SOLVED EXAMPLES

Ex.1 The internal energy of monatomic and diatomic gases are respectively due to
(A) Linear motion and rolling motion
(B) Rolling motion and linear motion
(C) Linear motion and rotatory motion
(D) Rotatory motion and linear motion

Sol.(A) The internal energy of a monatomic gas is due to linear motion only and that of the diatomic gas is due to rolling (linear trotatry) motion.

Ex.2 A body of mass 2kg is dragged on a horizontal surface with a constant speed of 2 m/s. If the coefficient of friction between the body and the surface is 0.2, then the heat generated in 5 sec will be -
(A) 7.65 cal   (B) 9.33 cal
(C) 10.25 cal   (D) 12.32 cal

Sol.(B) The work done against the force of friction
$= \mu R \times$ displacement $= 0.2 \times 2 \times 9.8 \times 2$ (in one second)
$= (0.2 \times 2 \times 9.8 \times 2) \times 5$ (in 5 second)
$= 39.2 J$
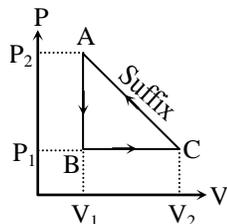Heat generated $= \dfrac{39.2}{4.2} = 9.33$ cal

Ex.3 The height of a water spring is 50m. The difference of temperatures at the top and bottom of the spring will be
(A) 0.437ºC   (B) 0.117ºC
(C) 11.7ºC   (D) 1.17ºC

Sol.(B) $mgh = ms\Delta\theta$
$\Delta\theta = \dfrac{gh}{s} = \dfrac{9.8 \times 50}{4.2 \times 10^3} = 0.117ºC$

Ex.4 In the figure (1) indicator diagram, the net amount of work done will be :

(A) Positive   (B) Negative
(C) Zero   (D) Infinity

Sol.(B) The cyclic process 1 is clockwise and the process 2 is anti-clockwise. Therefore w_1 will be positive and w_2 will be negative area$_2$ > area$_1$, Hence the net work will be negative

Ex.5 In the figure (1) the work done by the system in the closed path ABCA is
(A) $(v_1 - v_2)(p_1 - p_2)$
(B) zero
(C) $\dfrac{1}{2}(p_1 - p_2)(v_1 - v_2)$
(D) $-\dfrac{1}{2}(p_1 - p_2)(v_1 - v_2)$

Sol.(D) Work done in closed path ABCA
$W_{ABCA} = $ Area of ΔABC
$W_{ABCA} = \dfrac{1}{2} AB \times BC$
$W_{ABCA} = -\dfrac{1}{2}(p_1 - p_2)(v_1 - v_2)$

Ex.6 A bullet, moving with velocity v, is stopped by the target and then completely melts if the mass of bullet is m. its specific heat is 's', initially temperature is 25ºC, melting point is 475ºC and latent heat is L, then the velocity V is given by the relation -
(A) $mL = m(475 - 25) + \dfrac{mv^2}{2J}$
(B) $ms(475 - 25) + mL = \dfrac{mv^2}{2J}$
(C) $ms(475 - 25) + mL = \dfrac{2J}{mv^2}$
(D) $ms(475 - 25) = mL + \dfrac{2J}{mv^2}$

Sol.(B) $\because$ $W = JQ$
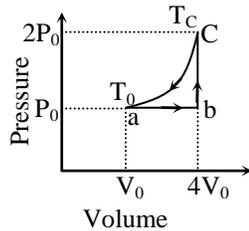and $W = \dfrac{mv^2}{2}$ and $Q = mL + ms(\theta_2 - \theta_1)$
$\therefore$ $\dfrac{mv^2}{2} = [mL + ms(\theta_2 - \theta_1)]$
$\therefore$ $\dfrac{mv^2}{2} = mL + ms(475 - 25)$

Ex.7 One mole of an ideal monatomic gas is caused to go through the cycle shown in fig. then the change in the internal energy in expanding the gas from a to c along path abc is

