PHYSICS

BOOKS - CP SINGH PHYSICS (HINGLISH)

LAWS OF THERMODYNAMICS

EXAMPLE

1. A thermally insulated, closed copper vessel contains water at $15^\circ C$. When the vessel is shaken vigorously for 15 minuts, the temperature rises to $17^\circ C$. The mass of the vessel is 100 g and that of the water is 200 g. The specific heat capacities of copper and water are

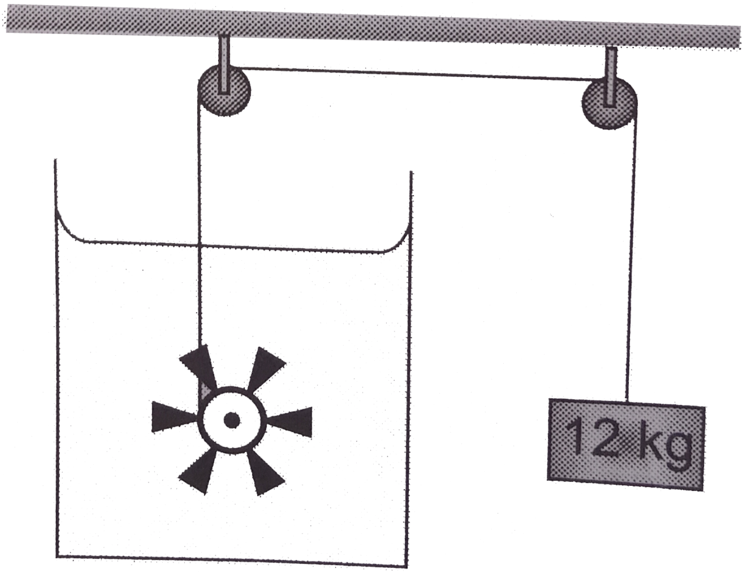
$420\frac{J}{kg-K}$ and $4200\frac{J}{kg-K}$ resprectively. Neglect any thermal expansion.

(a) How much heat is transferred to the liquid vessel system?

(b) How much work has been doen on this system?

(c) How much is the increase in internal energy of the system?

Watch Video Solution



2.

As shown in figure a paddle wheel coupled to a mass of 12 kg through fixed frictionless pulleys. The paddle is immersed in a liquid of heat capacity $4200\frac{J}{K}$ kept in an adiabatic container. Consider a time interval in which the 12 kg block falls slowly through 70 cm.

(a) How much heat is given to the liquid?

(b) How much work is done on the liquid?

(c) Calculate the rise in the temperature of the liquid neglecting the heat capacity of the container and the paddle.

Watch Video Solution

3. (a) An ideal gas contained in a cylinder is given 200 J of heat. The gas does 60 J of work in the expansion resulting from heating. Calculate the increase in internal energy in the process.

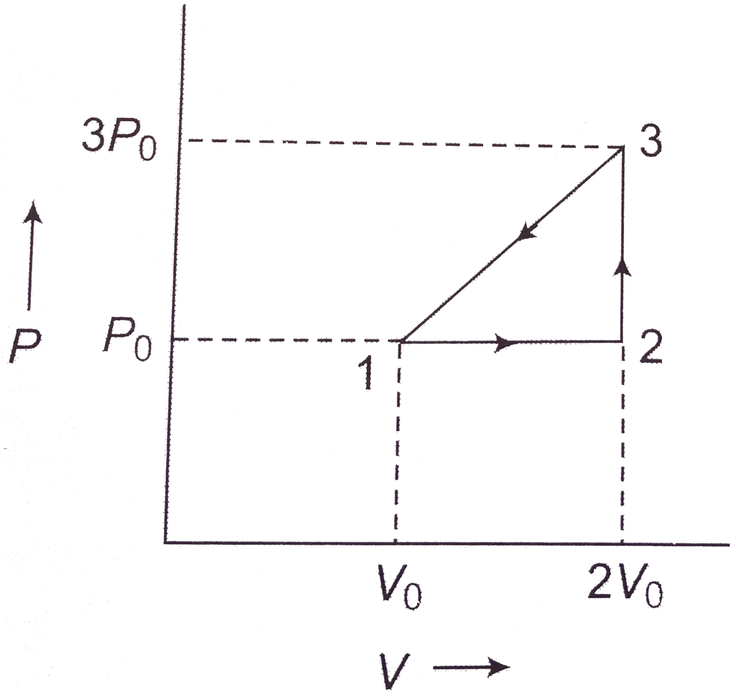
(b) Calculate the change in internal energy of a gas kept in a rigid container when 150 J of heat is supplied to it.

Watch Video Solution

4. (a) 2 moles of an ideas gas is heated at constant pressure so that its temperature increases from $27^{\circ} C$ to $127^{\circ} C$. Find work done by the gas.

(b) In a process, the volume of gas increases from 1000 cc to 2000 cc at constant pressure 100 kPa. Find work done by the gas.

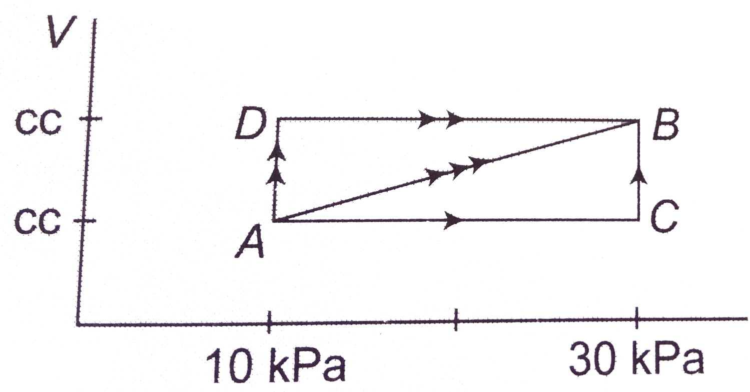
Watch Video Solution



5.

Calculate the work done by a gas as it is taken from 1 to 2,2 to 3 and 3 to 1 as shown. Also calculate the work done in cyclic process $1 \rightarrow 2 \rightarrow 3 \rightarrow 1$

Watch Video Solution



6.

As shown in figure three paths through which a gas can be taken from the state A to the state B. Calculate the work done by the gas in each of the three paths.

Watch Video Solution

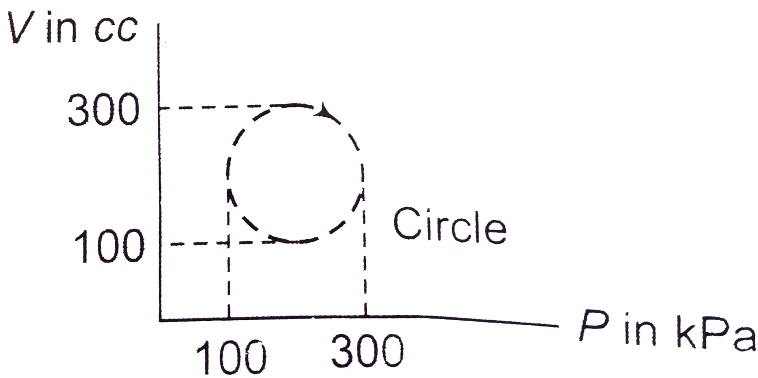
7. The pressure of a gas changes linearly with volume from 10 kPa, 200 cc to 50 kPa, 50 cc.

(a) Calculate the work done by the gas.

(b) If no heat is supplied or extracted from the gas, what is the changes in the internal energy of the gas?

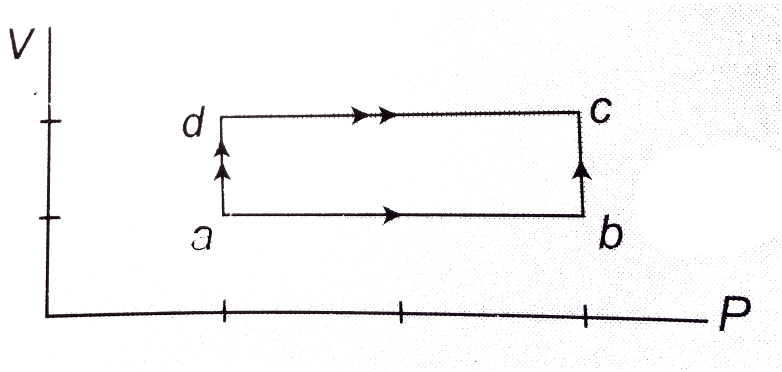
Watch Video Solution

8.



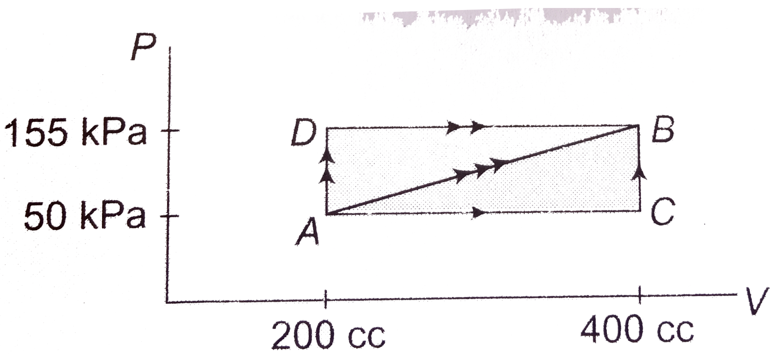
Calculate the heat rejected by a system in going through the cyclic process shown in figure.

Watch Video Solution

9. 

When a system is taken through the process abc shown in figure, 80 J of heat is absorbed by the system and 30 J of work is done by it. If the system does 10 J of work during the process adc, how much heat flows into it during process?

Watch Video Solution



10.

50 cal of heat should be supplied to take a system from the state A to the state B through the path ACB as shown in Figure. The quantity of heat to be supplied to take it from A to B via ADB.

Watch Video Solution

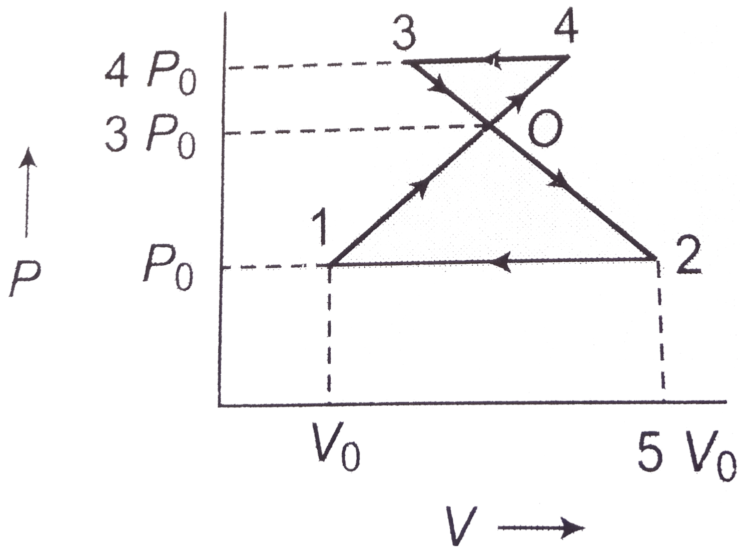
11. A gas is initially at a pressure of 100 kPa and its volume is $2.0m^3$. Its pressure is kept constant and the volume is changes from $2.0m^3$ to $2.5m^3$. Its volume is now kept constant and the pressure is increased from 100 kPa to 200 kPa. The gas is brought back to its initial state, the pressure verying linearly with its volume. Whether the heat is supplied to or extracted from the gas in the complete cycle?

Watch Video Solution

12. A gas is enclosed in a cylindrical vessel fitted with a frictionless piston. The gas is slowly heated for some time. During the process, 10 J of heat is supplied and the piston is found to move out 10 cm. The area of cross-section of the cylinder $= 4cm^2$ and the atmospheric pressure $= 100kPa$.

Watch Video Solution

Watch Video Solution



13.

Find the work done by an ideal gas during a closed cycle $1 \to 2 \to 3 \to 4 \to 1$ as shown in figure.

Watch Video Solution

14. Calculate the work done in the following processes, when gas expands from V_0 to $2V_0$

(a) $P = kV$, k is constant

(b) $T = T_0 + \alpha V$,T_0,α: constant n: number of moles of gas

Watch Video Solution

15. Calculate the increase in internal energy of 1 kg of water at $100^\circ C$ when it is converted into steam at the same temperature and at 1 atm (100kPa). The density of water and steam are $1000\frac{kg}{m^3}$ and $0.6\frac{kg}{m^3}$ resprectively. The latent heat of vaporization of water $= 2.25 \times 10^6 \frac{J}{kg}$

Watch Video Solution

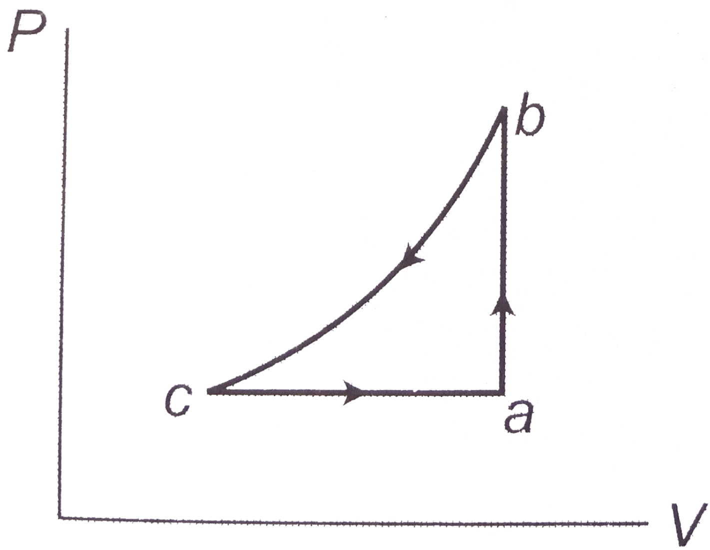
16. The internal energy of a gas is given by $U = 1.5pV$. It expands from $100cm^2$ to $200cm^3$ against a constant pressure of $1.0 \times 10^5 Pa$. Calculate the heat absorbed by the gas in the process.

Watch Video Solution

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

Watch Video Solution

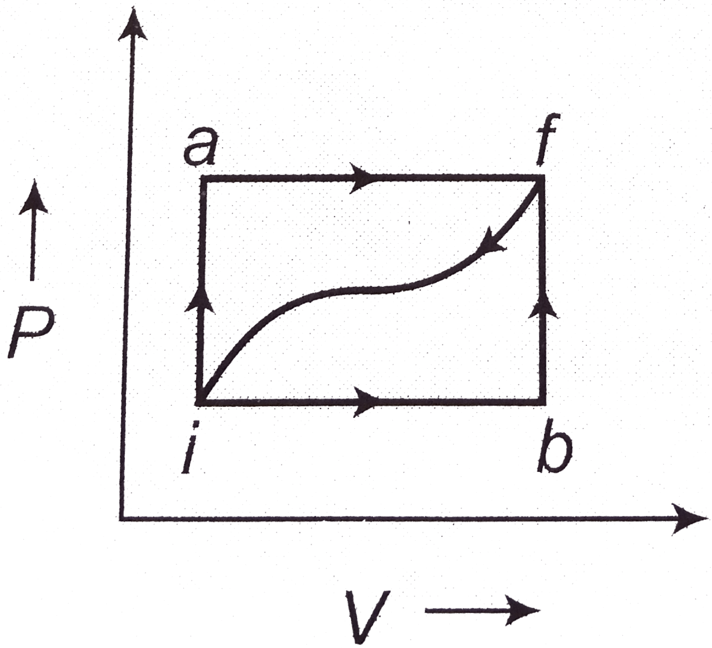
18.



