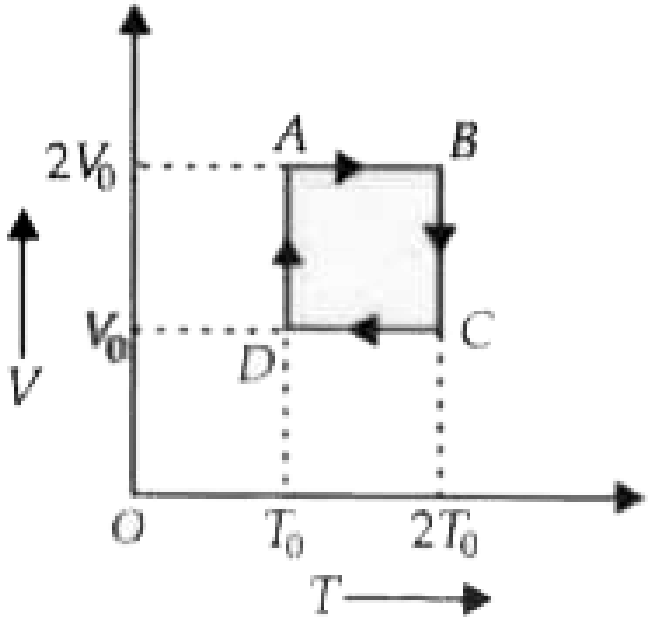
41. One mole of an ideal gas is taken through a cyclic process as shown in the V-T diagram. Which of the following statements is true

?



A. The magnitude of work done by the gas is $RT_0 \ln 2$.

B. Work done by gas is V_0T_0

C. Net work done by the gas is zero.

D. Work done by the gas is $2RT_0 \ln 2$.

Answer: A

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42. Pressure P, voluume V and temperature T for a certain gas are related by $P = \frac{AT - BT^2}{V}$ where A and B are constant. The work done by the gas as its temperature change from T_1 to T_2 with pressure remaining constant is

A. $A - \frac{B}{2}(T_2 - T_1)$

B. $A(T_2 - T_1) - B\left(T_2^2 - T_1^2\right)$

C. $\frac{A}{2}\left(T_2^2 - T_1^2\right) - \frac{B}{3}\left(T_2^3 - T_3^3\right)$

D. $A(T_2 - T_1)^2 - \frac{B}{3}(T_2 - T_1)^3$

Answer: B

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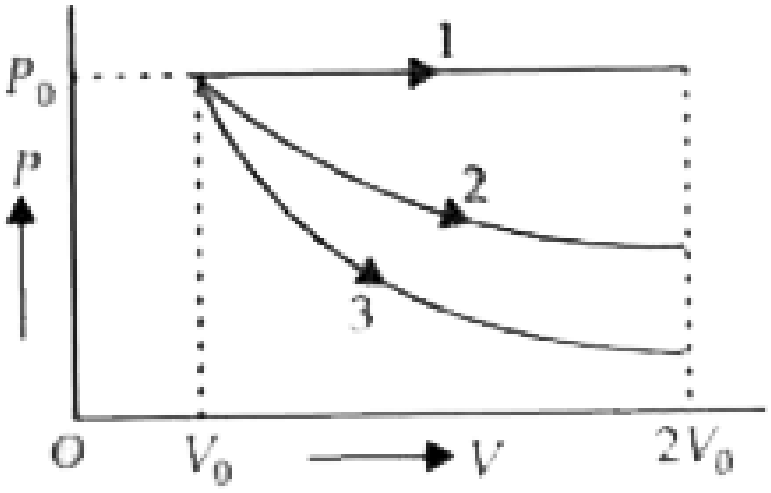
43. A gas is expanded from volume V_0 to $2V_0$ under three different processes, as shown in the figure. Process 1 is isobaric process,

process 2 is isothermal and process 3 is adiabatic. Let $\Delta U_1, \Delta U_2$ and ΔU_3 be the change in internal energy of the gas in these three processes. Then



A. $\Delta U_1 > \Delta U_2 > \Delta U_3$

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

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

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

Answer: A

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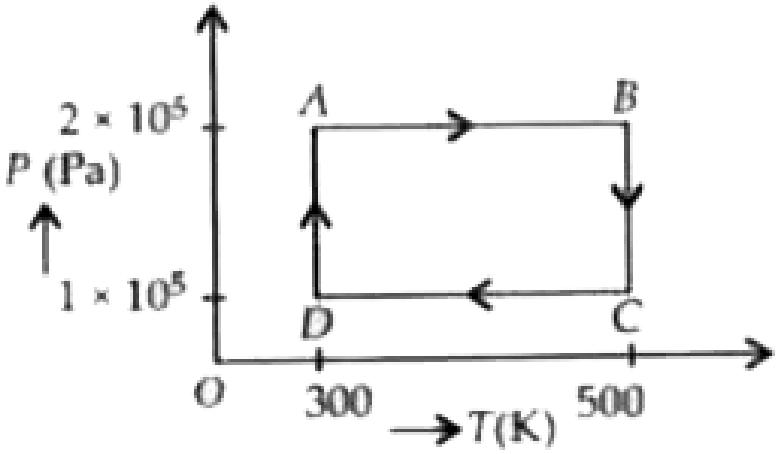
44. Two moles of helium gas are taken over the cycle ABCDA, as shown in below in P-T diagram. Assuming the gas to be ideal , the work done on the gas in taking it from A to B is



A. 300 R

B. 400 R

C. 500 R

D. 200 R

Answer: B

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45. The temperature of n moles of an ideal gas is increased from T to 4T through a process for which pressure $P = aT^{-1}$ where a is a constant. Then, the work done by the gas is

A. nRT

B. 4nRT

C. 2nRT

D. 6nRT

Answer: D

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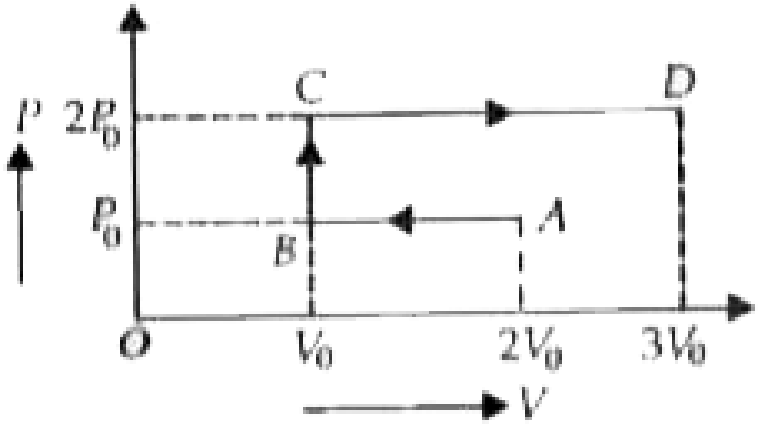
46. P-V diagram of an ideal gas is as shown in figure. Work done by the gas in the process ABCD is



A. $4P_0V_0$

B. $2P_0V_0$

C. $3P_0V_0$

D. P_0V_0

Answer: C

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47. For a monoatomic ideal gas undergoing an adiabatic change, the relation between temperature and volume is TV^x = constant, where x is