(A) $3P_0V_0$ (B) $6RT_0$

(C) $4.5 \, RT_0$ (D) $10.5 \, RT_0$

Sol.(D)

$$\because \quad \frac{Pv}{T} = nR = \text{constant}$$

For any state of an ideal gas. Therefore

$$\frac{P_a V_a}{T_a} = \frac{P_c V_c}{T_c} \quad \text{or} \quad \frac{P_0 V_0}{T_0} = \frac{2P_0 4V_0}{T_c}$$
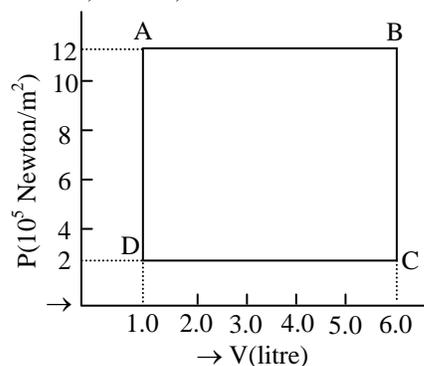
$$T_c = 8T_0$$

Thus change in internal energy

$$\Delta U = nC_v \Delta T$$

$$= 1 \times \frac{3}{2} \times R \times 7T_0 = \frac{21}{2} RT_0$$

$$= 10.5 \, RT_0$$

Ex.8 The diagram shows a P-V graph of the thermodynamic behavior of an ideal gas. Find to this graph (i) work done in processes $A \rightarrow B$, $B \rightarrow C$, $C \rightarrow D$ and $D \rightarrow A$

(A) 6000 J, 0, 1000J, 0

(B) 5000 J, 0, 0, 1000 J

(C) 0, 0, 6000J, 1000J

(D) 6000J, 0, 1000J, 1000J

Sol.(A) The work done in a thermodynamic process is equal to the area enclosed between the P-V curve and the volume axis.

work done by the gas in the process $A \rightarrow B$ is

$W_1 = $ area ABB'A' $= AB \times A' \times A$

$\therefore \quad W_1 = (6.0 - 1.0)$ litre $\times (12 \times 10^5)$ Nxm^2

$\Rightarrow \quad W_1 = 5.0 \times 10^{-3}$ m$^3 \times 12 \times 10^5$ N/m^2

$\Rightarrow \quad W_1 = 6000$ N-m $= 6000$J

work done in the process $B \rightarrow C$ is zero since volume remains constant

work done on the gas in the procces $C \rightarrow D$ is

$W_2 = $ area DCB'A'

$W_2 = DC \times AD' = (5 \times 10^{-3}) \times (2 \times 10^5) = 1000$J

work done in the process $D \rightarrow A$ is also zero

Hence the correct answer is (A)

Ex.9 The figure shows the change in a thermodynamic system is going from an initial state A to the state B and C and returning to the state A. if $U_A = 0$, $U_B = 30$J an the heat given to the system in the process $B \rightarrow C$, 50J, then determine:

(i) internal energy in the state C

(ii) heat given to the system in the process $A \rightarrow B$
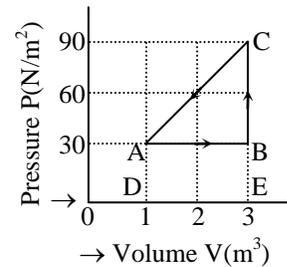
(A) 80J, 90J   (B) 120J, 60J

(C) 90J, 80J   (D) 50J, 60J

Sol. **(A)** Work done in the process $B \rightarrow C$, $W = 0$

$\because$ volume is constant and heat given to the system

$$Q = 50J \text{ (given)}$$

Hence, by the first law of thermodynamics, the change in the internal energy is

$$\Delta U = (U_C - U_B)$$

$$= Q - W = 50J$$

$\because \quad = U_C = U_B + \Delta U = 30 + 50 = 80J$

(ii) For the process $A \rightarrow B$, $\Delta U = U_B - U_A = 30$Joule and $W = $ area ABCD $= DE \times DA$

$$= 2 \times 30 = 60J$$

$\therefore \quad Q = \Delta U + W = 30 + 60 = 90J$

Ex.10 In the above question find out heat given to the system or taken out from the system in the process C → A and network done in complete cycle.