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

(a) Find the internal energy of the gas at b adn c if it is 1500 J at a. ltbr. (b) Calculate the work done by the gas during the part ca.

Watch Video Solution



19.

When a system is taken from a state i to a state f in Figure, along the path iaf, we find $\Delta Q = 50cal$ and $\Delta W = 20cal$ while during the path ibf, $\Delta Q = 36cal$. If $U_i = 10cal$.

(a) What is U?

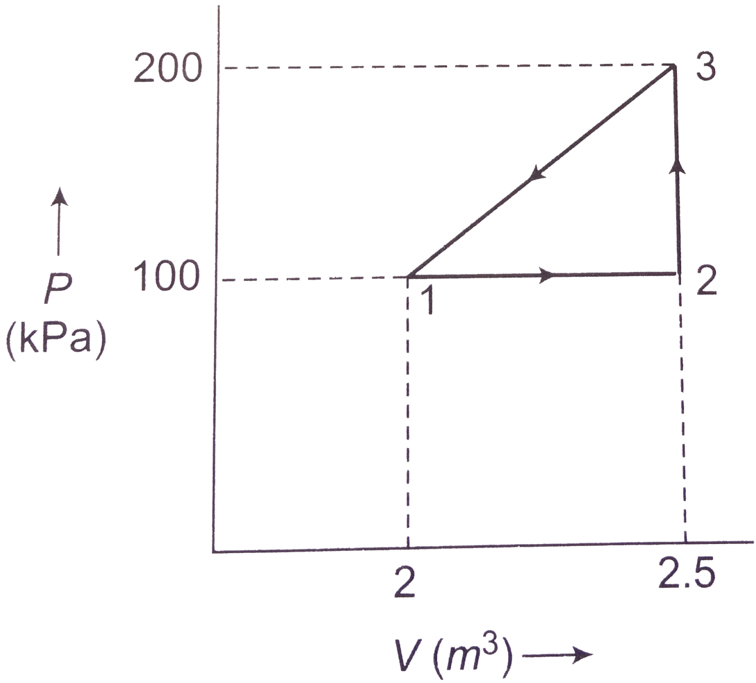
What is W along the path ibf?

(c) If $W = -13cal$, along the curved path fi, what is

ΔQ for this path?

(d) If $U_b = 22cal$, what is ΔQ for the process ib? for bf?

Watch Video Solution



20.

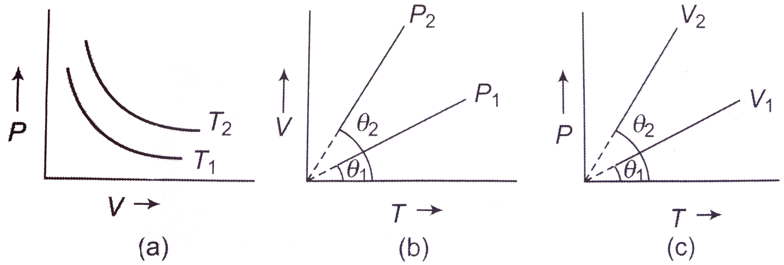
In the figure an ideal gas changes is state from state A to state C by two paths ABC and AC.

(a) Find the path along which the work done is least.

(b) The internal energy of the gas at A is 10 J and the amount of heat supplied to change its state to C through the path AC is 200 J. Calculate the internal energy at C.

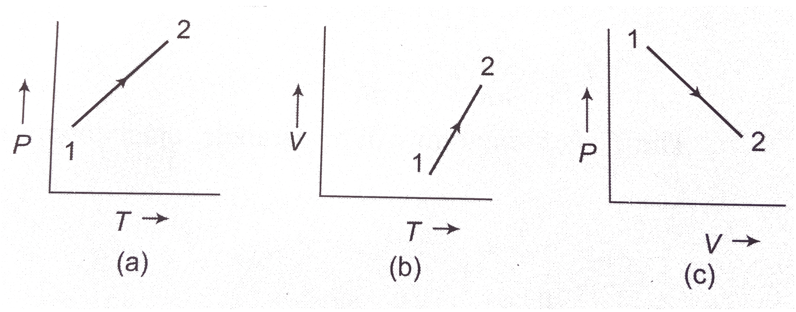
(c) The internal energy of the gas at state B is 20 J. Fid the amount of the heat supplied to gas to go from A to B.

Watch Video Solution

21. 

Explain whether (i) $T_2 > T_1$ (ii) $P_2 > P_1$ and (iii) $V_2 > V_1$ for given mass of gas.

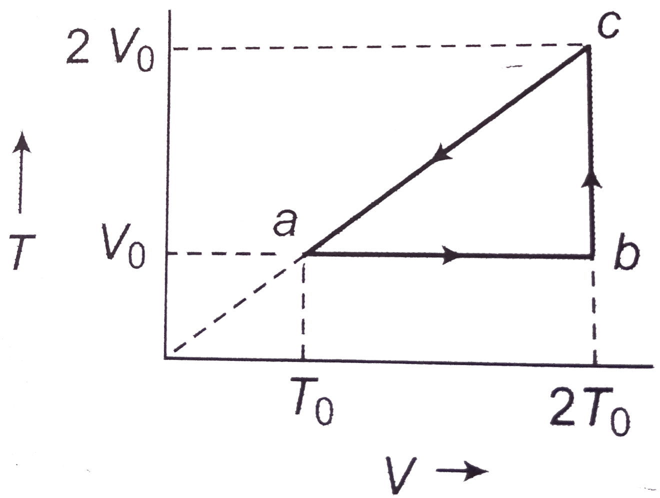
Watch Video Solution

22. 

For given mass of an ideal gas, consider the following diagrams

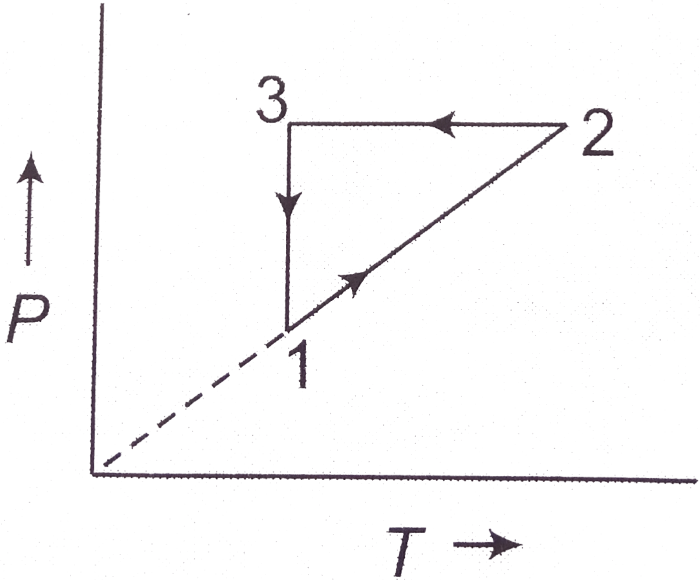
What is variation of volume in (a), pressure in (b) and temperature in (c).

Watch Video Solution



23. In the following cyclic process abca, find the net heat given to the system. Take number of moles of ideas gas n.

Watch Video Solution



24.

A cyclic process $1 \to 2 \to 3 \to 1$ shown in $P-T$ diagram is performed with a constant mass of an ideal gas. Show it on a (a) $P-V$ diagram (b) $V-T$

View Text Solution

25. Three moles of an ideal gas $\left(C_p = \frac{7}{2}R\right)$ at pressure, P_A and temperature T_A is isothermally expanded to twice its initial volume. It is then compressed at constant pressure to its original volume. Finally gas is compressed at constant volume to its original pressure P_A.

(a) Sketch P-V and P-T diagrams for the complete process.

(b) Calculate the net work done by the gas, and net heat supplied to the gas during the complete process.

Watch Video Solution

26. When an ideal monoatomic gas is heated at constant pressure find

(a) Fraction of heat energy which increases the internal energy

(b) Fraction of heat energy which is utlized as work.

Watch Video Solution

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

Watch Video Solution

28. (a) Show that internal energy of an ideal gas is expressed as

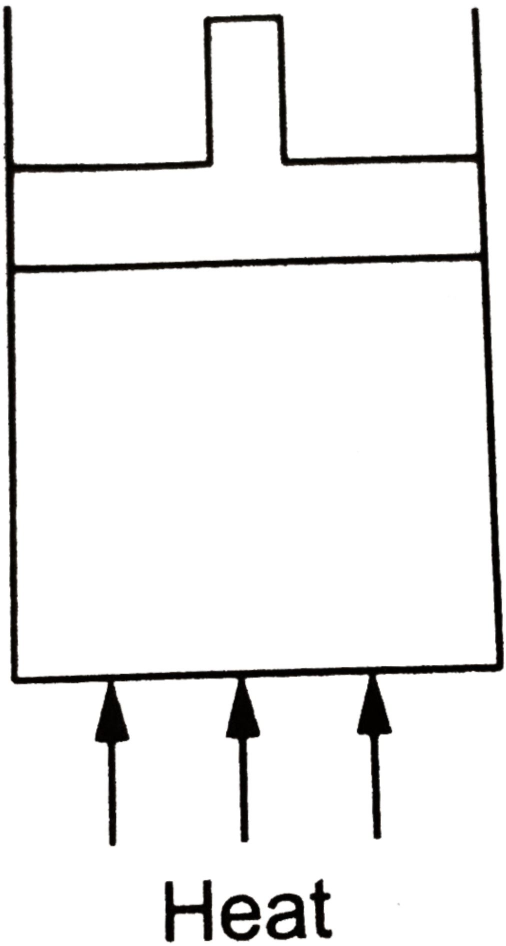
$U = \frac{PV}{(\gamma - 1)}$ when $P =$ pressure, $V =$ volume and $\gamma = \frac{C_P}{C_V}$.

(b) Hence find the internal energy of air in a room of volum $50m^3$ at atmospheric pressure.

$\left(1Atm = 10^5 \frac{N}{m^2}\right)$

Watch Video Solution

29. Figure shows a cylindrical container containing oxygen $(\gamma = 1.4)$ and closed by a $50kg$ frictionless piston. The area of cross section is $100cm(2)$, atmospheric pressure is $100kPa$ and g is $10ms^{-2}$. The cylinder is slowly heated for some time. Find the amount of heat supplied to gas if the piston moves out through a distance of $20cm$.



Watch Video Solution

30. About 0.014 kg nitrogen is enclosed in a vessel at temperature of $27^{\circ} C$ How much heat has to be transferred to the gas to double the rms speed of its molecules ? $(R = 2cal / molK)$

Watch Video Solution

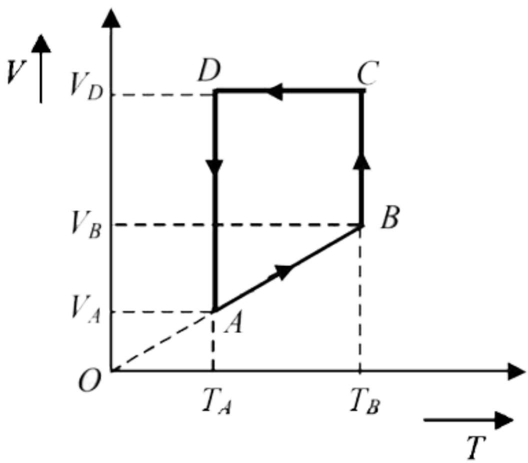
31. Calculate the value of $\gamma = \frac{C_P}{C_V}$ for a gaseous mixture consisting of $n_1 = 2$ moles of O_2 and $n_2 = 3$ moles of CO_2. The gases are assumed to be ideal.

(b) Inside a container one mole of He and n moles of H_2. The average value of γ for gaseous mixture is $\frac{19}{13}$. Find

n. Also find speed of sound in gaseous mixture at temperautre $27^{\circ} C$

Watch Video Solution

32. 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,

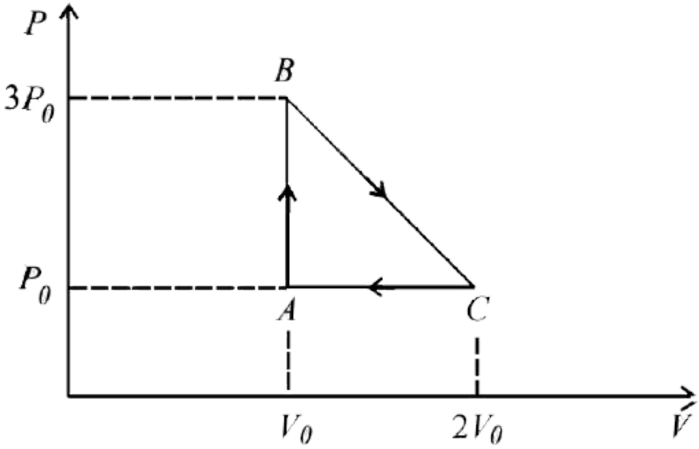
(a) the temperature of the gas at point B,

(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

33. One mole of an ideal monatomic gas is taken round the cyclic process ABCA as shown in figure. Calculate



(a) the work done by the gas.

(b) the heat rejected by the gas in the path CA and the heat absorbed by the gas in the path AB,

(c) the net heat absorbed by the gas in the path BC,

(d) the maximum temperature attained by the gas during the cycle.

Watch Video Solution

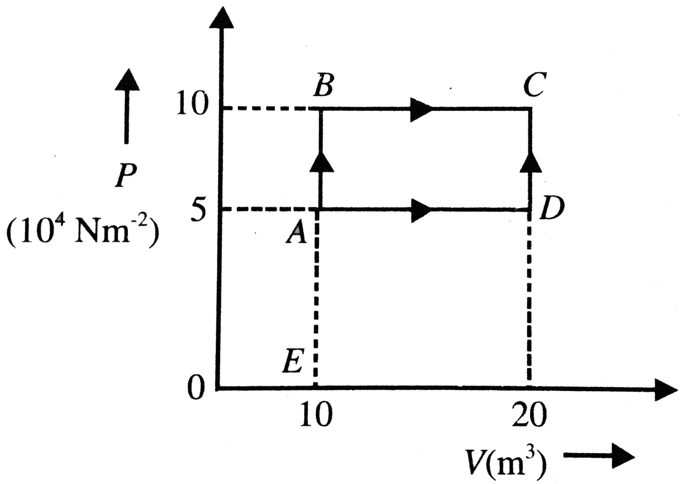
34. A sample of 2 kg of monatomic helium (assumed ideal) is taken through the process ABC another sample of 2 kg of the same gas is taken through the process ADC as shown in Fig. Given molecular mass of helium = 4.

a. What is the temperature of helium in each of the states A, B, C and D ?

b. Is there any way of telling afterwards which sample of helium went through the process ABC and which went through the process ADC ? Write yes or no.