A. $7/5$

B. $2/5$

C. $2/3$

D. $1/3$

Answer: C

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48. A polyatomic gas $\left(\gamma = \frac{4}{3}\right)$ is compressed to $\frac{1}{(8)^{th}}$ of its volume adiabatically. If its initially pressure is P_0. Its new pressure will be

A. $8P_0$

B. $16P_0$

C. $6P_0$

D. $2P_0$

Answer: B

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49. An ideal gas with pressure P, volume V and temperature T is expanded isothermally to a volume 2V and a final pressure P_1. The same gas is expanded adiabatically to a volume 2V, the final final pressure is P_A. In terms of the ratio of the two specific heats for the gas γ, the ratio P_I / P_A is

A. $2^{\gamma - 1}$

B. $2^{1 - \gamma}$

C. 2^{γ}

D. 2γ

Answer: A

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50. A given mass of gas is compressed isothermally untal its pressure is doubled. It is then allowed to expand adiabatically until its original volume is restore and its pressure is then found to be 0.75 of its initial pressure. The ratio of the specific heats of the gas is approximately

A. 1.20

B. 1.4

C. 1.67

D. 1.83

Answer: B

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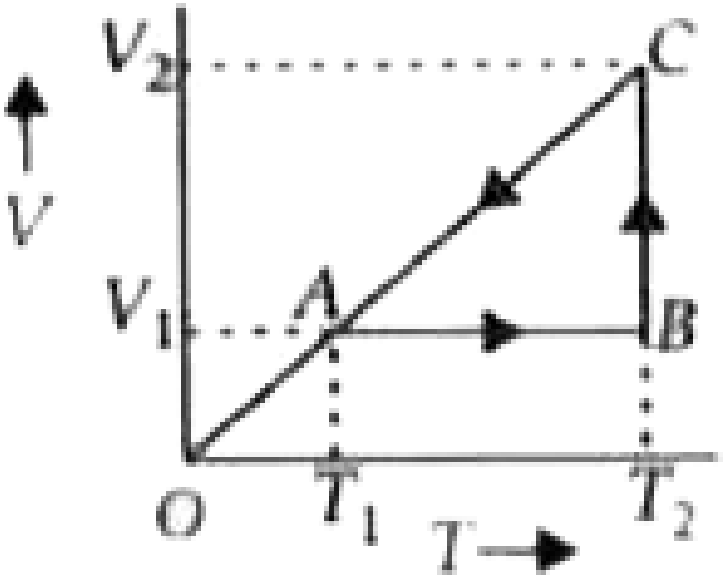
51. A cyclic process for 1 mole of an ideal gas is shown in the V-T diagram. The work done in AB, BC and CA respectively are



A. $0, RT_1 \ln\left(\frac{V_1}{V_2}\right), R(T_1 - T_2)$

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

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

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

Answer: D

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52. Starting with the same initial conditions, an ideal gas expands from volume V_1 to V_2 in three different ways. The work done by the gas is W_1 if the process is purely isothermal, W_2 if purely isobaric and W_3 is purely adiabatic. Then

A. $W_2 > W_1 > W_3$

B. $W_3 > W_1 > W_1$

C. $W_1 > W_2 > W_3$

D. $W_1 > W_3 > W_2$

Answer: A

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53. An ideal gas is taken round a cyclic process represened by the triangle ABC drawn in order on a P-V diagram. The coordinates of A, B, C are (4,1), (2,4), (2,1) respectively. The work done in the complete cycle is

A. 9 units

B. 6 units

C. 3 units

D. 0 units

Answer: C

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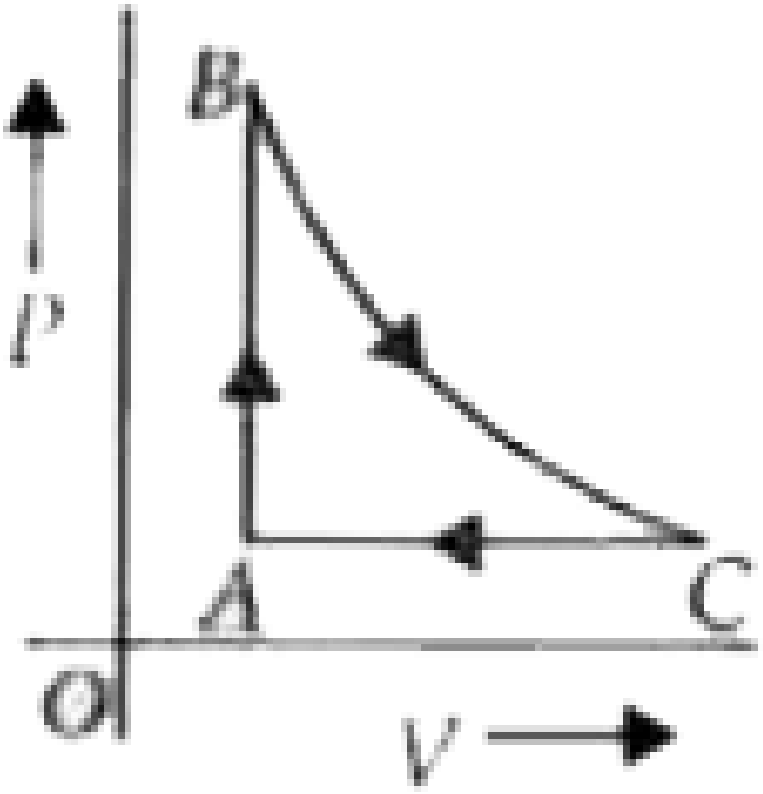
54. 0.2 moles of an ideal gas is taken round the cycle ABC as shown in the figure. The path $B \to C$ is an adiabatic process $A \to B$ is an isochoric process and $C \to A$ is an isobaric process. The temperature at A and B are $T_A 300K$ and $T_B = 500k$ and pressure at A is 1 atm and volume at A is 4.91. The volume at C is

(given :

$\gamma = \dfrac{C_P}{C_V} = \dfrac{5}{3}, R = 8.205 \times 10^{-2} L\text{atm mol}^{-1}K^{-1}, \left(\dfrac{3}{2}\right)^{2/5} = 0.81$

)



A. 6.9 L

B. 6.6 L

C. 5.5 L

D. 5.8 L

Answer: B

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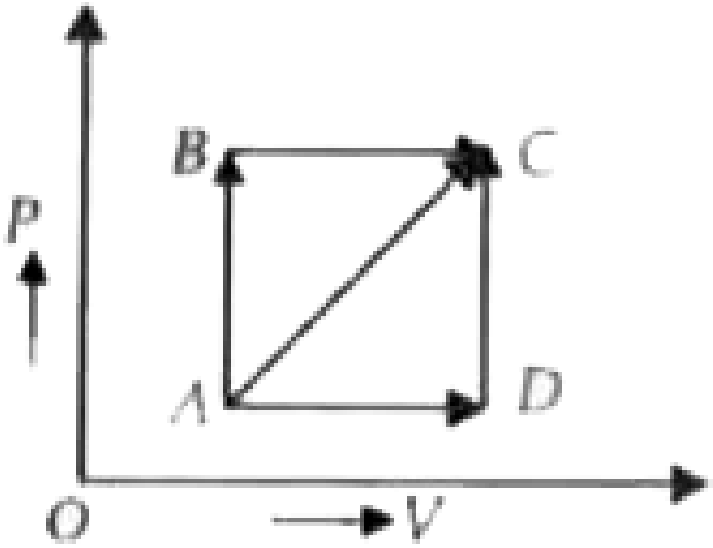
55. A thermodynamic process is as shown in figure such that