(A) – 200J, 50J   (B) – 200J, 60J
(C) 60J, – 200J   (D) +200J , – 69J

Sol.(B) For the process C → A, $\Delta U = U_A - U_C = 0 - 80$

$\Rightarrow \Delta U = -80J$

and W = area ACED = area ACB + area ABED

$\therefore \quad W = (\frac{1}{2} \times AB \times BC) + (DE \times DA)$

$\therefore \quad W = (\frac{1}{2} \times 2 \times 60) + (2 \times 30) = 120 \, J$

Since in this process the volume decreases, the work will be negative (W=120Joule). that is, the work will be done on the system. Now, by the first law of thermodynamics, will have

$Q = \Delta U + W = -80 - 120 = -200J$

Since it is negative, this heat is given out by the system and work done in the whole cycle

$= \text{area ABC} = \frac{1}{2} \times 2 \times 60 = 60J$

Since the cyclic process is traced anticlowise, the net work will be done on the system

Ex.11 An ideal gas expands from state (P_1, V_1) to state (P_2, V_2) where $P_2 = 2P_1$ and $V_2 = 2V_1$. The path of the gas is expressed by the following relation $P = P_1\left[1 + \left(\dfrac{V - V_1}{V_1}\right)^2\right]$ work done is

(A) $P_1 V_1$ (B) 4/3 $P_1 V_1$
(C) $2P_1 V_1$ (D) 4 $P_1 V_1$

Sol.(B) $W = \int_{V_1}^{2V_1} PdV = \int_{v_1}^{2v_1} P_1\left[1 + \left(\dfrac{V - V_1}{V_1}\right)^2\right] dV$

$\Rightarrow W = P_1 \int_{V_1}^{2V_1} \left(1 + \dfrac{V^2 + V_1^2 - 2VV_1}{V_1^2}\right) dV$

$\Rightarrow W = P_1 \left[2V + \dfrac{V^3}{3V_1^2} - \dfrac{2V^2}{2V_1}\right]_{V_1}^{2V_1}$

$\Rightarrow W = 4/3 \, P_1 V_1$

Ex.12 A Carnot engine takes 103 kilocalories of heat from a reservoir at 627ºC and exhausts it to a sink at 27ºC. The efficiency of the engine will be

(A) 22.2%   (B) 33.3%
(C) 44.4%   (D) 66.6%

Sol.(D) Efficiency of Carnot engine

$\eta = 1 - \dfrac{T_2}{T_1} = 1 - \dfrac{300}{900} = 2/3$

$\therefore \quad \eta = 66.6 \, \%$

Ex.13 From the relation $Cp - Cv = \dfrac{R}{J}$ it is inferred that

(A) the gas is monatomic
(B) gas is diatomic
(C) gas obeys ideal gas equation irrespective of whether it is mono or diatomic
(D) gas is monatomic and it can be ideal or real

Sol.(C) Gas obeys ideal gas equation irrespective of whether it is mono or diatomic

Ex.14 For a thermal expansion Initial and final pressure and volumes of a gas are P_1 , V_1 and P_2, V_2 respectively, if PV^n = constant then the amount of work done will be -

(A) minimum for $n = \gamma$
(B) minimum for $n = \dfrac{1}{\gamma}$
(C) minimum for $n = 1$
(D) maximum for $n = 0$

Sol.(A) The area between adiabatic curve and v-axis is minimum. Hence work done in adiabatic process will be minimum.

Ex.15 Hydrogen gas is filled in a vessel at 20ºC at a certain pressure. some gas is allowed to escape from the vessel and the temperature of the vessel is then raised to 40ºC to obtain the same pressure, then the fraction of the gas allowed to escape is

(A) 0.064   (B) 0.500
(C) 0.193   (D) 0.936

Sol.(A) Let initial n mole of gas was present in the vessel. then

$$n = \frac{PV}{RT_1} \qquad \text{....(1)}$$

Now let a fraction x escapes from the vessel. the remaining gas is let n' mole, then

$$\frac{n - n'}{n} = x \qquad \text{....(2)}$$
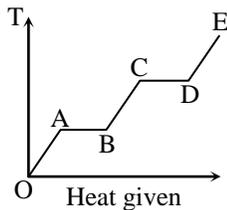
and $n' = \frac{PV}{RT_2}$ 　　　　　　　　　....(3)