How much is the heat involved in each of the process

ABC and ADC ?

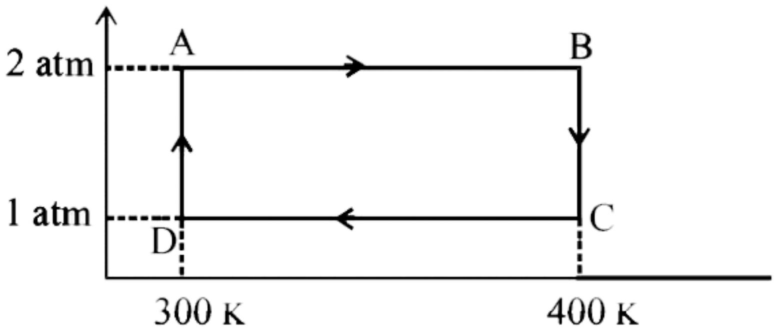


Watch Video Solution

35. Three moles on an ideal gas at 300 K are isothermally expanded to five times its volume and heated at this constant volume so that the pressure is raised to its initial value before expansion. In the whole process 83.14 kJ heat is required Calculate the ratio $\left(\frac{C_P}{C_V}\right)$ of the gas $[\log_e 5 = 1.61]$

Watch Video Solution

36. 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

Watch Video Solution

37. The pressure of one gram mole of a monoatomic gas increases linearly from $4 \times 10^5 N/M^2$ to $8 \times 10^5 N/m^2$. Calculate

(i) Work done by the gas,

(ii) increase in internal energy, (iii) amount of heat supplied,

(iv) molar heat capacity of the gas.

Take $R = 8.31 J mole^{-1} K^{-1}$.

Watch Video Solution

38. Two moles of an ideal monoatomic gas are confined within a cylinder by a massless and frictionless spring loaded piston of cross-sectional area $4 \times 10^{-3} m^2$. The spring is, initially in its relaxed state. Now the gas is heated by an electric heater, placed inside the cylinder, for some time. During this time, the gas expands and does $50J$ of work in moving the piston through a distance $0.10m$. The temperature of the gas increases by $50K$. Calculate the spring constant and the heat supplied by the heater.

$P_{atm} = 1 \times 10^5 N/m^2 R = 8.314 J/mol - K$

Watch Video Solution

39. Figure shows two vessels with adiabatic walls, one containing $0.1g$ of helium $(\gamma = 1.67, M = 4gmol^{-1})$ and the other containing some amount of hydrogen $(\gamma = 1.4, M = 2gmol^{-1})$. Initially , the temperatures of the two gases are equal. The gases are electrically heated for some time during which equal amounts of heat are given to the gases. It is found that the temperatures rise through the same amount in the two vessels. Calculate the mass of hydrogen.

Watch Video Solution

40. Two thermally insulated vessels 1 and 2 are filled with air and connected by a short tube equipped with a valve. The volumes of the vessels, the pressures and temperature of air in them are know $(V_1, p_1, T_1$ and $V_2, p_2, T_2)$. Find the air temperature and pressure established after the opening of the valve.

Watch Video Solution

41. Figure shows a cylindrial tube of volume V with adiabatic walls containing an ideal gas. The internal energy of this ideal gas is given by $1.5nRT$. The tube is divided into two equal parts by a fixed diathermic wall. Initially, the pressure and the temperature are p_1, T_1 on the left and p_2, T_2 on the right. The system is left for sufficient time so that the temperature becomes equal on the two sides.

(a) How much work has been done by the gas on the left part ?

(b) Find the final pressures on the two sides.

(c) Find the final equilibrium temperature.

(d) How much heat has flown from the gas on the right to the gas on the left ?

Watch Video Solution

42. A quantity of air is kept in a container having walls which are slightly conducting. The initial temperature and volume are $27^0 C$ (equal to the temperature of the surrounding) and $800 cm^3$ respectively. Find the rise in the temperature of the gas is compressed to $200 cm^3$ (a) in a short time (b) in a long time . Take gamma= 1.4.

Watch Video Solution

43. A sample of gas $(\gamma = 1.5)$ is taken through an adiabatic process in which the volume is compressed from $1600 cm^3$ to $400 cm^3$. If the initial pressure is $150 kPa$, (a) what is the final pressure and (b) how much work is done by the gas in the process?

Watch Video Solution

44. A monoatomic gas is compressed adiabatically to $\frac{8}{27}$ of its initial volume if initial temperature is $27^\circ C$, find increase in temperature

Watch Video Solution

45. Four moles of oxygen being initially at temperature $T_0 = 300K$ is adiabatically compressed so the pressure becomes $128P_0$,P_0 is initial pressure find

(a) the gas temperature after compression

(b) The work that has been performed on the gas.

Watch Video Solution

46. 2 moles of a gaseous mixture having volume V and temperature T are compressed to $\frac{1}{4}th$ of its initiall volume find the change in its adiabatic compressibility if $\gamma = \frac{3}{2}$.

Watch Video Solution

47. An ideal gas having initial pressure P, volume V and temperature T is allowed to expands adiabatically until its volume becomes 5.66V while its temperature falls to T/2.

(i) How many degrees of freedom do the gas molecules have?

Obtain the work done by the gas during the expansion as a function of the initial pressure P and volume V.

Watch Video Solution

48. 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. [$R = 8.31J/mol - K$]

Watch Video Solution

49. Two samples A and B are initially kept in the same state. The sample B through an isothermal process. The final volumes of the samples are the same

(a) Compare final temperatures, final pressures and work doen in A and B.

(b) Repeat the part (i), If samples are compressed to same final volume.

Watch Video Solution

50. Three samples A, B and C of the same gas $(\gamma = 1.5)$ have equal volumes and temperatures. The volume of each sample is doubled, the process being isothermal for A, adiabatic for B and isobaric for C. If

the final pressures are equal for the three samples, Find the ratio of the initial pressures.

Watch Video Solution

51. Two samples A and B of the same gas have equal volumes and pressures . The gas in sample A is expanded isothermally to double its volume and the the gas in B is expanded adiabatically to double its volume . If the work done by the gas is the same for the two cases, show that gamma satisfies the equation $\left(1 - 2^{1-\gamma}\right) = (\gamma - 1)1n2.$

Watch Video Solution

52. Two moles of helium gas $(\gamma = \frac{5}{3})$ are initially at $27^\circ C$ and occupy a volume of $20 litres$. The gas is first expanded at constant pressure until the volume is doubled. Then it undergoes an adiabatic change until the temperature returns to its initial value.

(a) Sketch the process in a p_V diagram.

(b) What is the final volume and pressure of the gas ?

(c) What is the work done by the gas?

Watch Video Solution

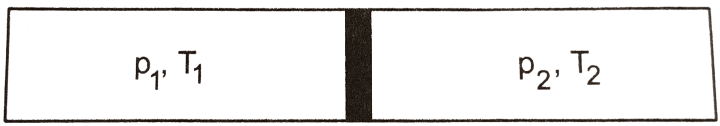
53. Figure shows an adiabatic cylindrical tube of volume (V_0) divided in two parts by a frictionless adiabatic separator . Initially, the separator is kept in the middle, an ideal gas at pressure (P_1) and the temperatures (T_1)

is injected into the left part and the another ideal gas at pressures (P_2) and temperature (T_2) is injected into the right part. $\left(\frac{C_p}{C_v} = \gamma\right)$ is the same for both the gases. The separator is slid slowly and is released at a position where it can stay in equilibrium. Find

(a) the volumes of the parts,

(b) the heat given to the gas in the left part and

(c) the final common pressure of the gases.



Watch Video Solution

54. A piston divides a closed gas cylinder into two parts. Initially the piston is kept pressed such that one part has a pressure P and volume 5V and the other part has pressure 8P and volume V, the piston is now left free. Find the new pressure and volume for the isothermal and aidabatic process. $(\gamma = 1.5)$

Watch Video Solution

55. A weightless piston divides a thermally insulated cylinder into two parts of volumes V and $3V$. 2 moles of an ideal gas at pressure $P = 2$ atmosphere are confined to the part with volume $V = 1$ litre. The remainder of the cylinder is evacuated. The piston is now released and the gas expands to fill the entire space of the cylinder. The piston is then pressed back to the initial position. Find the increase of internal energy in the process and final temperature of the gas. The ratio of the specific heats of the gas, $\gamma = 1.5$.

Watch Video Solution

56. One mole of an ideal gas with adiabatic exponent γ undergoes the process

(a) $P = P_0 + \frac{\alpha}{V}$

(b) $T = T_0 + \alpha V$

Find Molar heat capacity of the gas as a function of its volume.

Watch Video Solution

57. A heat enegine works on a carnot cycle with a heat sink at a temperature of $2700K$. The efficiency of the engine 10%. Determine the temperature of heat source.

A. $T = 3000K$

B. $T = 300K$

C. $T = 1000K$

D. $T = 30000K$

Answer: A

Watch Video Solution

58. A cornot engine in 1000 kilocal of heat from a reservoir at $627^{\circ}C$ and exhausts it to sink at $27^{\circ}C$. What is its efficiency? How much work does it perform?

Watch Video Solution

59. The temperatures T_1 and $T(2)$ of two heat reservoirs in an ideal carnot engine are $1500^{\circ}C$ and $500^{\circ}C$. Which of these (a) increasing $T_1 by 100^{\circ}C$ or (b) decreasing $T_2 by 100^{\circ}C$ would result in greater improvement of the efficiency of the engine?

Watch Video Solution

60. An inventor claims to have developed an engine that during a certain time interval takes in 110 MJ of heat at 415 K, rejects 50 MJ of heat at 212 K while manages to do 16.7 kW of work. Do you agree with the inventors's claim?

Watch Video Solution

61. A heat engine operates between a cold reservoir at temperature $T_2 = 300K$ and a hot reservoir at temperature T_1. It takes 200 J of heat from the hot reservoir and delivers 120 J of heat from the hot reservoir and delivers 120 J of heat to the cold reservoir in a cycle. What could be the minimum temperature of the hot reservoir?

Watch Video Solution

Watch Video Solution

62. A refrigerator whose coefficient of performance η' is 4, extracts heat from the cooling compartment at the rate of 400 J per cycle.

(a) How much work per cycle is required to operate the refrigerator cycle?

(b) How much heat per cycle is discharged to the room which acts as the high temperature reservoir?

Watch Video Solution

63. Find relation between efficiency (η) of carnot engine and coefficient of performance $(\eta$))` of refrigerator.

Watch Video Solution

64. An ideal gas is taken through a cyclic thermodynamic process through four steps. The amounts of heat involved in these steps are $Q_1 = 5960J, Q_2 = -5585J$, $Q_3 = -2980J$ and $Q_4 = 3645J$ respectively. The corresponding quantities of work involved are $W_1 = 2200J$, $W_2 = -825J$, $W_3 = -1100J$ and W_4 respectively.

(a) Find the value of W_4.

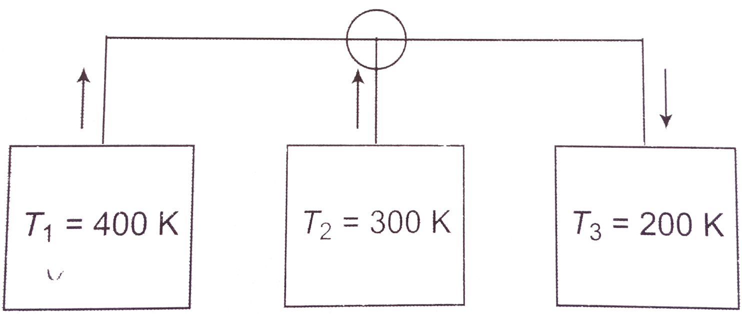
(b) What are the efficiency of the cycle?

Watch Video Solution

65. An ideal monoatomic gas $\left(\gamma = \frac{5}{3}\right)$ goes through a cyclic process consisting two isochoric and two isobaric lines. The absolute temperature of the gas rises two times both in isochoric heating and isobaric expansion. If number of moles are three, find efficiency of cyclic process.

Watch Video Solution

66.



During an integral number of complete cycles a reversible carnot engine (shown by a cycle) absors 1200 joule from reservoir at 400 K and performs 200 Joule of mechanical work.

(a) Find the quantities of heat exchanged with the other two reservoirs. State thether the reservoirs absorb or lose heat.

(b) Find the change in entropy of each reservoir.

(c) What is the change in entropy of the universe?

Watch Video Solution

67. A sample of 100 g water is slowly heated from $27^{\circ}C$ to $87^{\circ}C$. Calculate the change in the entropy of the water specific heat capacity of water $= 4200 \frac{J}{kg - K}$

Watch Video Solution

Watch Video Solution

68. 100 gram of ice at $0^{\circ}C$ is converted into water vapour at $100^{\circ}C$ Calculate the change in entropy.

Watch Video Solution

EXERCISE

1. The first law of thermodynamics incorporates are concept

(i) conservation of energy

(ii) convervation of heat

(iii) conservation of work

(iv) equivalence of heat and work

A. (i),(iii)

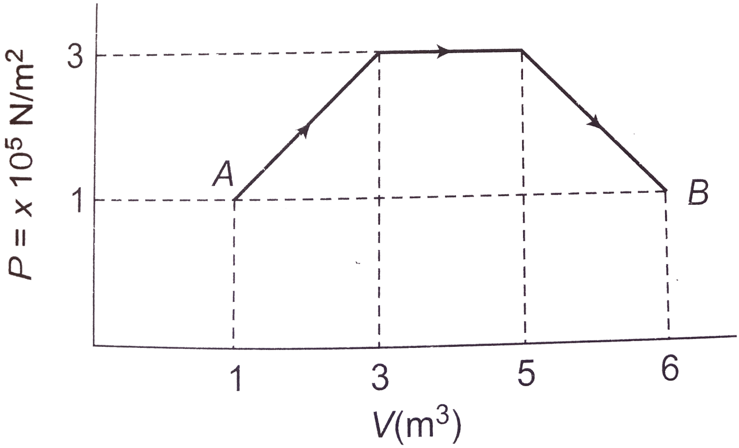
B. (ii),(iii)

C. (iii),(iv)

D. (i),(iv)

Answer: D

Watch Video Solution

2. 