$P_A = 3 \times 10^4 Pa,$

$P_B = 8 \times 10^4 Pa,$

$V_A = 2 \times 10^{-3} m^3,$

$V_D = 5 \times 10^{-3} m^3$



In procss AB, 600 J of heat is added to the system and in process BC, 200 J of heat is added to the system. The change in internal energy of the system in proess AC is

A. 560 J

B. 800 J

C. 600 J

D. 640 J

Answer: A

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56. The thermodynamic process in which no work is done on or by the gas is

A. isothermal process

B. adiabatic process

C. isochoric process

D. isobaric process

Answer: C

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57. The work done by a gas is maximum when it expands

A. isothermally

B. adiabatically

C. isochorically

D. isobarically

Answer: D

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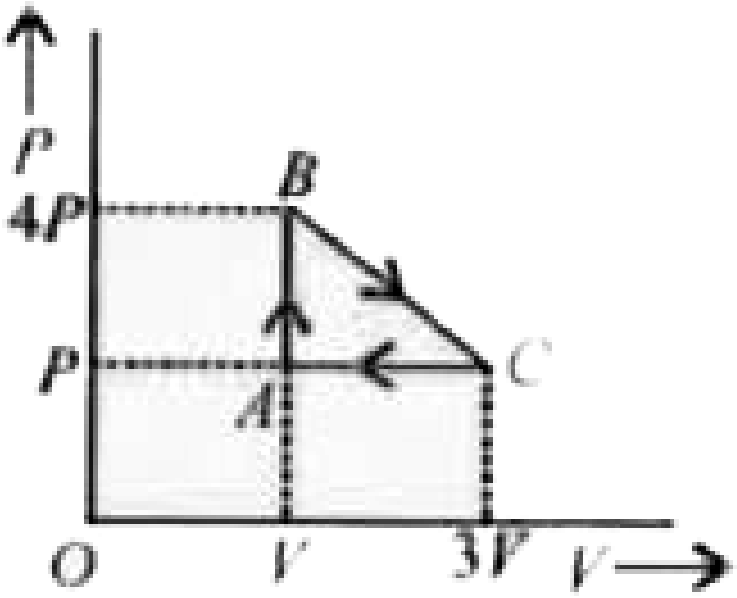
58. An ideal gas is taken around the cycle ABCA as shown in the P-V diagram.

The total work done by the gas during the cycle is



A. PV

B. 2PV

C. 4PV

D. 3PV

Answer: D

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59. No heat flows between the system and surroundings. Then the thermdynamic process is

A. isothermal

B. isochoric

C. adiabatic

D. isobaric

Answer: C

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60. The volume of one mole of an ideal gas changes from V to 2V at temperature 300 K. If R is universal gas constant, then work done in this process is

A. 300 Rln2

B. 600 Rln2

C. 300 ln2

D. 600 ln2

Answer: A

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61. "Heat cannot itself flow from a body at lower temperature to the body at higher temperature" is a statement or consequence of

A. second law of thermodynamics

B. conservation of momentum

C. conservation of mass

D. first law of thermodynamics

Answer: A

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62. The temperature T_1 and T_2 of heat reservoirs in the ideal Carnot engine are $1500^\circ C$ and $500^\circ C$ respectively. If T_1 increases by $100^\circ C$, what will be the efficiency of the engine ?

A. $62\ \%$

B. $59\ \%$

C. $65\ \%$

D. $100\ \%$

Answer: B

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63. A Carnot engine operates with source at 500 K and sink at 375 K. Engine consumes 600 kcal of heat per cycle. The heat rejected to sink per cycle is

A. 250 kcal

B. 350 kcal

C. 450 kcal

D. 550 kcal

Answer: C

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

A. $99^\circ C, 27^\circ C$

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

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

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

Answer: A

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65. The efficiency of a carnot engine working between temperature T_1 and T_2 is η. It will be also η if it works between temperatures

A. $T_1 + 10$ and $T_2 + 10$

B. $T_1 - 10$ and $T_2 - 10$

C. $2T_1$ and $2T_2$

D. in all the above cases

Answer: C

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66. An engineer claims to have made an engine delivering 10 kW power with fuel consumption of 1g/sec. The calorific value of the fuel is 2 kcal/g. The claim of the engineer

A. is valid

B. is invalid

C. depends on engine design

D. depends on the load

Answer: B

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

A. 30 kJ

B. 10 kJ

C. 4 kJ

D. 1 kJ

Answer: B

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68. An ideal gas hea engine operates in a Carnot cycle between $227^{\circ}C$ and $127^{\circ}C$. It absorbs 6 kcal of heat at higher temperature. The amount of heat in kcal rejected to sink is

A. 4.8

B. 2.4

C. 1.2

D. 6.0

Answer: A

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69. The efficiency of Carnot engine is 50% and temperature of sink is 500 K. If temperature of source is kept constant and its efficiency raised to 60%, then the required temperature of sink will be

A. 100 K

B. 600 K

C. 400 K

D. 500 K

Answer: C

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70. A heat engine has an efficiency η. Temperature of source and sink are each decreased by 100 K. Then, the efficiency of the engine

A. increases

B. decreases

C. remains constant

D. becomes 1

Answer: A

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71. A steam engine delivers $5.4 \times 10^8 j$ of work per minute and absorbs $3.6 \times 10^9 J$ of heat per minute from its boiler. What is the efficiency of the engine ?

A. $10\ \%$

B. $12\ \%$

C. $15\ \%$

D. $18\ \%$

Answer: C

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72. A refrigerator is to maintain eatables kept inside at $9^{\circ}C$. The coefficient of performance of the refrigerator if room temperature is $36^{\circ}C$, is

A. 10.4

B. 11.4

C. 12.4

D. 13.4

Answer: A

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73. The inside and outside temperature of a refrigerator are 273 K and 303 K respectively. Assuming that refrigerator cycle is reversible for every joule of work done, the heat delivered to the surroundings will be

A. 10 J

B. 20 J

C. 30 J

D. 50 J

Answer: A

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74. A Carnot engine takes 3×10^6 cal of heat from a reservoir at $627^\circ C$ and gives it to a sink $27^\circ C$. The work done by the engine is

A. $4.2 \times 10^6 J$

B. $8.4 \times 10^6 J$

C. $16.8 \times 10^6 J$

D. zero

Answer: B

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75. A Carnot engine will sink temperature at $17^{\circ}C$ has 50% efficiency. By now much should its source temperature by changed to increase its efficiency to 60% ?