Thus using (1) and (3) in (2)

$$\therefore \quad x = 1 - \frac{n'}{n} = 1 - \frac{T_1}{T_2}$$

$$\Rightarrow \quad x = \frac{T_2 - T_1}{T_2} = \frac{20}{(273 + 40)}$$

$$\Rightarrow \quad x = 0.064$$

Ex.16 A solid material is given energy at a constant rate due to which its temperature changes, as shown in fig. The AB portion of the curve denotes –

(A) change from liquid to solid state
(B) change from solid to liquid state
(C) change from liquid to vapour state
(D) change from vapour to liquid state

Sol. **(B)** The horizontal portion of curve AB represents change from solid to liquid state at constant temperature

Ex.17 The temperature of an air bubble while rising from bottom to surface of a lake remains constant but its diameter is doubled if the pressure on the surface is equal to h meter of mercury column and relative density of mercury is ρ then the depth of lake is.

(A) $2\rho hm$ 　　　　　　(B) $4 \rho hm$
(C) $8 \rho hm$ 　　　　　　(D) $7 \rho hm$

Sol. **(D)** Let density of water $= d_w$ & density of mecury d_{Hg}

From Boyle's law (T = constant)

$$P_1 V_1 = P_2 V_2$$

$$\therefore \quad (H\, d_w + h\, d_{Hg})\, g\, (\tfrac{4}{3}\, \pi r^3)$$

$$= h \times d_{Hg}\, g\, (\tfrac{4}{3}\, \pi (2r)^3)$$

$$\Rightarrow \quad Hd_w = 8hd_{Hg} - hd_{Hg}$$

$$\Rightarrow \quad H = 7h\, \frac{d_{mercury}}{d_{water}}$$

$$\therefore \quad H = 7h\rho$$

LEVEL # 1

Temperature scale

Q.1 A temperature different of 5°C on Celsius scale corresponds to the following temperature difference in the Fahrenheit scale -
(A) 9°   (B) 41°
(C) 2.8°   (D) 15°

Q.2 In a temperature scale called Z the boiling point of water is at 65° Z and the freezing point is at – 14° Z. Then the temperature T = – 98° Z corresponds on the Fahrenheit scale to –
(A) – 191 °F
(B) – 159 °F
(C) 79°F
(D) none of the above

Q.3 Suppose that on a temperature scale X, water boils at – 53.5°X and freezes at – 170°X. What would be temperature of 340K be on the X scale ?
(A) 544°   (B) –103°
(C) –91.9°   (D) –120.5°

Q.4 0°C is equivalent to the following :
(A) 273.15 K   (B) 273 K
(C) 0 K   (D) 32 K

Q.5 The temperature of a substance rises by 27°C. The rise is temperature in Kelvin scale will be :
(A) 300 K   (B) 2.46 K
(C) 27 K   (D) 7 K

Mechanical equivalent of heat

Q.6 A water fall is 84 m high. Assuming that half the kinetic energy of the falling water gets converted to heat, the rise in temperature of water is -
(A) 0.098°C   (B) 0.98°C
(C) 9.8°C   (D) 0.0098°C

Q.7 Two bullets of same metal and mass 10gm and 5gm respectively collide against a target with the same velocity. If the whole energy of the bullets is used up in increasing their temperatures then greater increase of temperature will be in :
(A) first bullet   (B) second bullet
(C) equal in both bullets (D) none of these

Q.8 An object of 5kg mass falls from a height of 30m. If the whole amount of mechanical energy is converted into heat, the number of calories generated is :
(A) 150   (B) 60
(C) 350   (D) 6

Q.9 A lead sphere of mass one kg falls from a height of 126m. If the whole kinetic energy is converted into heat, then increase in its temperature will be: (specific heat of lead is 30 calorie/kg°C and g = 9.8 m/sec^2)
(A) 9.8°C   (B) 4.2°C
(C) 4.7 °C   (D) 37°C