The work done in the process AB is

A. $8 \times 10^5 J$

B. $10 \times 10^5 J$

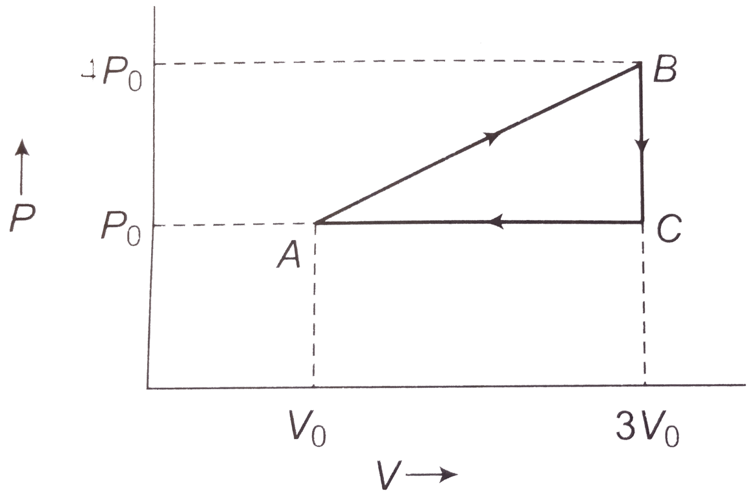
C. $7 \times 10^5 J$

D. $12 \times 10^5 J$

Answer: D

Watch Video Solution

3.



(i) $\Delta W_{AB} = 5P_0V_0$

(ii) $\Delta W_{BC} = 0$

(iii) $\Delta W_{CA} = -2P_0V_0$

(iv) $\Delta W_{ABCA} = 3P_0V_0$

A. (i),(iii)

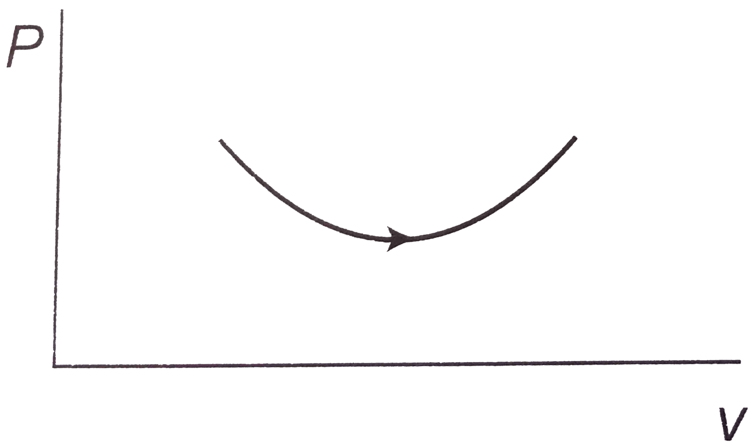
B. (ii),(iii)

C. (iii),(iv)

D. all

Answer: D

Watch Video Solution



4.

Consider the process on a system shown in figure. During the process, the work done by the system

A. continuously increases

B. continuously decreases

C. first increases then decreases

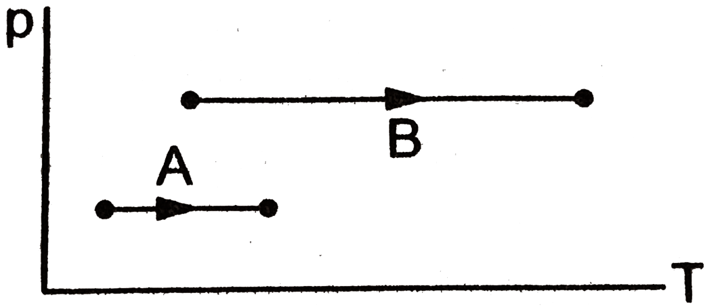
D. first decrease then increases

Answer: A

Watch Video Solution

5. Consider two processes on a system as shown in figure.

The volumes in the initial states are the same in the two processes and the volume in the final states are also the same. Let ΔW_1 and ΔW_2 be the work done by the system in the processes A and B respectively.



A. $\Delta W_1 > \Delta W_2$

B. $\Delta W_1 = \Delta W_2$

C. $\Delta W_1 < \Delta W_2$

D. none

Answer: C

Watch Video Solution

6. A system can be taken from the initial state p_1, V_1 to the final state p_{2}, V_2 by two different methods, let ΔQ and ΔW represent the heat given to the system and the work done by the system. Which of the following must be the same in both the method?

A. ΔQ

B. ΔW

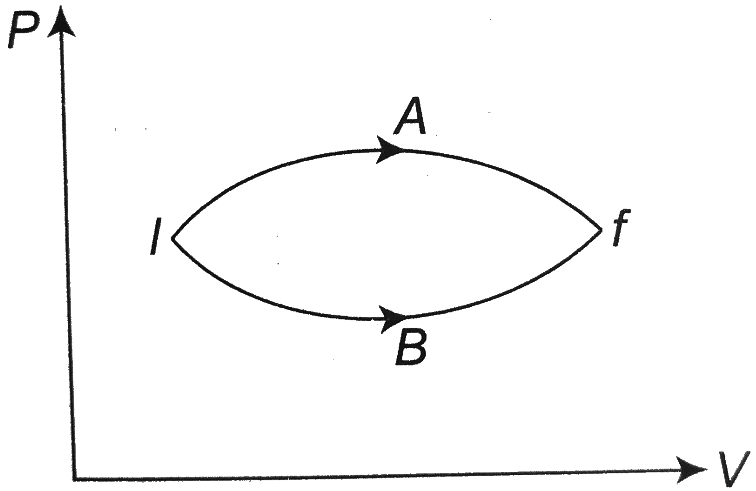
C. $\Delta Q + \Delta W$

D. $\Delta Q - \Delta W$

Answer: D

Watch Video Solution

7. In the figure given two processes A and B are shown by which a thermodynamic system goes from initial to final state F. if ΔQ_A and ΔQ_B are respectively the heats supplied to the systems then



A. $\Delta Q_1 > \Delta Q_2$

B. $\Delta Q_1 = \Delta Q_2$

C. $\Delta Q_1 < \Delta Q_2$

D. $\Delta Q_1 \leq \Delta Q_2$

Answer: A

Watch Video Solution

8. Refer to figure in previous question, ΔU_1 and ΔU_2 be the changes in internal energy of the system in the processes A and B then

A. $\Delta U_1 > \Delta U_2$

B. $\Delta U_1 = \Delta U_2$

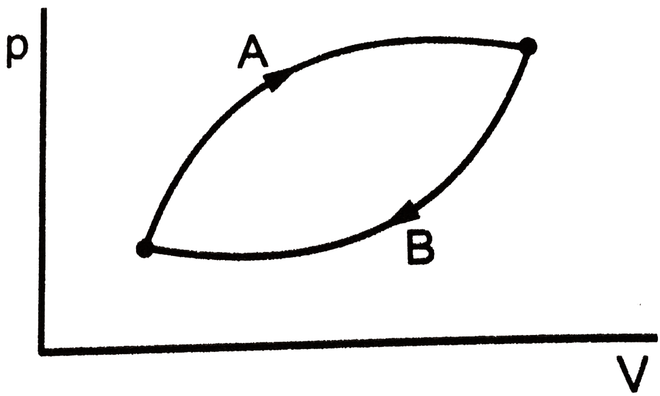
C. $\Delta U_1 < \Delta U_2$

D. $\Delta U_1 \neq \Delta U_2$

Answer: B

Watch Video Solution

9. Refer to figure ΔU_1 and ΔU_2 be the changes in internal energy in the system in process $A+B$ and ΔW be the net work done by the system in the process $A+B$,



A. (i),(iii)

B. (ii),(iii)

C. (iii),(iv)

D. (i),(iv)

Answer: A

Watch Video Solution

10. In a given process on an ideal gas, $dW = 0$ and $dQ < 0$. Then for the gas

A. the temperature will decrease

B. the volume will increase

C. the pressure will remain constant

D. the temperature will increase

Answer: A

Watch Video Solution

11. Consider the following two statements.

(A) If heat is added to a system, its temperature must increase.

(B) If positive work is done by a system in a thermodynamic process, its volume must increase.

A. Both A and B are correct

B. A is correct but B is wrong

C. B is correct but A is wrong

D. Both A and B are wrong

Answer: C

Watch Video Solution

12. In a process on a system, the initial pressure and volume are equal to the final pressure and volume

(i) The initial temperature must be equal to the final temperature

(ii) The initial internal energy must be equal to the final internal energy

(iii) The net heat given to the system in the process must be zero.

(iv) The net work done by the sytem in the process must be zero.

A. (i),(ii)

B. (ii),(iii)

C. (iii),(iv)

D. (i),(iv)

Answer: A

Watch Video Solution

13. The pressure p and volume V of an ideal gas both increase in a process.

A. (i),(ii)

B. (ii),(iii)

C. (iii),(iv)

D. (i),(iv)

Answer: B

Watch Video Solution

14. The state of a thermodynamic system is represented by

A. Pressure only

B. Volume only

C. Pressure, volume and temperature

D. Number of moles

Answer: C

Watch Video Solution

15. Which of the following is not a thermodynamical function

A. Enthalpy

B. work done

C. Gibb's energy

D. internal energy

Answer: B

Watch Video Solution

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

A. $E = 0$

B. $Q = 0$

C. $W = 0$

D. $Q = W = 0$

Answer: A

Watch Video Solution

17. For free expansion of the gas, which of the following is true?

A. $Q = W = 0$ and $\Delta E_{\text{int}} = 0$

B. $Q = 0$ and $W > 0$ and $\Delta E_{\text{int}} = -W$

C. $W = 0, Q > 0$ and $\Delta E_{\text{int}} = Q$

D. $W > 0, Q < 0$ and $\Delta E_{\text{int}} = 0$

Answer: A

Watch Video Solution

18. A system is given 300 calories of heat and it does 600 joules of work. How much does the internal energy of the system change in this process $(J = 4.18 \text{joules} / cal)$

A. 654 joule

B. 156.5 joule

C. -300 joule

D. -528.2 joule

Answer: A

Watch Video Solution

19. In thermodynamic process, pressure of a fixed mass of a gas is changes in such a manner that the gas molecules gives out 20 J of heat and 10 J of work is done in the gas. If the initial internal energy of the gas was 40 J, then the final internal energy will be

A. 30 J

B. 20 J

C. 60 J

D. 40 J

Answer: A

Watch Video Solution

20. A perfect gas goes from a state A to another state B by absorbing 8 × 105 J of heat and doing 6.5 × 105 J of external work. It is now transferred between the same two states in another process in which it absorbs 105 J of heat. In the second process

A. Work done on the gas is $0.5 \times 10^5 J$

B. Work done by gas is $0.5 \times 10^5 J$

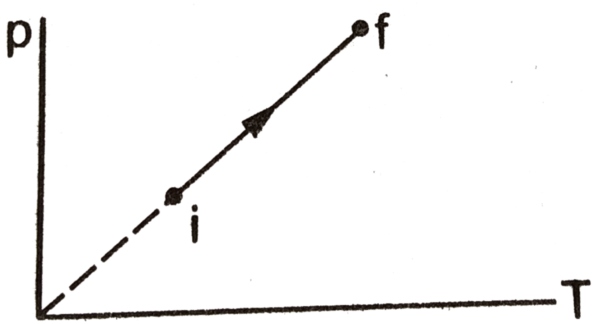
C. Work done on gas is $10^5 J$

D. Work done by gas is $10^5 J$

Answer: A

Watch Video Solution

21. An ideal gas goes from the state i to the state f as shown in the figure.The work done by the gas during the process



A. is positive

B. is negative

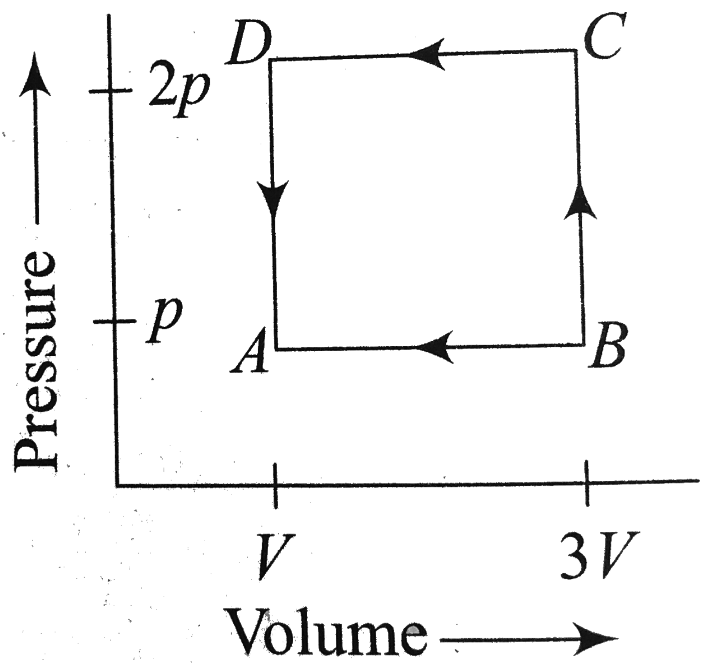
C. is zero

D. none

Answer: C

Watch Video Solution

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



A. $2PV$

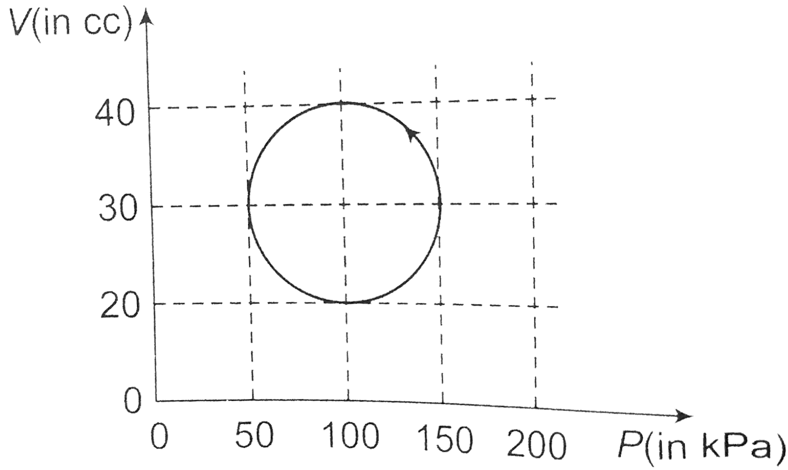
B. $4PV$

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

D. PV

Answer: A

Watch Video Solution



23.

A system is taken through a cyclic process represented by a circle as shown in the figure. The heat absorbed by the system is

A. $\pi \times 10^3 J$

B. $\frac{\pi}{2} J$

C. $4\pi \times 10^2 J$

D. πJ

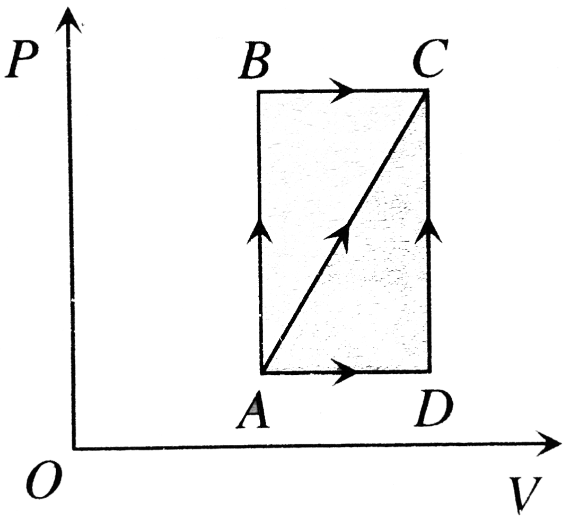
Answer: B

Watch Video Solution

24. A thermodynamic process is shown in Fig. The pressures and volumes corresponding to some points in the figure are : $P_A = 3 \times 10^4 Pa, P_B = 8 \times 10^4 Pa$ and $V_A = 2 \times 10^{-3} m^3, V_D = 5 \times 10^{-3} m.$

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

AC would be.