A. 225 K

B. $128^{\circ}C$

C. 580 K

D. 145 K

Answer: D

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76. A Carnot's reversible engine converts $\frac{1}{6}$ of heat input into work. When the temperature of the sink is reduced by 62 K, the efficiency of Carnot's cycle becomes (1/3). The temperature of the source and the sink, in kelvin, are respectively

A. 372, 310

B. 472, 410

C. 310, 372

D. 744, 682

Answer: A

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77. A Carnot engine whose efficiency is 40%, receives heat at 500 K. If the efficiency is to be 50%, the source temperature for the same exhaust temperature is

A. 900 K

B. 600 K

C. 700 K

D. 800 K

Answer: B

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78. A Carnot cycle has the reversible processes in the following order :

A. Isothermal expansion, adiabatic expansion, isothermal compression and adiabatic compression

B. Isothermal compression, adibatic expansion, isothermal expansion and adiabatic compression.

C. Isothermal expansion, adiabatic compression, isothermal compression and adibatic expansion

D. Adiabatic expansion, isothermal expansion, adiabatic compression and isothermal compression.

Answer: A

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79. If the energy input to a carnot engine is thrice the work it performs then, the fraction of energy rejected to the sink is

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

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

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

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

Answer: C

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80. Two Carnot engines A and B are operated in series. The engine A receives heat from the source at temperature T_1 and rejects the heat to the sink at temperature T. The second engine B receives the heat at temperature T and rejects to its sink at temperature T_2. For what value of T the efficiencies of the two engines are equal.

A. $\frac{T_1 - T_2}{2}$

B. $T_1 T_2$

C. $\sqrt{T_1 T_2}$

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

Answer: C

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Neet Itals

1. "Two systems in thermal equilibirum with a third system separately are in thermal equilibrium with each other". The aove statement is

A. First law of thermodynamics

B. Second law of thermodynamics

C. Third law of thermodynamics

D. Zeroth law of thermodynamics

Answer: D

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2. A geyser heats water flowing at the rate of 4 litre per minute from $30^{\circ}C$ to $85^{\circ}C$. If the geyser operates on a gas burner then the amount of heat used per minute is

A. $9.24 \times 10^{5} J$

B. $6.24 \times 10^{7} J$

C. $9.24 \times 10^{7} J$

D. $6.24 \times 10^{5} J$

Answer: A

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3. The amount of heat supplied to $4 \times 10^{-2} kg$ of nitrogen at room temperature to rise its temperature by $50^{\circ}C$ at constant pressure is (Molecular mass of nitrogen is 28 and $R = 8.3 Jmol^{-1} K^{-1}$)

A. 2.08 kJ

B. 3.08 kJ

C. 4.08 kJ

D. 5.08 kJ

Answer: A

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4. If two bodies at different temperatures T_1 and T_2 are brought in thermal contact, the mean temperature $\frac{T_1 + T_2}{2}$. When

A. mass of two bodies are equal

B. pressure on two bodies are equal

C. therma capacities of two bodies are equal

D. volume of two bodies are equal

Answer: C

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5. When the state of a gas adiabatically changed from an equilibrium state A to another equilibrium state B, an amount of work 35 J is done on the system. If the gas is taken from state A to B via process in which the net heat absorbed by the system is 12 cal, then net work done by the system in the latter case is (1 cal = 4.19 J)

A. 13.2 J

B. 15.4 J

C. 12.6 J

D. 16.8 J

Answer: B

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6. The coefficient of performance of a refrigerator if it is to maintain eatables kept inside at $7^{\circ}C$ and the room temperature is $38^{\circ}C$ is

A. 15.5

B. 16.3

C. 20.1

D. 9.03

Answer: D

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7. If an engine delivers $9.5 \times 10^{6}J$ of work per hour and absorbs $6.2 \times 10^{7}J$ of heat per hour, then the amount of heat wasted per hour is

A. $6.95 \times 10^7 J$

B. $5.25 \times 10^7 J$

C. $8.55 \times 10^7 J$

D. $9.55 \times 10^7 J$

Answer: B

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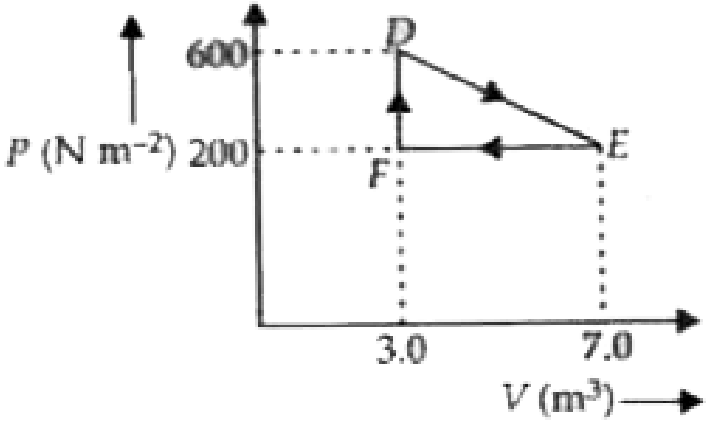
8. A thermodynamics process is carried out from an original state D to an intermediate state E by the linear process shown in figure, the

total work is done by the gas from D to E to F is



A. 100 J

B. 450 J

C. 300 J

D. 250 J

Answer: B

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9. A Carnot's cycle operating between $T_1 = 600K$ and $T_2 = 300K$ producing 1.5 kJ of mechanical work per cycle. The heat transferred to the engine by the reservoirs is

A. 2.5 kJ

B. 3 kJ

C. 3.5 kJ

D. 4 kJ

Answer: B

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10. If an average person jogs, produces $1.25 \times 10^5 cal \ \min^{-1}$. This is removed by the evporation of sweat. The amount of sweat

evaporated per minute if 1 kg requires 5.8×10^5 cal for evaporation is

A. 0.25 kg

B. 2.25 kg

C. 0.22 kg

D. 0.15 kg

Answer: C

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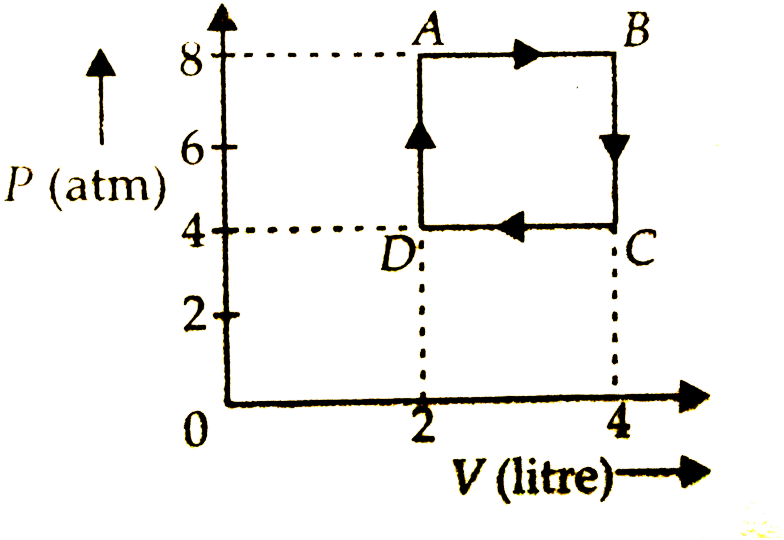
11. One mole of an ideal gas undergoes a cyclic process ABCDA as shown in the P-V diagram, The net work done in the process is

$(1atm = 10^6 dy \neq cm^{-2})$ ltbvrgt



A. 500 J

B. 700 J

C. 800 J

D. 900 J

Answer: C

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12. The conclusion of second law of thermodynamics is that

A. no heat engine can have efficiency η equal to zero.

B. no heat engine can have efficiency η equal to one.

C. no heat engine can have efficiency η greater than one.

D. no heat engine can have efficiency η less than one.

Answer: B

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13. A person of mass 70 kg wants to lose 5 kg by going up and down a 10 m high stairs. He burns twice as much fat while going up than coming down. If 1 kg is burnt on expending 7000 kilocalories, the number of times he must go up and down to reduce his weight by 4 kg is

A. 1000

B. 5600

C. 22400

D. 11200

Answer: D

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14. The relation between the slope of isothermal curve and slope of adiabatic curve is

A. slope of adiabatic curve $= \gamma$ times slope of isothermal curve

B. slope of isothermal curve $= \gamma$ times slope of adiabatic curve

C. slope of adiabatic curve $= \gamma^2$ times slope of isothermal curve

D. slope of isothermal curve $= \gamma^2$ times slope of adiabatic curve

Answer: A

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15. In a cyclic process, which of the following statements is not correct ?