Q.10 A body of 10 kg mass falls from a height of 25m and gets rebound to 0.50m. If the loss in energy is converted to heat the body, then rise in temperature will be :
(sp. heat of material is 25.2 J/kg°K)
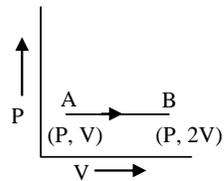(A) 9.8 K   (B) 0.095 K
(C) 0.0095 K   (D) none of these

Work done in different thermodynamic process

Q.11 A thermodynamical system goes from one state to another state (as shown in fig) the external work done is given by–
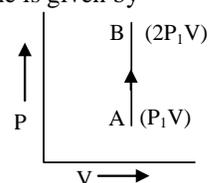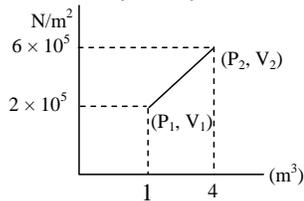

(A) PV   (B) 2PV
(C) zero   (D) 2P^{2}V^2

Q.12 A thermodynamical system goes from state A to state B (as shown figure), the work done is given by -
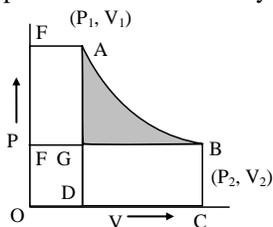

(A) PV   (B) 2PV
(C) zero   (D) 2P^{2}V^2

Q.13 A system changes from the state (P_1, V_1) to (P_2, V_2) as shown in the figure below. What is the work done by the system –
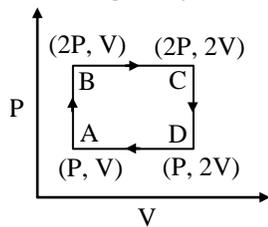

(A) 7.5×10^5 joule (B) 7.5×10^4 erg

(C) 12×10^5 joule (D) 6×10^5 joule

Q.14 An ideal gas is transformed from state $A(P_1, V_1)$ to the state $B(P_2, V_2)$ through path AB. In this process the work done by the gas is –
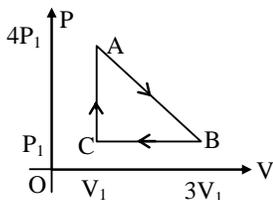

(A) W = area ABCDA
(B) W = area ABEFA
(C) W = area ABGA
(D) W = area ABCOFA

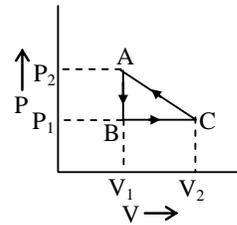**Q.15** An ideal monoatomic gas is taken round the cycle ABCDA as shown P-V diagram. The work-done during the cycle is –

(A) PV (B) 2PV
(C) PV/2 (D) zero

**Q.16** An ideal gas is taken through series of changes ABCA. The amount of work involved in the cycle is –

(A) $12P_1V_1$ (B) $6P_1V_1$
(C) $3P_1V_1$ (D) P_1V_1

Q.17 As shown in the diagram, for a closed path ABCA –

(A) the amount of work done by the system is zero

(B) the amount of work done by the system is
$= -\dfrac{1}{2} (P_2 - P_1)(V_2 - V_1)$

(C) the amount of work done on the system is
$= (P_2 - P_1)(V_1 - V_2)$

(D) the amount of work done by the system is
$= \dfrac{1}{2}(P_2 - P_1)(V_2 - V_1)$

Q.18 A gas of given mass, is brought from stage A to B along three paths 1, 2 and 3, as shown in the figure. If the amount of work done in these three processes is respectively equal to W_1, W_2 and W_3, then –
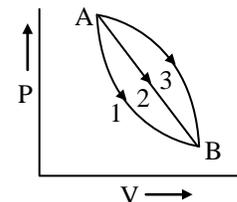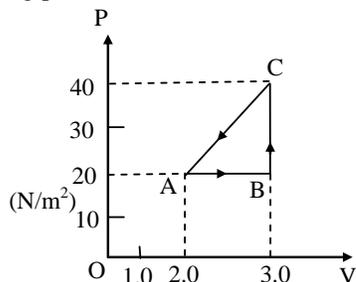