A. 560 J

B. 800 J

C. 600 J

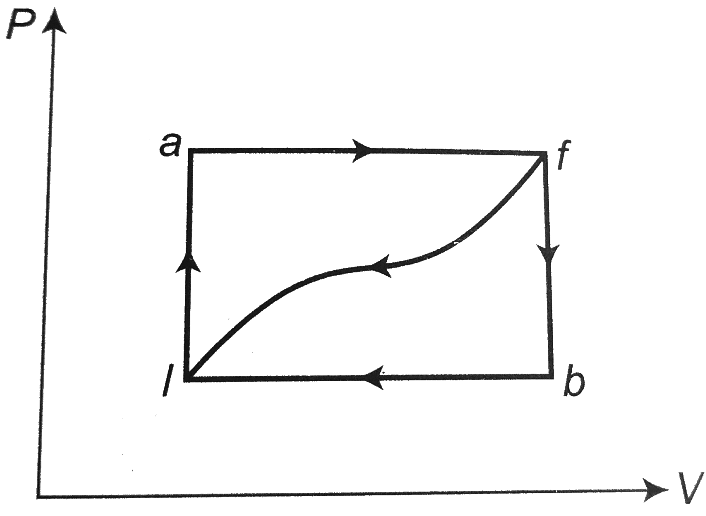
D. 640 J

Answer: A

Watch Video Solution

Watch Video Solution

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



A. 33 J

B. 23 J

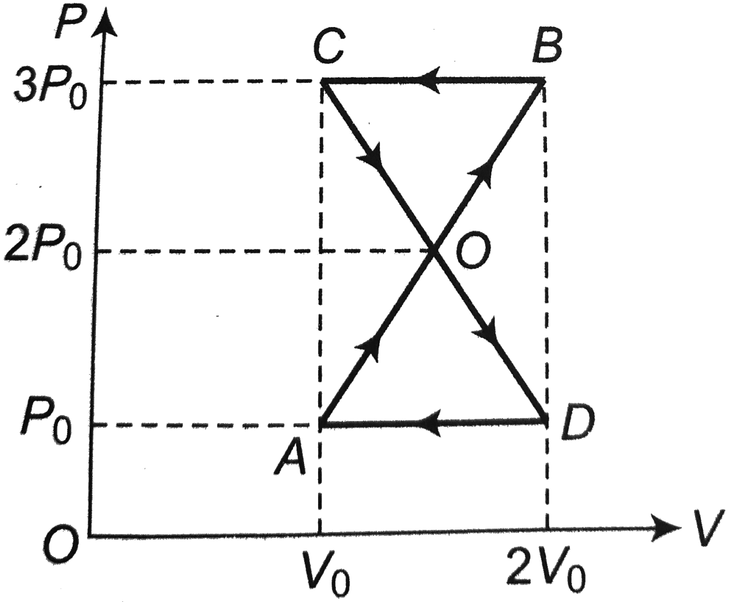
C. -7 J

D. $-43J$

Answer: D

Watch Video Solution

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



A. P_0V_0

B. $2P_0V_0$

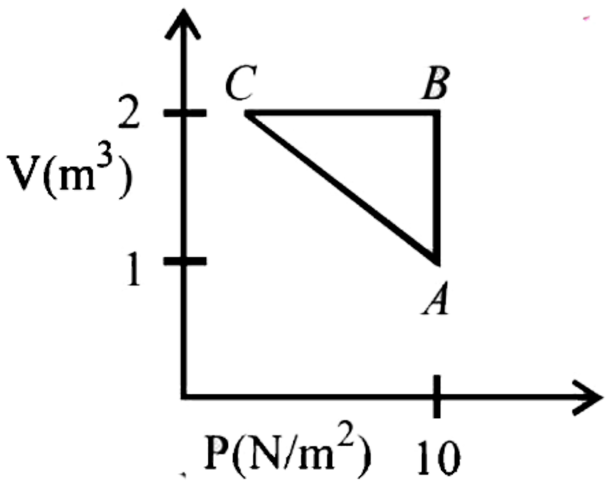
C. $\frac{P_0V_0}{2}$

D. zero

Answer: D

Watch Video Solution

27. An ideal gas is taken through the cycle $A \to B \to C \to A$, as shown in the figure, If the net heat supplied to the gas in the cycle is 5J, the work done by the gas in the process CtoA is



A. $-5J$

B. $-10J$

C. $-15J$

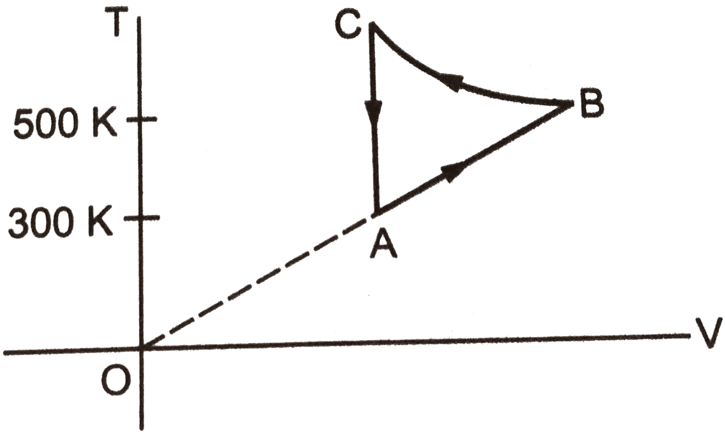
D. $-20J$

Answer: C

Watch Video Solution

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

BC.



A. $-2520J$

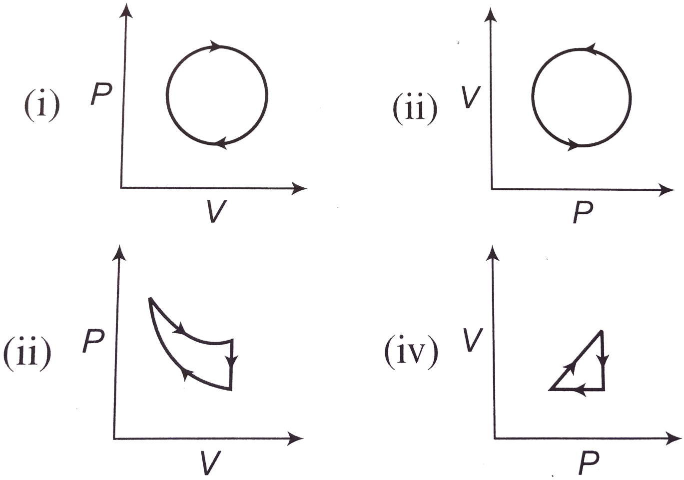
B. $-3250J$

C. $-4520J$

D. $-5520J$

Answer: C

Watch Video Solution



29.

The following are the $P-V$ diagrams for cyclic processes for a gas. In which of these processes is heat absorbed by the gas?

A. (i),(ii)

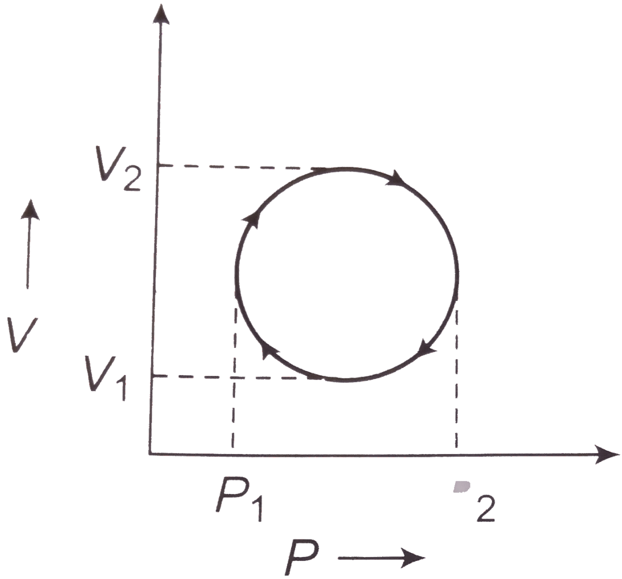
B. (ii),(iii)

C. (iii),(iv)

D. (i),(ii),(iii)

Answer: D

Watch Video Solution



30.

In the cyclic process shown in the $V-P$ diagram the magnitude of the work is done is

A. $\pi\left(\frac{P_1-P_2}{2}\right)^2$

B. $\pi\left(\frac{V_1 - V_2}{2}\right)^2$

C. $\frac{\pi}{4}(P_2 - P_1)(V_2 - V_1)$

D. $\pi(P_2V_2 - P_1V_1)$

Answer: C

Watch Video Solution

31. In the previous question

(i) work is done by the gas

(ii) work is done on the gas

(iii) heat is absorbed by the gas

(iv) heat is given out by the gas

A. (i),(iii)

B. (ii),(iii)

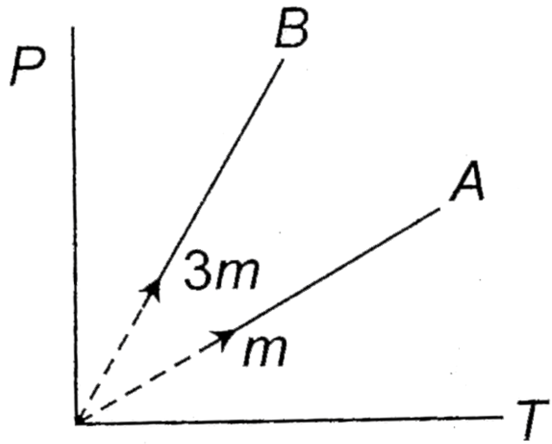
C. (iii),(iv)

D. (i),(ii)

Answer: C

View Text Solution

32. Two different masses m and $3m$ of an ideal gas are heated separately in a vessel of constant volume, the pressure P and absolute temperature T, graphs for these two cases are shown in the figure as A and B. The ratio of slopes of curves B to A is



A. $3:1$

B. $1:3$

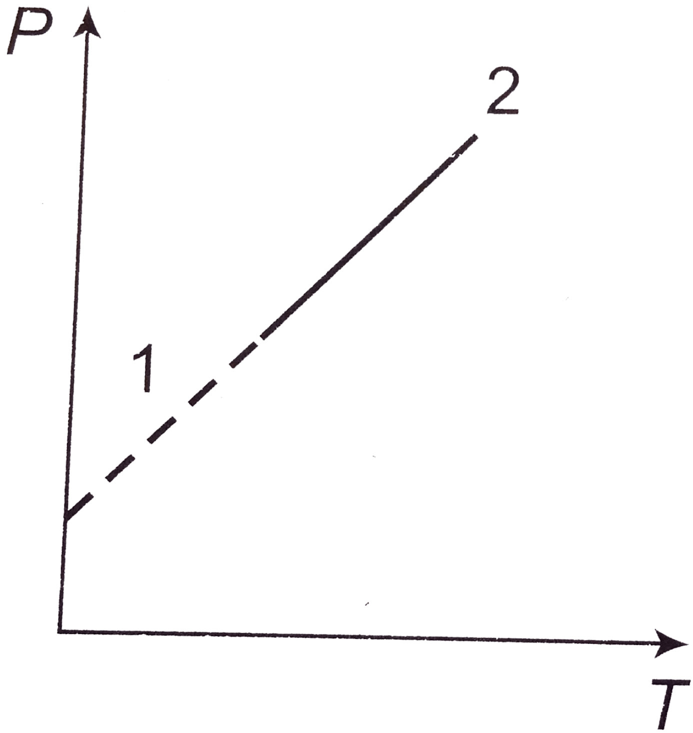
C. $9:1$

D. $1:9$

Answer: A

Watch Video Solution

33.



A pressure P, absolute temperature T, graph was obtained whe a given mass of a gas heated. During the heating process from the state 1 to the state 2, the volume

A. remained same

B. decreased

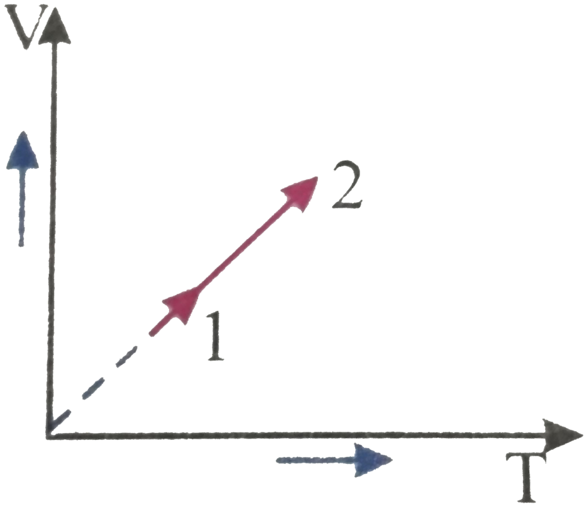
C. increased

D. none

Answer: C

Watch Video Solution

34. A volume V absolute temperature T diagram was obtained when a given mass of gas was heated. During the heating process from state 1 to 2, the pressure



A. remained same

B. decreased

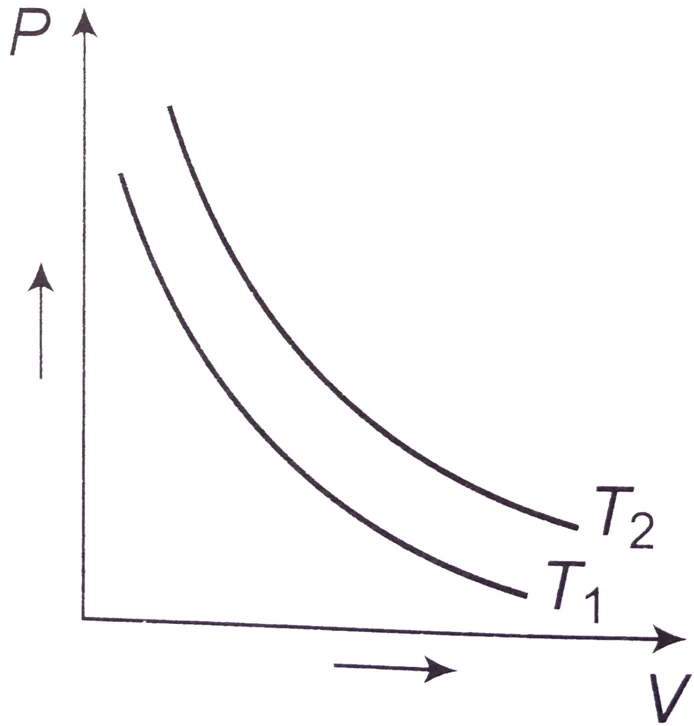
C. increased

D. none

Answer: B

Watch Video Solution

35.