A. Change in internal energy is zero.

B. The system returns to its initial state and it is reversible.

C. The total heat absorbed by the system is equals to work done by the system.

D. Change in internal energy is not zero.

Answer: D

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16. An ideal gas system undergoes an isothermal process, then the work done during the process is

A. $nRT \ln\left(\frac{V_2}{V_1}\right)$

B. $nRT \ln\left(\frac{V_1}{V_2}\right)$

C. $2nRT \ln\left(\frac{V_2}{V_1}\right)$

D. $2nRT \ln\left(\frac{V_1}{V_2}\right)$

Answer: A

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17. A monoatomic gas is compressed adiabatically to $1/4^{th}$ of its original volume, the final pressure of gas in terms of initial pressure

P is

A. 7.08 P

B. 8.08 P

C. 9.08 P

D. 10.08 P

Answer: D

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18. An engine has an efficiency of 0.25 when temperature of sink is reduced by $58^\circ C$, if its efficiency is doubled, then the temperature of the source is

A. $150^\circ C$

B. $222^\circ C$

C. $242^\circ C$

D. $232^\circ C$

Answer: D

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19. A definite mass of a gas at $60^\circ C$ and 80 cm of mercury pressure is compressed slowly. If the final volume is half of the initial volume then the final pressure of the gas is $(\gamma = 3/2)$

A. 120 cm of Hg

B. 140 cm Hg

C. 160 cm of Hg

D. 180 cm of Hg

Answer: D

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20. An ideal gas at pressure P is adiabatically compressed so that its density becomes n times the initial value. The final pressure of the gas will be $\left(\gamma = \frac{C_P}{C_V}\right)$

A. $n^{\gamma}P$

B. $(n-\gamma)P$

C. $n(\gamma-1)P$

D. $n(1-\gamma)P$

Answer: A

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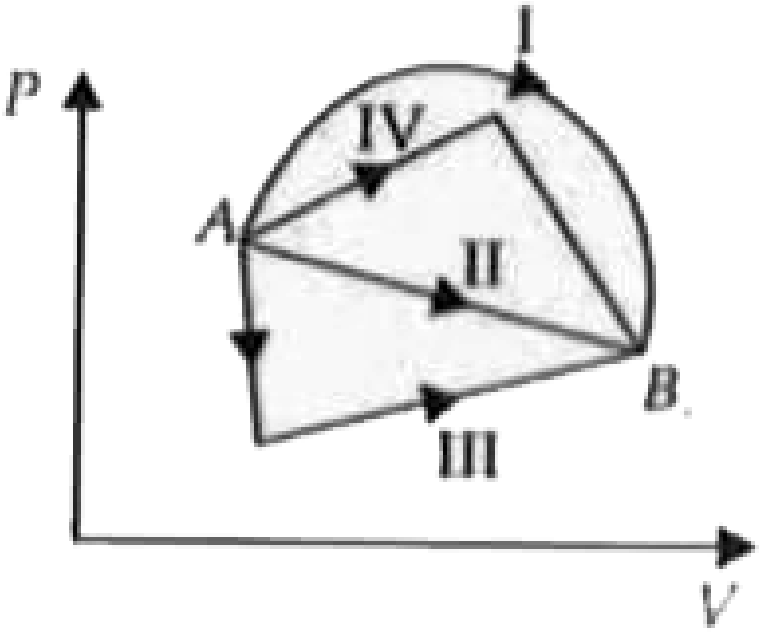
21. The given P - V diagram is showing an ideal gas undergoing a change of state different paths I, II, III and IV that lead to the same change of state, then change in internal energy is



A. maximum along path 1

B. maximum and same along paths III and IV

C. minimum along path II

D. same in all the four cases

Answer: D

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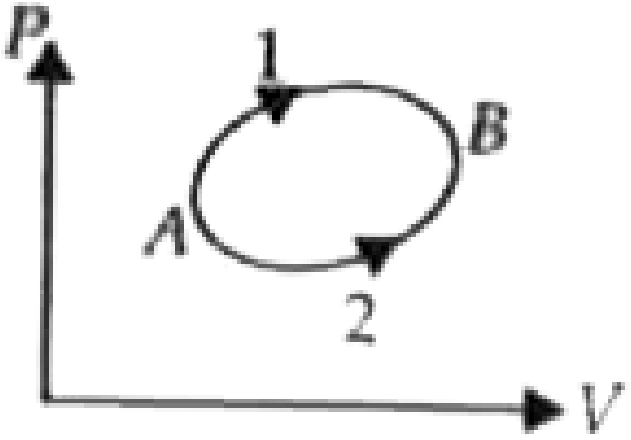
22. A system goes from P to Q by two different paths in the P-V diagram as shown in figure. Heat given to the system in path 1 is 1100 J, the work done by the system along path 1 is more than path 2 by 150 J. The heat exchanged by the system in path 2 is



A. 800 J

B. 750 J

C. 1050 J

D. 950 J

Answer: D

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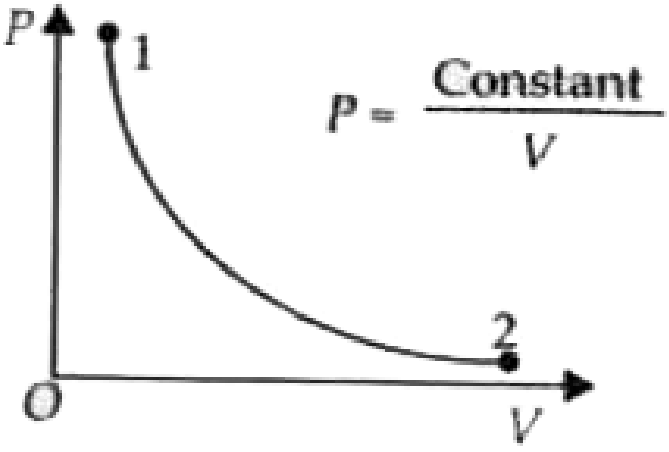
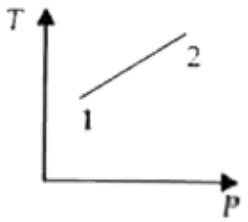
23. The P-V diagram for an ideal gas is shown in figure.