(A) $W_1 > W_2 > W_3$
(B) $W_1 < W_2 < W_3$
(C) $W_1 = W_2 = W_3$
(D) $W_1 < W_2, W_3 < W_2$

Q.19 The indicator diagrams representing minimum and maximum amounts of work done are respectively.
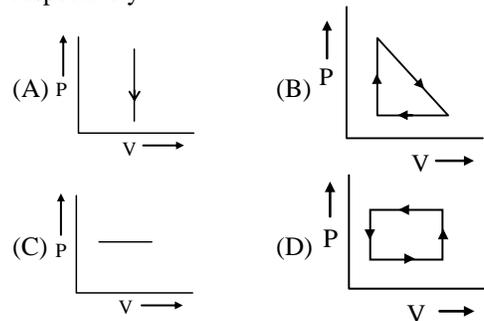
(A) c and a (B) a and c
(C) b and a (D) d and b

Q.20 In the indicator diagram shown, the work done along path AB is -

(A) Zero (B) 20 Joule
(C) – 20 Joule (D) 60 Joule

Q.21 In the above problem work done along path BC is-
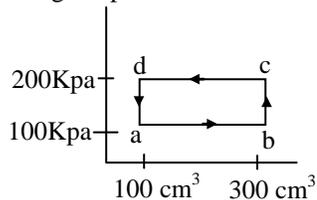(A) Zero
(B) (40 – 20) = 20 Joule
(C) 40 Joule
(D) 60 Joule

Q.22 In the above question, the work done along path CA is –
(A) 20 Joule (B) 30 Joule
(C) – 30 Joule (D) Zero
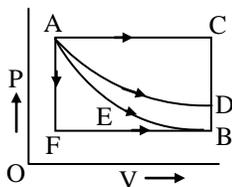
<div style="border:1px solid">Questions based on</div> **First law of thermodynamics**

Q.23 A thermodynamic system is taken through the cycle abcda, find the total heat rejected by the gas during the process –

(A) – 10J (B) – 20J
(C) – 30J (D) – 40J

Q.24 An ideal system can be brought from stage A to B through four paths as shown in the figure. The energy given to the system is minimum in :

(A) path ACB (B) path ADB
(C) path AEB (D) path AFB

Q.25 A system is given 400 calories of heat and 1000 Joule of work is done by the system, then the change in internal energy of the system will be -
(A) 680 Joule (B) 680 erg
(C) 860 Joule (D) – 860 Joule

Q.26 For a thermodynamic process $\delta Q = -50$ calorie and $W = -20$ calorie. If the initial internal energy is -30 calorie then final internal energy will be -
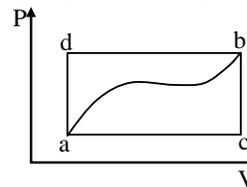(A) 191.20 Calorie (B) – 60 Calorie
(C) 100 Calorie (D) – 100 Calorie

Q.27 The differential form of first law of thermodynamics is -
(A) $\delta Q = \delta W + \delta U$
(B) $\delta Q = \delta W - \delta U$
(C) $\delta Q = \delta U - \delta W$
(D) $\delta Q + \delta U + \delta W = 0$

Q.28 When an ideal diatomic gas is heated at constant pressure then what fraction of heat given is used to increase internal energy of gas ?
(A) $\dfrac{5}{7}$ (B) $\dfrac{3}{7}$
(C) $\dfrac{3}{5}$ (D) $\dfrac{2}{5}$

Q.29 In the adjoined figure the indicator diagram of an ideal thermodynamic gas system is represented. If the change in internal energy along the path **acb** is 10 calorie then change in internal energy along the path **bda** will be –

(A) 10 Calorie
(B) – 10 Calorie
(C) more than 10 Calorie
(D) less than 10 Calorie

Q.30 In the above problem, if the work done along path ac is 20 calorie then the heat given to the system along path acb will be.
(A) 20 Cal. (B) 10 Cal.
(C) 30 Cal. (D) – 10 Cal.