The adjoining figure shows graphs of pressure and volume of a gas at two temperature T_1 and T_2 Which of the following inferences is correct?

A. $T_1 > T_2$

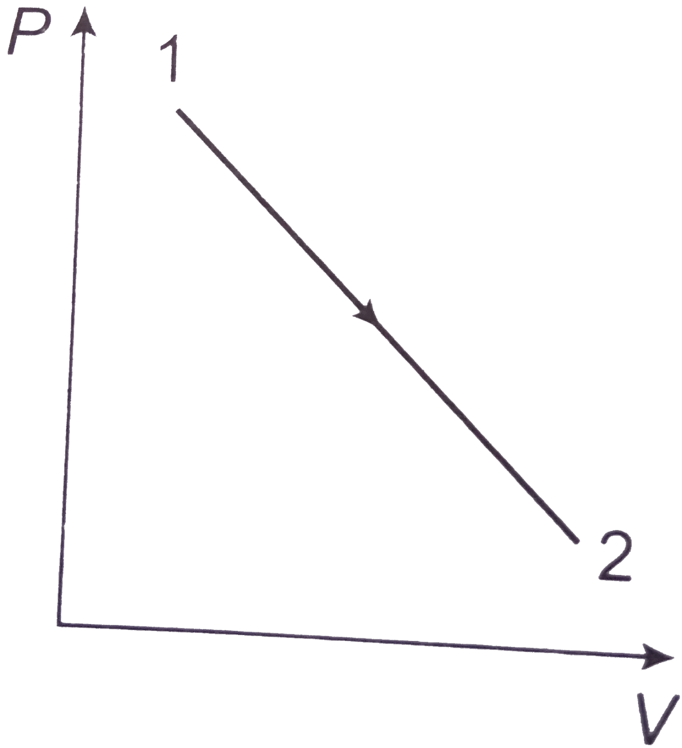
B. $T_1 = T_2$

C. $T_1 < T_2$

D. none

Answer: C

Watch Video Solution



36.

$P - V$ graph was obtained from state 1 to state 2 when a given mass of a gas is subjected to temperature changes during the process the gas is

A. Heated continuously

B. Cooled continuously

C. Heated in the beginning and cooled towards the end

D. cooled in the biginning and heated towards the end

Answer: C

Watch Video Solution

37. A gas expands such that its initial and final temperature are equal . Also, the process followed by the gas traces a straight line on the $P-V$ diagram:-

A. (i),(ii)

B. (ii),(iii)

C. (iii),(iv)

D. (i),(iv)

Answer: D

Watch Video Solution

38. An ideal gas is taken form the state $A(P, V)$ to the state $B\left(\frac{P}{2}, 2V\right)$ along a straight line path in the $P-V$ diagram.

Select the correct options

(i) The work done by the gas in the process A to B exceeds the work that would be done by it if the system were taken from A to B along the isotherm

(ii) In the $T-V$ diagram, the path AB becomes part of a hyperbola

(iii) In the $P-T$ diagram, the path AB becomes part of a hyperbola

(iv) In going from A to B, the temperature T of the first increases to maximum value and then decreases

A. (i),(iii)

B. (ii),(iii)

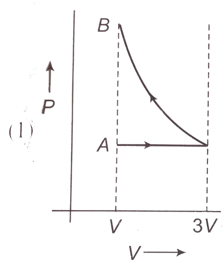
C. (iii),(iv)

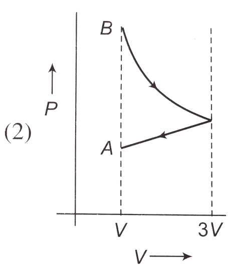
D. (i),(ii),(iv)

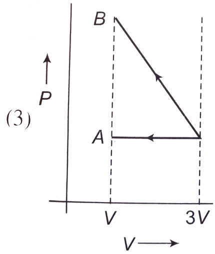
Answer: D

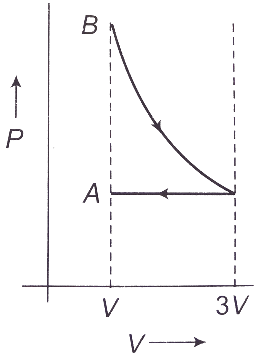
Watch Video Solution

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

A. 

B. 

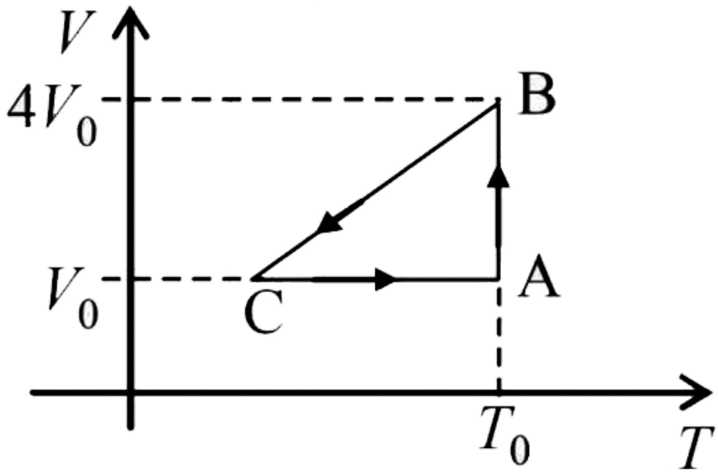
C. 

D. 

Answer: D

Watch Video Solution

40. 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. (i),(ii)

B. (ii),(iii),(iv)

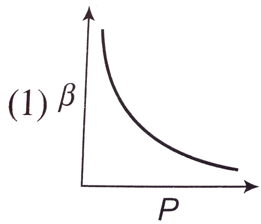
C. (i),(ii),(iii)

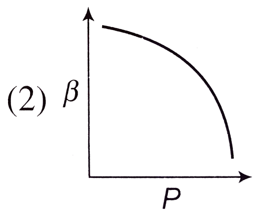
D. all

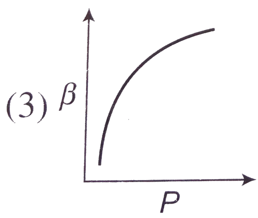
Answer: D

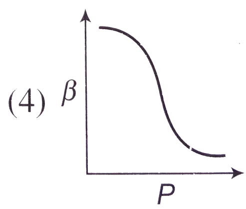
Watch Video Solution

41. Which of the following graphs correctly represents the variation of $\beta = -\dfrac{dV/dP}{V}$ with P for an ideal gas at constant temperature?

A. 

B. 

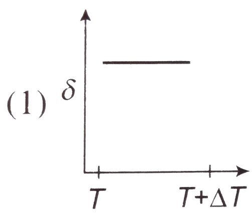
C. 

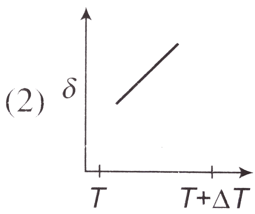
D. 

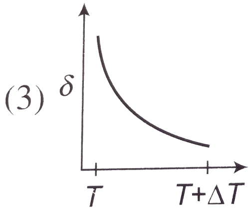
Answer: A

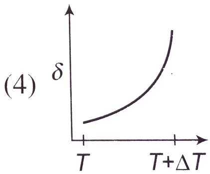
Watch Video Solution

42. An ideal gas is initially at temperature T and volume V. Its volume is increased by ΔV due to an increase in temperature ΔT, pressure remaining constant. The quantity $\delta = \frac{\Delta V}{V \Delta T}$ varies with temperature as

A. 

B. 

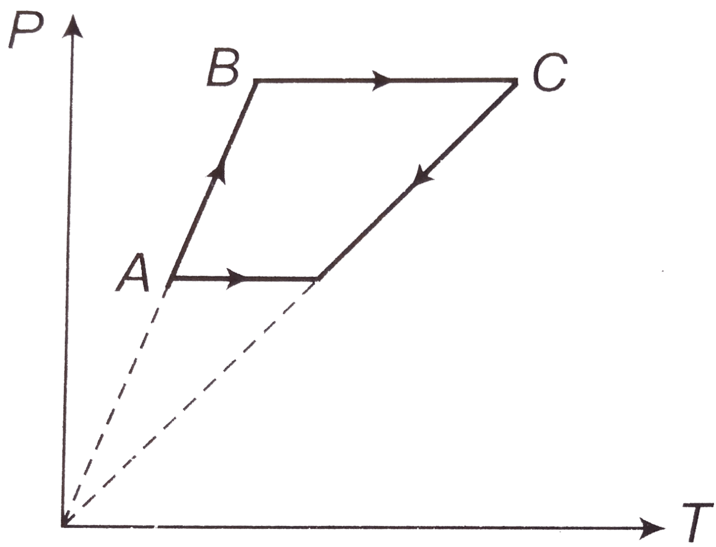
C. 

D. 

Answer: C

Watch Video Solution

43.



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

A. 20 kJ

B. 30 kJ

C. 40 kJ

D. 60 kJ

Answer: C

Watch Video Solution

44. Assertion: The internal energy of an ideal gas does not change during an isothermal process.

Reason: The decrease in volume of a gas is compensated by a corresponding increase in perssure, when its temp. is held constant.

A. Both A and B are tue and R is the correct explanation of A

B. Both A and R are true but R is not the correct explanation of A

C. A is true but R is false

D. A is false but R is true

Answer: A

Watch Video Solution

45. For an isothermal expansion of a perfect gas, the value of $\frac{\Delta P}{P}$ is

A. $-\gamma^{\frac{1}{2}}\frac{\Delta V}{V}$

B. $-\frac{\Delta V}{V}$

C. $-\gamma \frac{\Delta V}{V}$

D. $\gamma^2 \frac{\Delta V}{V}$

Answer: B

Watch Video Solution

46. If heat is supplied to an ideal gas in an isothermal process.

A. the internal energy of the gas will increase

B. the gas will do positive work

C. the gas will do negative work

D. the said process is not possible

Answer: B

Watch Video Solution

47. In an isothermal process on an ideal gas, the pressure increases by 0.5% . The volume decreases by about.

A. 0.25%

B. 0.50%

C. 0.7%

D. 1%

Answer: B

Watch Video Solution

48. The internal energy of a system remains constant when it undergoes

(i) a cyclic process

(ii) an isothermal process

(iii) an adiabatic process

(iv) any process in which the heat given out by the system equal to the work done on the system

A. (i),(iii)

B. (ii)

C. (ii),(iv)

D. (i),(ii),(iv)

Answer: B

Watch Video Solution

49. When an ideal gas in a cylinder was compreswsed isothermally by a piston, the work done on the gas found to be 1.5×10^4 cal. During this process about

A. $3.6 \times 10^3 cal$ of heat flowed out from the gas

B. $3.6 \times 10^3 cal$ of heat flowed into the gas

C. 1.5×10^4 cal of heat flowed into the gas

D. 1.5×10^4 cal of heat flowed out from the gas

Answer: A

Watch Video Solution

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

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

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

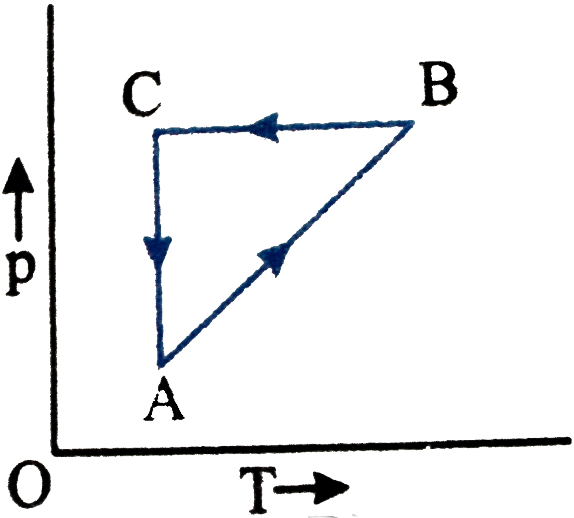
C. 300 J of heat has been added to the gas

D. No heat is transferred because the process is isothermal

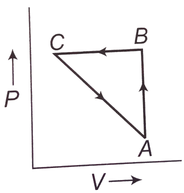
Answer: B

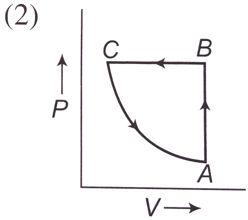
Watch Video Solution

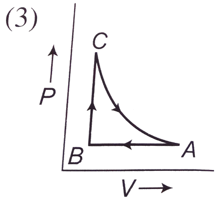
51. A cyclic process is shown in the $P-T$ siagram. Whech of the curves show the same process on a $P-V$ diagram ?

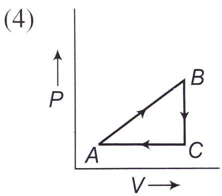


A. (1)



B. 

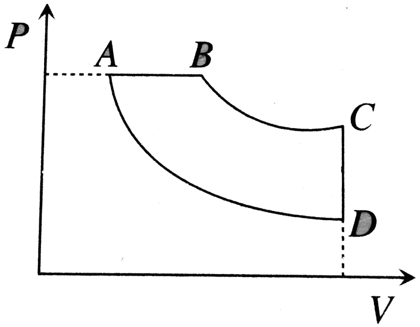
C. 

D. 

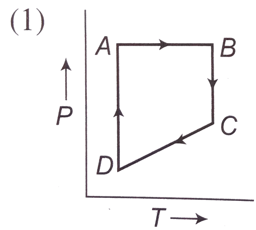
Answer: B

Watch Video Solution

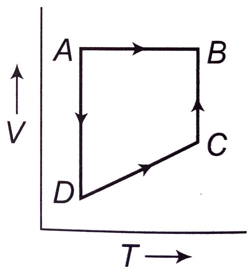
52. A cyclic process $ABCD$ is shown is shown in the following $P - V$ diagram. Which of the following curves represent the same process ?



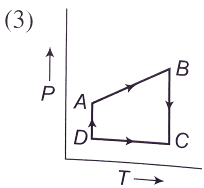
A.

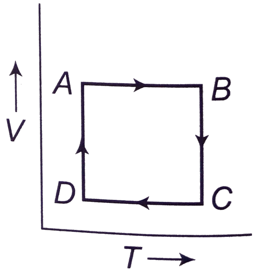


B.



C.