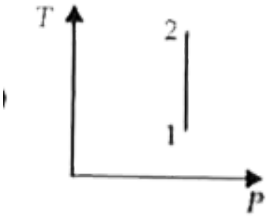


Out of the following diagrams which one represents the T-P diagram ?

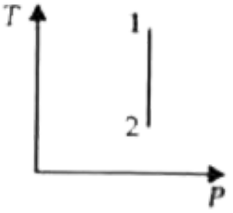
A.



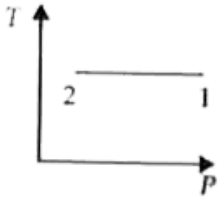
B.



C.



D.



Answer: D

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24. Consider two containers A and B containing identical gases at the same pressure, volume and temperature. The gas in container A is compressed to half of its original volume isothermal while the gas in container B is compressed to half of its original value adiabatically. The ratio of final pressure of gas in B to that of gas in A is

A. $2^{\gamma-1}$

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

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

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

Answer: A

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25. A carnot cycle has the reversible process in the following order:

A. Isothermal expansion, adiabatic expansion, isothermal compression and adiabatic compression

B. Isothermal compression, adibatic expansion, isothermal expansion and adiabatic compression.

C. Isothermal expansion, adiabatic compression, isothermal compression and adibatic expansion

D. Adiabatic expansion, isothermal expansion, adiabatic compression and isothermal compression.

Answer: A

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Aipmt Neet Mcqs

1. If ΔU and ΔW represent the increase in internal energy and work done by the system respectively in a thermodynamical process, which of the following is true ?

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

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

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

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

Answer: A

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2. A monatomic gas at pressure P_1 and volume V_1 is compressed adiabatically to $\frac{1}{(8)^{th}}$ of its original volume. What is the ginal pressure of the gas ?

A. $64P_1$

B. P_1

C. $16P_1$

D. $32P_1$

Answer: D

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3. During an isothermal expansion, a confined ideal gas does -150 J of work against its surroundings. This implies that

A. 150 J of heat has been removed from the gas

B. 300 J of heat has been added to the gas

C. no heat is transferred because the process is isothermal

D. 150 J of heat has been added to the gas

Answer: D

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

A. 8 atm

B. 28 atm

C. 68.7 atm

D. 256 atm

Answer: D

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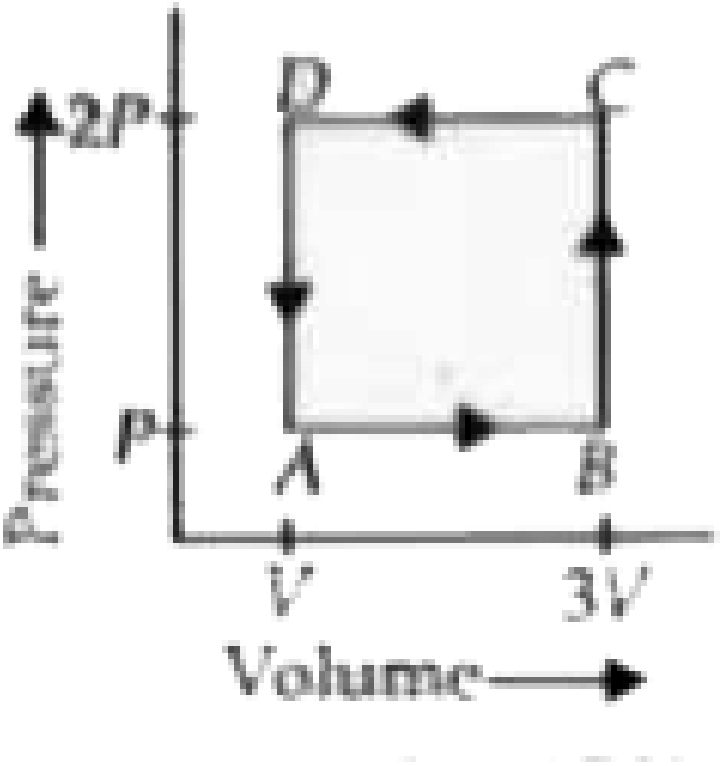
5. A thermodynamic system is taken through the cycle ABCD as shown in figure. Heat rejected by the gas during the cycle is



A. 2PV

B. 4PV

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

D. PV

Answer: A

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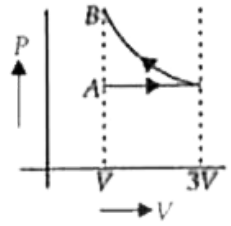
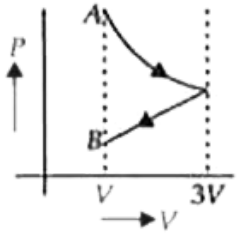
6. One mole of an ideal gas goes from an initial state A to final state B via two processes : It first undergoes isothermal expansion from volume V to 3V then its volume is reduced from 3V to V at constant pressure. The correct P-V diagram representing the two processes is

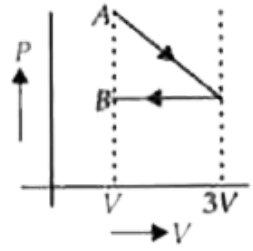
A.



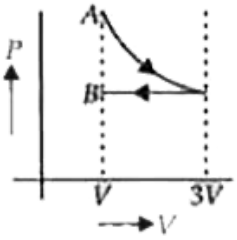
B.



C.



D.

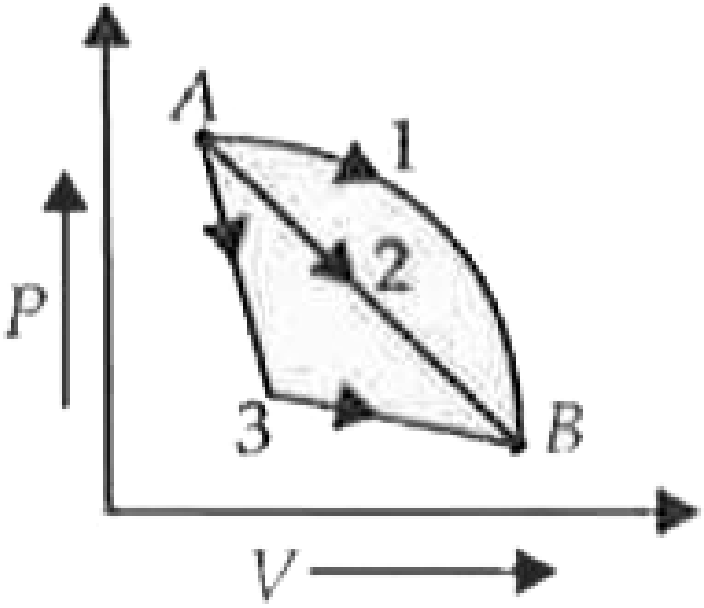


Answer: D

View Text Solution

7. An ideal gas goes from state A to state B via three different processes as indicated in the P-V diagram. If Q_1, Q_2, Q_3 indicate the heat absorbed by the gas along the three processes and $\Delta U_1, \Delta U_2, \Delta U_3$ indicate the change in internal energy along the