Q.31 A gas is compressed from 10 m³ volume to 4m³ volume at constant pressure of 50 N/m². Then the gas is heated by giving it 100 Joules of energy. The internal energy of the gas will
(A) Increase by 100 Joule
(B) increase by 200 Joule
(C) increases by 400 Joule
(D) decrease by 200 Joule.

Q.32 The pressure of given mass of a gas in a thermodynamic system is changed in such a way that 20 joule of heat is released from the gas and 8 joule of work is done on the gas. If the initial internal energy of the gas was 30 joule then final internal energy will be
(A) 2 Joule (B) 42 Joule
(C) 18 Joule (D) 58 Joule

Q.33 In the diagram, the graph between volume and pressure for a thermodynamical process in shown. If $U_A = 0$, $U_B = 20J$ and the energy given from B to C is 30J, then at the stage of C, the internal energy of the system is –
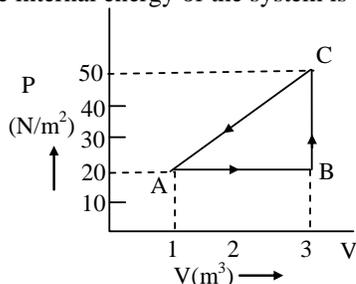
(A) 50J (B) 60J
(C) 30J (D) 10J

Q.34 In the foregoing question, the amount of energy given to the system from A to B is :
(A) 50J (B) 60J
(C) 30J (D) 10J

Q.35 In the foregoing question, work done in the process $A \rightarrow B \rightarrow C \rightarrow A$ is :
(A) 50J (B) 60J
(C) 30J (D) zero

Q.36 A system does 30 joule work after absorbing 32 cal heat. The change in the internal energy of the system will be -
(A) 92J (B) 104.4J
(C) 2J (D) 164.4J

Q.37 Among of work done in changing the state of a system is –15J. If the internal energy and change in internal energy 60J and + 15J, then -
(A) $\Delta Q = 30$ J, $U_f = 45$ J
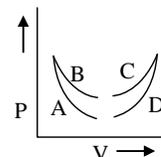(B) $\Delta Q = 0$, $U_f = 75$ J
(C) $\Delta Q = 30$ J, $U_f = 75$ J
(D) $\Delta Q = 0$, $U_f = 45$ J

Q.38 The change in internal energy during the adiabatic expansion of 2 mole gas is found to be (–) 100 J. The work done during the process will be –
(A) zero (B) – 100J
(C) 200J (D) 100J

Thermodynamic process

Q.39 Four curves A, B, C and D are drawn in the figure for a given amount of a gas. The curves representing adiabatic and isothermal process are –

(A) C and D respectively
(B) D and C respectively
(C) A and B respectively
(D) B and A respectively

Q.40 In reference of above figure, no heat exchange between the gas and the surrounding will take place if the gas is taken along -
(A) curve A (B) curve B
(C) curve C (D) curve D

Q.41 During the adiabatic change of ideal gas, the relation between the pressure and the density will be -
(A) $\frac{P_1}{P_2} = \left(\frac{d_2}{d_1}\right)^{1/\gamma}$ (B) $P_1 d_1^\gamma = P_2 d_2^\gamma$
(C) $P_1 d_1^{-\gamma} = P_2 d_2^{-\gamma}$ (D) $\frac{P_1}{P_2} = \left(\frac{d_1}{d_2}\right)^{1/\gamma}$

Q.42 The pressure of the gas filled in thermally insulated container is P and temperature is T. If the ratio of specific heats of the gas is γ, which of the following will be constant -
(A) $PT^{\gamma-1}$ (B) $P^\gamma T^{1-\gamma}$
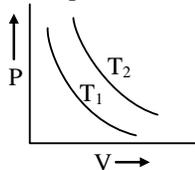(C) $P^{1-\gamma} T^\gamma$ (D) $P^{-\gamma} T^{\gamma-1}$

Q.43 The slope of indicator curve in adiabatic change relative to volume axis is -
(A) P/V^γ (B) $P^\gamma/V^{\gamma-1}$
(C) $\frac{P}{\gamma(V)}$ (D) $-\gamma \left(\frac{P}{V}\right)$