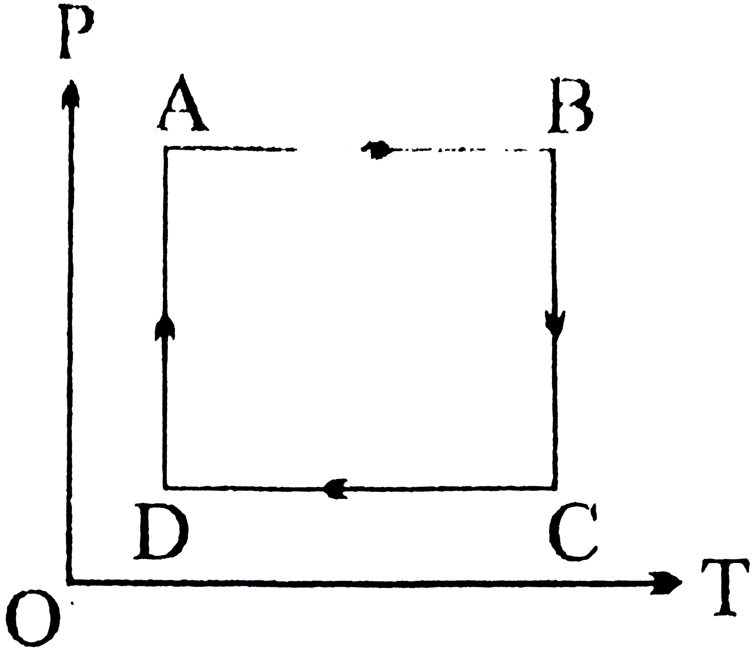


D. 

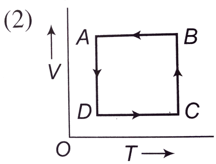
Answer: A

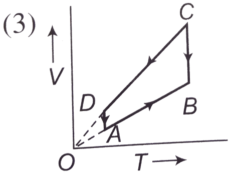
Watch Video Solution

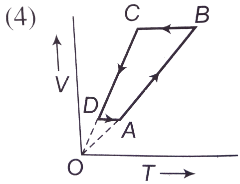
53. A cyclic process is shown on the P-T diagram. Which of the curve shown the same process on a V-T diagram?



A. 

B. 

C. 

D. 

Answer: C

Watch Video Solution

54. A gas is contained in a metallic cylinder fitted with a piston.The piston is suddenly moved in to compress the gas and is maintained at this position. As time passes the pressure of the gas in the cylinder

A. increases

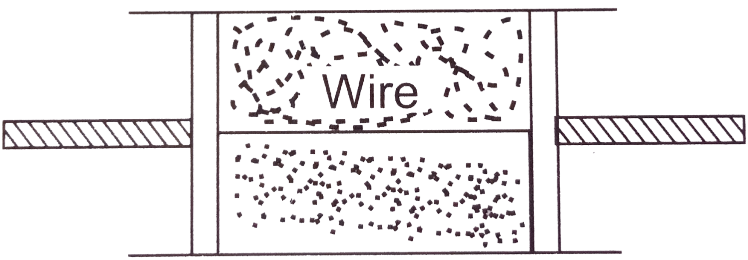
B. decreases

C. remains same

D. none

Answer: B

Watch Video Solution

55. 

A cylindrical tube of uniform cross-sectional area A is fitted with two air tight frictionless pistons. The pistons are connected to each other by a metallic wire. Initially the pressure of the gas is P_0 and temperature is T_0, atmospheric pressure is also P_0. Now the temperature of the gas is increased to $2T_0$, the tension in the wire will be

A. $2P_0A$

B. P_0A

C. $\frac{P_0A}{2}$

D. $4P_0A$

Answer: B

Watch Video Solution

56. The latent heat of vaporisation of water is 2240 J/gm. If the work done in the process of expansion of 1 g of water is 168 J, then increase in internal energy is

A. 2408 J

B. 2240 J

C. 2072 J

D. 1904 J

Answer: C

Watch Video Solution

57. When 1g of water at $0^\circ C$ and $1 \times 10^5 \frac{N}{m^2}$ pressure is converted into ice of volume $1.091 cm^3$. The external work done will e

A. 0.0091 Joule

B. 0.0182 Joule

C. -0.0091 Joule

D. -0.0 Joule

Answer: A

Watch Video Solution

58. A vessel containing 5 litres of a gas at 0.8 m pressure is connected to an evacuated vessel of volume 3 litres. The resultant pressure inside with be (assuming whole system to be isolated)

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

B. $0.5m$

C. $2.0m$

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

Answer: B

Watch Video Solution

59. A thermally insulated container is divided into two parts by a screen. In one part the pressure and temperature are P and T for an ideal gas filled. In the second part it is vacuum. If now a small hole is created in the screen, then the temperature of the gas will

A. decrease

B. increase

C. remains same

D. none of the above

Answer: C

Watch Video Solution

60. Each molecule of a gas has f degrees of freedom. The ratio γ for the gas is

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

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

C. $1 + \frac{2}{f}$

D. $1 + \frac{(f-1)}{3}$

Answer: C

Watch Video Solution

61. The molar heat capacity of a gas at constant volumes is C_V. If n moles of the gas under ΔT change in temperature it's internal energy will change by $nC_V\Delta T$

A. only if the change of temperature occurs at constant volume

B. only if the change of temperature occurs at constant pressure

C. in any process which is not adiabatic

D. in any process

Answer: D

Watch Video Solution

62. Let (C_v) and (C_p) denote the molar heat capacities of an ideal gas at constant volume and constant pressure respectively . Which of the following is a universal constant?

A. $\frac{C_p}{C_v}$

B. $C_pC - v$

C. $C_p - C_v$

D. $C_p + C_v$

Answer: C

Watch Video Solution

63. The molar heat capacity for an ideal gas cannot

A. cannot be negative

B. must be equal to either C_v or C_p

C. must lie in the range $C_v \leq C \leq C - p$

D. may have any value between $-\infty$ and $+\infty$

Answer: D

Watch Video Solution

64. If for a gas, $\frac{R}{C_V} = 0.67$, the gas is

A. diatomic

B. monoatomic

C. polyatomic

D. mixture of diatomic and polyatomic gases

Answer: B

Watch Video Solution

65. For hydrogen gas $C_p - C_v = a$ and for oxygen gas $C_p - C_v = b$,C_p and C_v being molar specific heats. The relation between a and b is

A. $a = 16$

B. $16a = b$

C. $a = 4$

D. $a = b$

Answer: D

Watch Video Solution

66. If for hydrogen $s_p - s_v = a$ and oxygen $s_p - s_v = b$, where s_p and s_v refer to specific heats at constant pressure and at constant volume then

A. $a = b$

B. $a = 16b$

C. $b = 16a$

D. a and b are not related

Answer: B

Watch Video Solution

67. The ratio $\frac{C_p}{C_v} = \gamma$ for a gas. Its molecular weight is M. Its specific heat capacity at constant pressure is

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

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

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

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

Answer: C

Watch Video Solution

68. C_p is always greater than C_v for a gas, which of the following statements provide, partly or wholly, the reason for this?

(i) No work is done by a gas at constant volume

(ii) When a gas absorbs heat at constant pressure, its volume must change

(iii) For the same change in temperature, the internal energy of a gas changes by a smaller amount at constant volume that at constant pressure

(iv) The internal energy of an ideal gas is a function only of its temperature

A. (i),(ii)

B. (ii),(iii)

C. (iii),(iv)

D. all

Answer: A

Watch Video Solution

69. If one mole of a monatomic gas $\left(\gamma = \frac{5}{3}\right)$ is mixed with one mole of a diatomic gas $\left(\gamma = \frac{7}{5}\right)$, the value of gamma for mixture is

A. 1.4

B. 1.5

C. 1.53

D. 3.07

Answer: B

Watch Video Solution

70. A mixture of n_1 moles of monoatomic gas and n_2 moles of diatomic gas has $\gamma = 1.5$

A. $n_1 = n_2$

B. $2n_1 = n_2$

C. $n_1 = 2n_2$

D. $n_1 = 3n_2$

Answer: A

Watch Video Solution

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

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

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

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

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

Answer: D

Watch Video Solution

72. A gas, for which γ is $\frac{4}{3}$ is heated at constant pressure. The percentage of heat supplied used for external work is

A. $25\ \%$

B. $15\ \%$

C. $60\ \%$

D. $40\ \%$

Answer: A

Watch Video Solution

73. A monatomic gas expands at constant pressure on heating. The percentage of heat supplied that increases the internal energy of the gas and that is involed in the expansion is

A. $75\%, 25\%$

B. $25\%, 75\%$

C. $60\%, 40\%$

D. $40\%, 60\%$

Answer: C

Watch Video Solution

74. 70 calories of heat required to raise the temperature of 2 moles of an ideal gas at constant pressure from $30^\circ C \rightarrow 35^\circ C$. The amount of heat required (in calories) to raise the temperature of the same gas through the same range $(30^\circ C \rightarrow 35^\circ C)$ at constant volume is:

A. 30 cal

B. 50 cal

C. 70 cal

D. 90 cal

Answer: B

Watch Video Solution

75. The average degrees of freedom per molecule for a gas are 6. The gas performs $25J$ of work when it expands at constant pressure. The heat absorbed by gas is

A. 75 J

B. 100 J

C. 150 J

D. 125 J

Answer: B

Watch Video Solution

76. A rigid container of negligible heat capacity contains one mole of an ideal gas. The temperatures of the gas increases by $1^{\circ}C$ if 3.0 cal of heat is added to it. The gas may be

A. (i),(ii)

B. (ii),(iii)

C. (iii),(iv)

D. (i),(iv)

Answer: A

Watch Video Solution

77. Work done by a sample of an ideal gas in a process A is double the work done in another process B. The temperature rises through the same amount in the two processes. If `(C_A and C_B) be the molar heat capacities for the two processes,

A. $C_A = C_B$

B. $C_A < C_B$

C. $C_A > C_B$

D. none

Answer: C

78. In case of water from 0 to $4^{\circ} C$

(i) Volume decreases and density of water is maximum at $4^{\circ} C$

(ii) ΔW will be negative, since volume decreases

(iii) $C_p > C_V$

(iv) $C_P < C_V$

A. (i),(ii)

B. (ii),(iii)

C. (iii),(iv)

D. (i),(ii),(iv)

Answer: D

Watch Video Solution

79. A monoatomic gas of n-moles is heated temperature T_1 to T_2 under two different conditions

(i) at constant volume and

(ii) At constant pressure The change in internal energy of the gas is

A. More for (i)

B. More for (ii)

C. Same in both cases

D. Independent of number of moles

Answer: C

Watch Video Solution

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

A. 4 R

B. 2 R

C. 3 R

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

Answer: B

Watch Video Solution

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

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

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

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

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

Answer: C

Watch Video Solution

82. Which of the following is correct regarding adiabatic process

(i) In adiabatic process, all the three variables, P, V and T changes

(ii) In adiabatic process, the heat exchanged between system and surrounding is zero i.e., $\Delta Q = 0$

(iii) Since $\Delta Q = nC\Delta T$, therefore for adiabatic process molar specific heat $C = 0$

(iv) If a gas is suddenly expanded adiabatically temperature falls and if gas is adiabatically compressed, temperature rises

A. (i),(iii)

B. (ii),(iii)

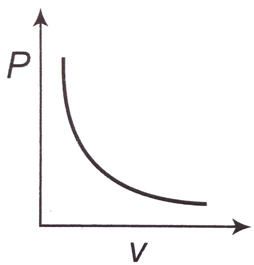
C. (iii),(iv)

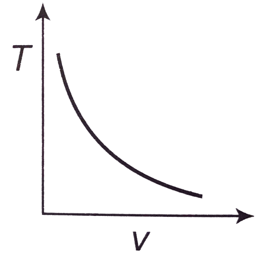
D. all

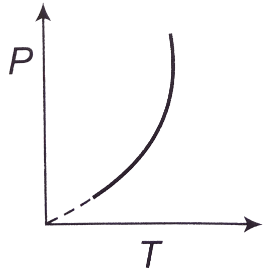
Answer: D

Watch Video Solution

83. Which of the following is correct regarding adiabatic process

A. 

B. 

C. 

D. All option are correct

Answer: D

Watch Video Solution

84. The molar heat capacity for an ideal gas (i) Is zero for an adiabatic process

(ii) Is infinite for an isothermal process

(iii) depends only on the nature of the gas for a process in which either volume or pressure is constant

(iv) Is equal to the product of the molecular weight and specific heat capacity for any process

A. (i),(iii)

B. (ii),(iii)

C. (iii),(iv)

D. all

Answer: D

Watch Video Solution

85. For an adiabatic expansion of a perfect gas, the value of $\frac{\Delta P}{P}$ is equal to

A. $-\gamma^{\frac{1}{2}}\frac{\Delta V}{V}$

B. $-\frac{\Delta V}{V}$

C. $-\gamma\frac{\Delta V}{V}$

D. $\gamma^2\frac{\Delta V}{V}$

Answer: C

Watch Video Solution

86. In an adiabatic process on a gas with $(\gamma = 1.4)$ the pressure is increased by 0.5% . The volume decreases by about

A. $0.36\ \%$

B. $0.5\ \%$

C. $0.7\ \%$

D. $1\ \%$

Answer: A

Watch Video Solution

87. Diatomic gas at pressure 'P' and volume 'V' is compressed adiabatically to 1/32 times the original volume. Then the final pressure is

A. 32 P

B. 64 P

C. 128 P

D. 256 P

Answer: C

Watch Video Solution

88. An ideal gas at $27^\circ C$ is compressed adiabatically to $8/27$ of its original volume. If $\gamma = 5/3$, then the rise in temperature is

A. $450^\circ C$

B. $375^{\circ}C$

C. $225^{\circ}C$

D. $405^{\circ}C$

Answer: B

Watch Video Solution

89. An ideal gas at pressure of 1 atmosphere and temperature of $27^{\circ}C$ is compressed adiabatically until its pressure becomes 8 times the initial pressure, then the final temperature is $(\gamma = 3/2)$

A. $627^{\circ}C$

B. $527^\circ C$

C. $427^\circ C$

D. $327^\circ C$

Answer: D

Watch Video Solution

90. The pressure and density of a diatomic gas $(\gamma = 7/5)$ change adiabatically from (p,d) to (p', d'). If $\frac{d'}{d} = 32$, then $\frac{P'}{P}$ should be

A. $\frac{1}{128}$

B. 32

C. 128

D. none of the above

Answer: C

Watch Video Solution

91. A monoatomic ideal gas, initially at temperature T_1, is enclosed in a cylinder fitted with a friction less piston. The gas is allowed to expand adiabatically to a temperature T_2 by releasing the piston suddenly. If L_1 and L_2 are the length of the gas column before expansion respectively, then $\frac{T_1}{T_2}$ is given by

A. $\left(\frac{L_1}{L_2}\right)^{\frac{2}{3}}$

B. $\left(\frac{L_1}{L_2}\right)$

C. $\left(\frac{L_2}{L_1}\right)$

D. $\left(\frac{L_2}{L_1}\right)^{\frac{2}{3}}$

Answer: D

Watch Video Solution

92. In an adiabatic change, the pressure p and temperature T of a diatomic gas are related by the relation $p \propto T^{\alpha}$, where α equals

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

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

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

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

Answer: D

Watch Video Solution

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

A. 2

B. 1.5

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

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

Answer: B

Watch Video Solution

94. The work of 146 kJ is performed in order to compress one kilo mole of a gas adiabatically and in this process the temperature of the gas increases by $7^{\circ} C$. The gas is $(R = 8.3 ml^{-1} J mol^{-1} K^{-1})$