three processes respectively, then



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

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

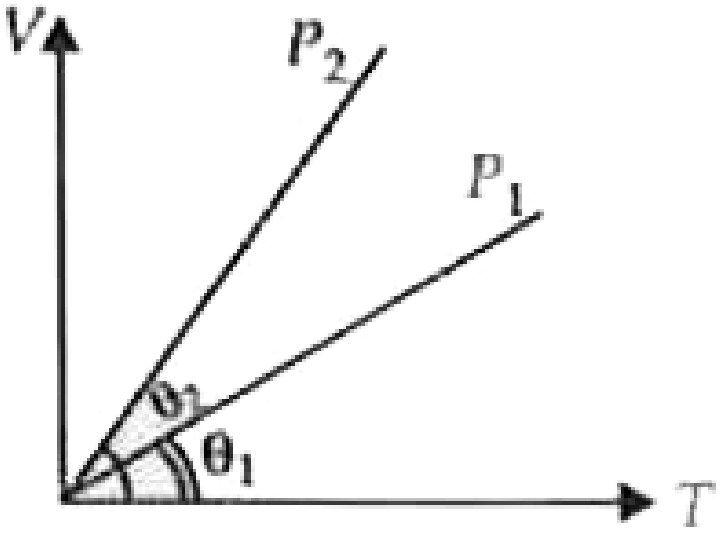
C. $Q_1 = Q_2 = Q_3$ and $\Delta U_1 > \Delta U_2 > \Delta U_3$

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

Answer: A

View Text Solution

8. In the given (V-T) diagram, what is the relation between pressures P_1 and P_2 ?



A. $P_2 > P_1$

B. Cannot be predicted

C. $P_2 = P_1$

D. $P_2 > P_1$

Answer: A

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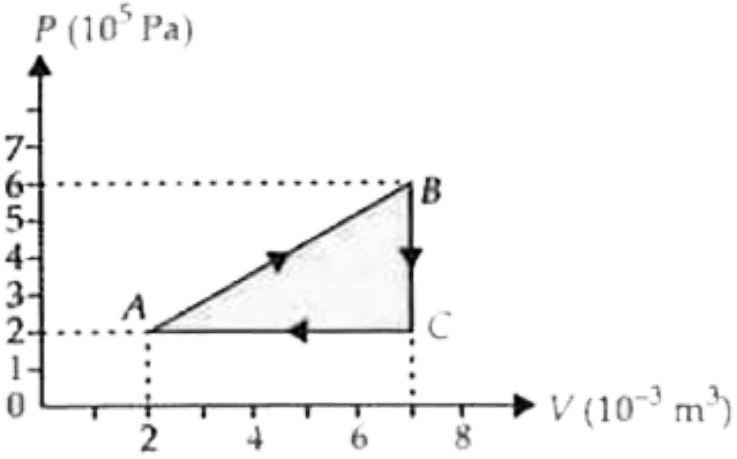
9. A gas is taken through the cycle $A \to B \to C \to A$, as shown. What is the net work done by the gas ?



A. zero

B. $-2000J$

C. 2000 J

D. 1000 J

Answer: D

View Text Solution

10. During an adiabatic process, the pressure of a gas is found to be proportional to the cube of its temperature. The ratio of $\frac{C_P}{C_V}$ for the gas is

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

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

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

D. 2

Answer: B

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11. A monoatomic gas at a pressure P, having a volume V expands isothermally to a volume 2V and then adiabatically to a volume 16 V.

The final pressure of the gas is (Take $\gamma = 5/3$)

A. 64 P

B. 32 P

C. P/64

D. 16 P

Answer: C

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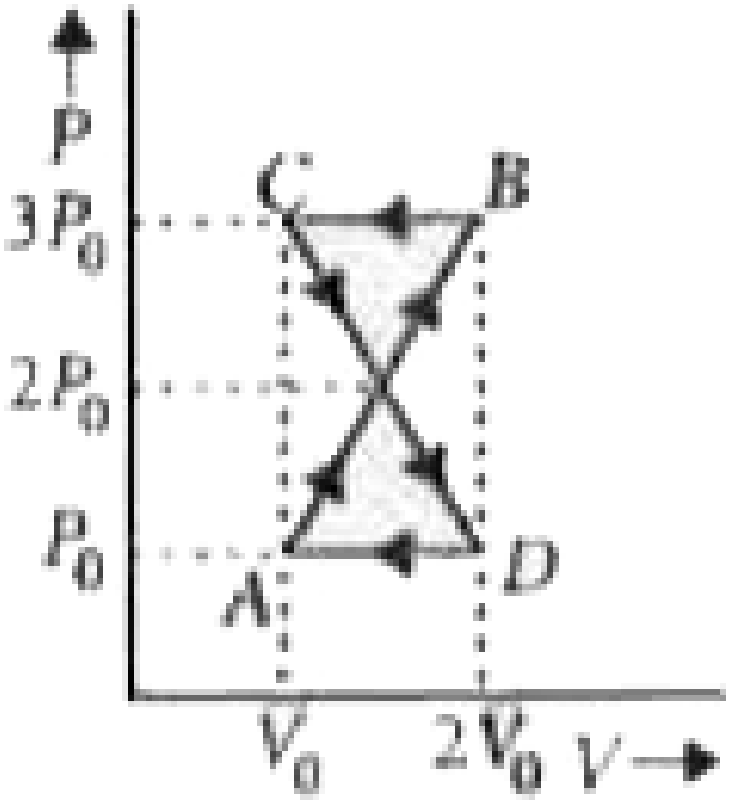
12. A thermodynamic system undergoes cyclic process ABCDA as shown in figure. The work done by the system in the cycle is



A. P_0V_0

B. $2P_0V_0$

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

D. zero

Answer: D

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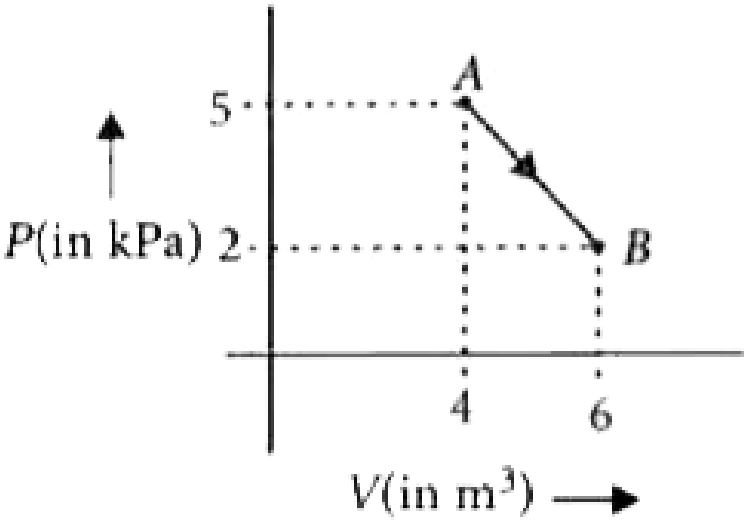
13. One mole of an ideal diatomic gas undergoes a transition from A to B along a path AB as shown in the figure. The change in internal energy of the gas during the transition is