Q.44 The ratio of slopes of adiabatic and isotherm is -
(A) 1 : γ (B) 1 : 1
(C) γ : 1 (D) 1 : 4

Q.45 Two curves are given at temperatures T_1 and T_2 in an isothermal process, then -

(A) $T_1 > T_2$ (B) $T_1 = T_2$

(C) $T_1 < T_2$ (D) no knowledge

Q.46 The initial volume and pressure of a gas are V and P respectively. It is expand by two different processes such that in each process the final volume becomes 2V. If the work done in isothermal change is W_1 and the amount of work done in adiabatic change is W_2, then -

(A) $W_1 > W_2$

(B) $W_1 < W_2$

(C) $W_1 = W_2$

(D) nothing can be said

Q.47 Dry air at one atmospheric pressure is suddenly compressed so that its volume becomes one-fourth. Its pressure will become $-(\gamma = 1.5)$

(A) 4 atm   (B) 8 atm

(C) 16 atm   (D) 32 atm

Q.48 Three curves are shown in the P-V diagram. P, Q and R represent the processes respectively
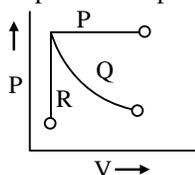
(A) isothermal, adiabatic, isometric

(B) isobaric, isothermal, isometric

(C) isometric, isobaric, adiabatic

(D) isometric, isobaric, isothermal

Q.49 If 1 Kg air (g = 1.4) is heated adiabatically from 0ºC to 10ºC then increase in its internal energy will be- (C_v = 0.172 Cal/gmºC)

(A) 1720 Joule   (B) 7224 Joule

(C) 172 Calorie   (D) 7224 Calorie

Q.50 In an adiabatic process :

(A) the internal energy of the system remains constant

(B) the pressure of the system remains constant

(C) the volume of the system remains constant

(D) heat energy stored in it remains constant

Q.51 In an adiabatic expansion of a gas, its temperature :

(A) always increases

(B) always diminishes

(C) remains constant

(D) diminishes initially and then increases

Q.52 In an adiabatic process, n moles of a perfect gas expand from temperature T_1 to T_2. The amount of work done by the gas will be :

(A) $C_p(T_1 - T_2)/n$ (B) $C_v(T_1 - T_2)/n$

(C) $nC_p(T_1 - T_2)$ (D) $nC_v(T_1 - T_2)$

Q.53 A perfect gas is compressed adiabatically. In that state the value of $\Delta P/P$ will be :

(A) $\dfrac{1}{\gamma} \cdot \dfrac{\Delta V}{V}$ (B) $-\dfrac{\Delta V}{V}$

(C) $-\gamma \dfrac{\Delta V}{V}$ (D) $+\gamma \dfrac{\Delta V}{V}$

Q.54 In an adiabatic expansion of 2 moles of a gas, the change in its internal energy was found to be –100J. The work done in this process is :

(A) zero   (B) –1000 J

(C) 200 J   (D) 100 J

Q.55 The pressure and volume of a gas are P and V. If its pressure is reduced to P/2, by (A) isothermal process (B) by adiabatic process then the final volume will be :

(A) more in A

(B) more in B

(C) equal in A and B

(D) depends on the nature of gas

Questions based on **Second law of thermodynamics**

Q.56 An ideal heat engine exhausting heat at 77ºC is to have a 30% efficiency. It must take heat at -

(A) 127ºC   (B) 227ºC

(C) 327ºC   (D) 673ºC

Q.57 A Carnot engine, whose sink is at 300 K, has an efficiency of 40%. By how much the source temperature should be changed so as to increase the efficiency to 60% ?

(A) 250K increase   (B) 250 K decrease

(C) 325K increase   (D) 325 K decrease

Q.58 Two steam engine A and B, have their sources respectively at 700 K and 650 K and their sinks at 350 K and 300 K. Then –

(A) A is more efficient than B

(B) B is more efficient than A

(C) both are equally efficient

(D) depends on the fuels used in A & B