A. Triatomic

B. A mixture of monoatomic and idatomic

C. Monoatomic

D. Diatomic

Answer: D

Watch Video Solution

95. The adiabatic elasticity of hydrogen gas $(\gamma = 1.4)$ at NTP

A. $1 \times 10^5 \frac{N}{m^2}$

B. $1 \times 10^8 \frac{N}{m^2}$

C. $1.4 \frac{N}{m^2}$

D. $1.4 \times 10^5 \frac{N}{m^2}$

Answer: D

Watch Video Solution

96. $1mm^3$ of a gas is compressed at 1 atmospheric pressure and temperature $27^\circ C$ to $627^\circ C$. What is the final pressure under adiabatic condition (γ for the gas $= 1.5$)

A. $27 \times 10^5 \frac{N}{m^2}$

B. $80 \times 10^5 \frac{N}{m^2}$

C. $36 \times 10^5 \frac{N}{m^2}$

D. $56 \times 10^5 \frac{N}{m^2}$

Answer: A

Watch Video Solution

97. For which of the following processes is the entropy change zero,

A. Isobaric

B. Isothermal

C. Adiabatic

D. none of the above

Answer: C

Watch Video Solution

98. If a cylinder containing a gas at high pressure explodes, the gas undergoes

A. reversible adiabatic change and fall of temperature

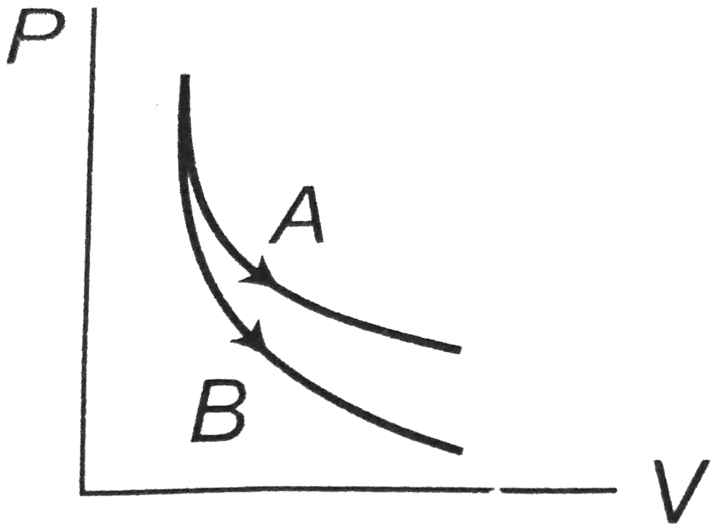
B. reversible adiabatic change and rise of temperature

C. Irreversible adiabatic change and fall of temperature

D. Irreversible adiabatic change and rise of temperature

Answer: C

Watch Video Solution



99.

Consider the process A and B shown in the figure. It is possible that

A. both the processes are isothermal

B. both the processes are adiabatic

C. A is isothermal and B is adiabatic

D. A is adiabatic and B is isothermal

Answer: C

Watch Video Solution

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

A. (i),(iii)

B. (ii),(iii)

C. (iii),(iv)

D. (i),(ii),(iii)

Answer: D

Watch Video Solution

101. 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 if purely adiabatic, then

A. $W_2 > W_1 > W_3$

B. $W_2 > W_3 > W_1$

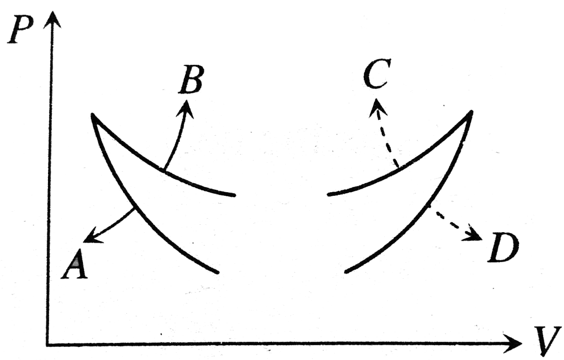
C. $W_1 > W_2 > W_3$

D. $W_3 > W_1 > W_2$

Answer: A

Watch Video Solution

102. Four curves A, B, C and D are drawn in Fig. for a given amount of gas. The curves which represent adiabatic and isothermal changes



A. C and D respectively

B. D and C respectively

C. A and B respectively

D. B and A respectively

Answer: C

Watch Video Solution

103. A thermally insulated vessel contains an ideal gas of molecular mass M and ratio of specific heats γ. It is moving with speed v and it's suddenly brought to rest. Assuming no heat is lost to the surroundings, Its temperature increases by:

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

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

C. $\frac{\gamma M v^2}{2R}$

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

Answer: D

Watch Video Solution

104. Initial pressure and volume of a gas are P and V respectively. First it is expanded isothermally to volume 4 V and then compressed adiabatically to volume V. The final pressure of gas will be (given $\gamma = \frac{3}{2}$)

A. $1P$

B. $2P$

C. $4P$

D. $8P$

Answer: B

Watch Video Solution

105. 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

Watch Video Solution

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

A. $(T + 2.4)K$

B. $(T - 2.4)K$

C. $(T + 4)K$

D. $(T - 4)K$

Answer: D

Watch Video Solution

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

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

B. PV

C. $\frac{PV}{(\gamma - 1)}K$

D. $(T - 4)K$

Answer: C

Watch Video Solution

108. For an ideal gas,

(i) the change in internal energy in a constant pressure process from temperature T_1 to T_2 is equal to $nC_V(T_2 - T_1)$, where C_V is the molar heat capacity at constant volume and n is the number of moles of the gas

(ii) The change in internal enregy of the gas and the work done by the gas are equal in magnitude in an adiabatic process.

(iii) The internal energy does not change in an isothermal process. ltbr. (iv) no heat is added or removed in an adiabatic process

A. (i),(iii)

B. (ii),(iii)

C. (iii),(iv)

D. all

Answer: D

Watch Video Solution

109. A gas may expand either adiabatically or isothermally. A number of $p-V$ curves are drawn for the two processes over different ranges of pressure and volume, it will be found that

(i) Two adiabatic curves do not intersect

(ii) two isothermal curves do not intersect

(iii) an adiabatic curve and an isothermal curve may intersect.

(iv) the magnitude of the slope of an adiabatic curve is greater thanthe magnitude of the slope of an isothermal curve

A. (i),(ii)

B. (ii),(iii)

C. (iii),(iv)

D. all

Answer: D

Watch Video Solution

110. The internal energy of an ideal gas decreases by the same amount as the work done by the system

(i) The process must be adiabatic

(ii) The process must be isothermal

(iii) The process must be isobaric

(iv) The temperature must decrease

A. (i),(ii)

B. (ii),(iii)

C. (iii),(iv)

D. (i),(iv)

Answer: D

Watch Video Solution

111. Three identical adiabatic containers A, B and C Contain helium, neon and oxygen respectively at equal pressure. The gases are pushed to half their original volumes.

A. (i),(ii)

B. (ii),(iii)

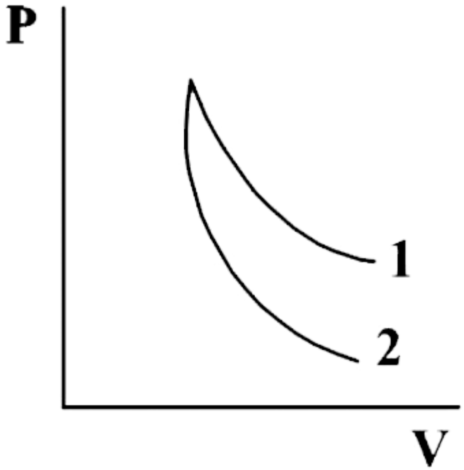
C. (iii),(iv)

D. (i),(iv)

Answer: C

Watch Video Solution

112. P-V plots for two gases during adiabatic processes are shown in the figure. Plots 1 and 2 should corresponds respectively to



A. He or O_2

B. O_2 and He

C. He and Ar

D. O_2 and N_2

Answer: B

Watch Video Solution

113. A gas undergoes a process in which its pressure P and volume V are related as $VP^n =$ constant. The bulk modulus of the gas in the process is:

A. np

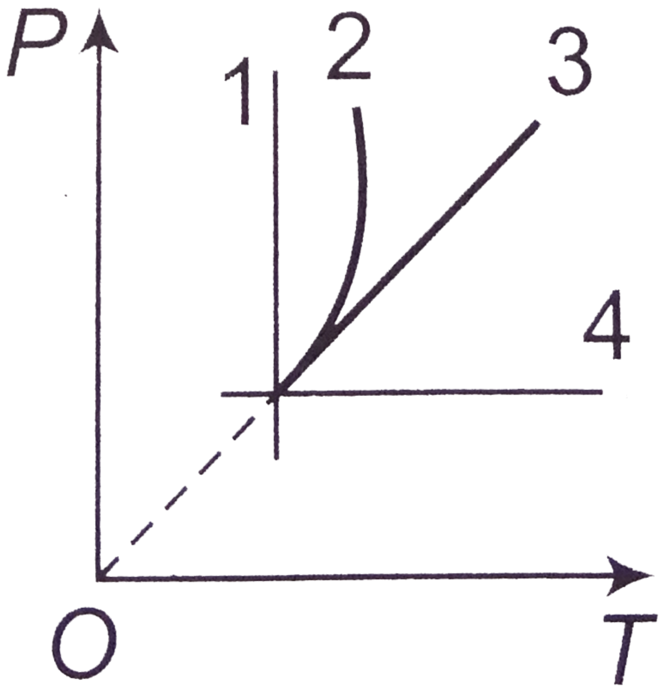
B. $p^{\frac{1}{n}}$

C. $\frac{p}{n}$

D. p^n

Answer: C

Watch Video Solution



114.

In the figure shown, the processes leveled 1,2,3 and 4 are

A. isothermal, adiabatic, isobaric, isochoric

B. isothermal, adiabatic, isochoric, isobaric

C. adiabatic, isothemal, isobaric, isochoric

D. adiabatic, isobaric, isothermal, isochoric

Answer: B

Watch Video Solution

115. "Heat cannot by itself flow from a body at lower temperature to a 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

Watch Video Solution

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

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

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

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

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

Answer: A

Watch Video Solution

117. Choose the incorrect statement from the following:

S1: The efficiency of a heat engine can be 1, but the coefficient of performance of a refrigerator can never be infinity

S2: The first law of thermodynamics is basically the principle of conservation of energy

S3: The second law of thermodynamics does not allow

S4: A process, whose sole result is the transfer of heat from a colder object to hotter object is impossible

A. S1

B. S3

C. S2

D. S4

Answer: A

Watch Video Solution

118. An ideal gas is subjected to cyclic process involving four thermodynamics thates, the amounts of heat (Q)

and work (W) involved in each of these states.

$$Q_1 = 6000J, Q_2 = -5500J, Q_3 = -3000J, Q_4 = 3500J$$

$$W_1 = 2500J, W_2 = -1000J, W_3 = -1200J, W_4 = xJ$$

The ratio of the net work done by the gas to the total heat absorbed by the gas is η. The values of x and η respectively are

A. $500, 7.5\%$

B. $700, 10.5\%$

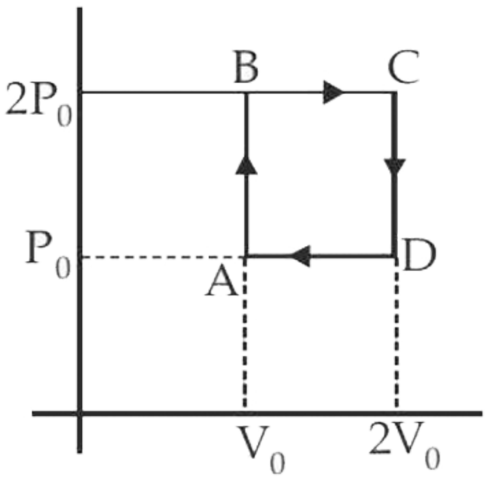
C. $1000, 21\%$

D. $1500, 15\%$

Answer: B

Watch Video Solution

119. Helium gas goes through a cycle ABCDA (consisting of two isochoric and isobaric lines) as shown in figure Efficiency of this cycle is nearly: (Assume the gas to be close to ideal gas)



A. $15.4\ \%$

B. $9.1\ \%$

C. $10.5\ \%$

D. $12.5\ \%$

Answer: A

Watch Video Solution

120. The maximum possible efficiency of an engine that aborbs hat at $327^\circ C$ and exhausts heat at $127^\circ C$ is

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

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

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

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

Answer: A

Watch Video Solution

121. The efficiency of a carnot engine is $\frac{1}{6}$. If the temperature of the sink is reduced by 62 K, the efficiency becomes $\frac{1}{3}$. The temperature of the source and the sink in the first case are respectively.

A. 372 K, 290 K

B. 372 K, 310 K

C. 744 K, 310 K

D. 744 K, 290 K

Answer: B

Watch Video Solution

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

A. 200 K

B. 400 K

C. 600 K

D. 800 K

Answer: C

Watch Video Solution

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

A. $325^{\circ}C$

B. $325K$

C. $39^{\circ}C$

D. $320^{\circ}C$

Answer: C

Watch Video Solution

124. An ideal refrigerator is used to transfer heat from a freezer at $-23^{\circ}C$ to the surrounding at $27^{\circ}C$. Its coefficient of performance is

A. 2.5

B. 5

C. 7.5

D. 10

Answer: B

Watch Video Solution

125. In a refrigerator, heat from inside at 277K is transferred to a room at 300K. How many joules of heat shall be delivered to the room for each joule of electrical energy consumed ideally?

A. 12 J

B. 1 J

C. 13 J

D. 25 J

Answer: C

Watch Video Solution

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

A. Room is cooled

B. Room is heated

C. Room is either cooled or heated

D. Room is neither cooled nor heated

Answer: B

Watch Video Solution

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

A. 99 J

B. 90 J

C. 1 J

D. 100 J

Answer: B

Watch Video Solution

128. Which of the following statements is correct for any thermodynamic system

A. The internal energy changes in all process

B. Internal energy and entropy are state function

C. The change in entropy can never be zero

D. The work done in an adiabatic process is always zero

Answer: B

Watch Video Solution

129. A mearsure of the degree of disorder of a system is known as

A. Isobaric

B. Isotropy

C. Enthalpy

D. Entropy

Answer: D

Watch Video Solution

130. The change in the entropy of a 1 mole of an ideal gas which went through an isothermal process form an initial state (P_1, V_1, T) to the final state $(P_2, V_2 < T)$ is equal to

A. zero

B. R ln T

C. R ln $\frac{V_1}{V_2}$

D. $R\frac{\ln(V_2)}{V_1}$

Answer: D

Watch Video Solution

131. If heat Q is added reversibly to a system at temperature T and heat Q' is taken away from it reversibly at temperature T', then which one of the following is correct

A. $\frac{Q}{T}-\frac{Q'}{T'}=0$

B. $\frac{Q}{T} - \frac{Q'}{T'} > 0$

C. $\frac{Q}{T} - \frac{Q'}{T'} < 0$

D. $\frac{Q}{T} - \frac{Q'}{T'} =$ change in internal energy of the system

Answer: B

Watch Video Solution