A. 20 J

B. $-12kJ$

C. 20 kJ

D. $-20kJ$

Answer: D

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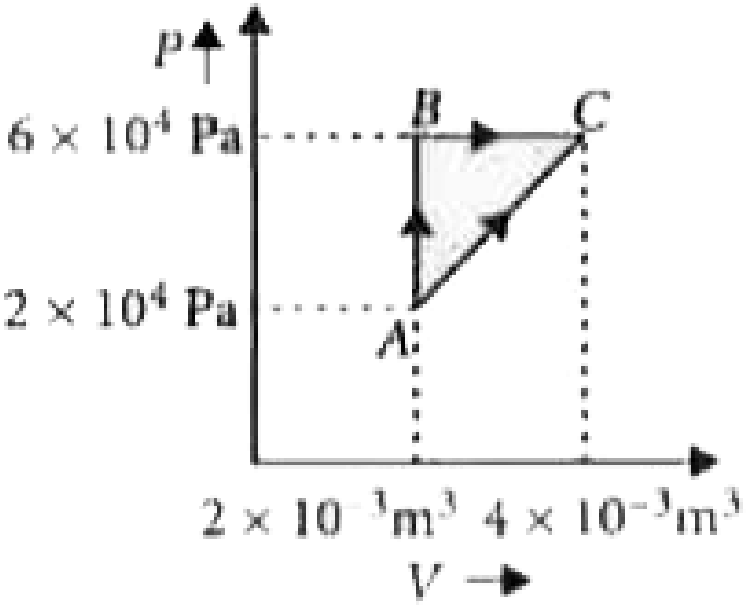
14. Figure below shows two paths that may be taken by a gas to go from state A to a state C. In process AB, 400 Jof heat is added to the system and in proces BC, 100 J of heat is added to the system. The heat absorbed by the system in the process AC will be



A. 460 J

B. 300 J

C. 380 J

D. 500 J

Answer: A

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15. An ideal gas is compressed to haf f its initial volume by means of several processes. Which of the process results in the maximum work done on the gas ?

A. Isochoric

B. Isothermal

C. adiabatic

D. isobaric

Answer: C

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16. The coefficient of performace of a refrigerator is 5. If the temperature inside freezer is $-20^{\circ}C$, the temperature of the surroundings to which it rejects heat is

A. $11^{\circ}C$

B. $21^{\circ}C$

C. $31^{\circ}C$

D. $41^{\circ}C$

Answer: C

View Text Solution

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

A. Compressing the gas isothermally or adiabatically will require the same amount of work.

B. Which of the case (whether compression through isothermal or through adiabatic process) requires more work will depend upon the atomicity of the gas.

C. Compressing the gas isothermally will require more work to be done.

D. Compressing the gas through adiabatic process will require more work to be done.

Answer: D

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18. A refrigerator works between $4^\circ C$ and $30^\circ C$. It is required to remove 600 calories of heat every second in order to keep the temperature of the refrigerator space constant. The power required is (Takae 1 cal = 4.2 Joules)

A. 236.5 W

B. 2365 W

C. 2.365 W

D. 23.65 W

Answer: A

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

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

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

C. 2R

D. R

Answer: D

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20. The temperature inside a refrigerator is $t_2^\circ C$ and the room temperature is $t_1.^\circ C$. The amount of heat delivered to the room for each joule of electrical energy consumed ideally will be

A. $\frac{t_1}{t_1 - t_2}$

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

C. $\frac{t_2 + 273}{t_1 - t_2}$

D. $\frac{t_1 + t_2}{t_1 + 273}$

Answer: B

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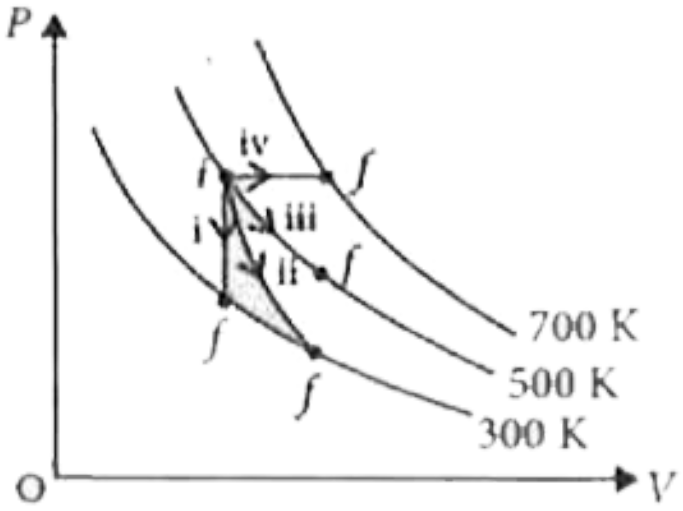
21. Thermodynamic process are indicated in the following diagram.



Match the following

Column-1		Column-2	
P.	Process I	A.	Adiabatic
Q.	Process II	B.	Isobaric
R.	Process III	C.	Isochoric
S.	Process IV	D.	Isothermal

A. $P \rightarrow C, Q \rightarrow A, R \rightarrow D, S \rightarrow B$

B. $P \rightarrow C, Q \rightarrow D, R \rightarrow B, S \rightarrow A$

C. $P \rightarrow D, Q \rightarrow B, R \rightarrow A, S \rightarrow C$

D. $P \to A, Q \to C, R \to D, S \to B$

Answer: A

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22. A carnot engine having an efficiency of $\frac{1}{10}$ as heat engine, is used as a refrigerator. If the work done on the system is 10 J, the amount of energy absorbed from the reservoir at lower temperature is

A. 90 J

B. 99 J

C. 100 J

D. 1 J

Answer: A

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

A. 104.3 J

B. 208.7 J

C. 42.2 J

D. 84.5 J

Answer: B

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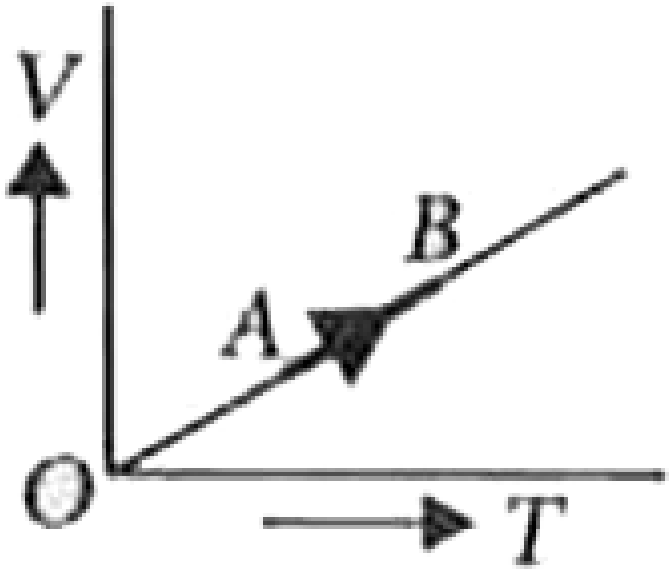
24. The volume (V) of a moatomic gas varies with its temperature (T), as shown in the graph. The ratio of work done by the gas, to the heat absorbed by it, when it undergoes a change from state A to state B, is



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

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

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

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

Answer: A

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

A. $26.8\ \%$

B. $20\ \%$

C. $6.25\ \%$

D. $12.5\ \%$

Answer: A

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26. In which of the following processes, heat is neither absorbed nor released by a system ?

A. isochoric

B. isothermal

C. adiabatic

D. isobaric

Answer: C

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