Shiksha Classes, Bhandara

Physics

Subject : Physics **Topic : Thermodynamics** **M.M. : 180**

Marking Scheme:
(i) Each question is allotted 4 (four) marks for each correct response.
(ii) ¼ (one fourth) marks will be deducted for indicating incorrect response of each question. No deduction from the total score will be made if no response is indicated for an item in the answer sheet.

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Q.1 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 is suddenly brought to rest. Assuming no heat is lost to the surroundings, its temperature increases by –

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

(3) $\frac{\gamma Mv^2}{2R}K$ (4) $\frac{(\gamma-1)Mv^2}{2R}K$

Q.2 The efficiently of a Carnot engine operating with reservoir temperature of 100°C and –23°C will be

(1) $\frac{373-250}{373}$ (2) $\frac{275+250}{373}$

(3) $\frac{100+23}{100}$ (4) $\frac{373+123}{100}$

Q.3 An inventor claims that when temperatures of source and sink are 127°C and 27°C respectively then efficiency of engine is 26%, then :

(1) It is impossible
(2) It in possible but possibility is less
(3) It's possibility is high
(4) Data is insufficient

Q.4 The initial volume and pressure of a gas are V and P respectively. It is expanded through two different processes such that the final volume becomes 2V in each case. If the amount of work done in isothermal process is W_1 and that in adiabatic process is W_2, then

(1) $W_1 > W_2$ (2) $W_1 < W_2$
(3) $W_1 = W_2$ (4) Nothing can be stated

Q.5 The value of internal energy in an adiabatic process

(1) Remains unchanged
(2) Only increases
(3) Only diminishes
(4) May diminish and may also increase

Q.6 If H calories are generated on doing work W_0, and if by H calories, amount of work done is W, which of the following is the correct relation :

(1) W_0/H = constant (2) W/H = constant
(3) W_0H = constant (4) None of the above

Q.7 C_p and C_v are the specific heats of 1 gm mole of a gas constant pressure and constant volume respectively. The ratio of adiabatic and isothermal elasticities will be

(1) C_p/C_v (2) C_v/C_p
(3) C_pC_v (4) $(C_p - C_v)/C_v$

Q.8 If energy given to a system is 35 joules and the work done by the system is 15 joules, the change in the internal energy of the system is :

(1) - 50 J (2) 20 J
(3) 30 J (4) 50 J

Q.9 A gas at 50 N/m^2 pressure is compressed from $10m^3$ to $4m^3$ under constant pressure subsequently it is given 100 J of heat. The internal energy of the gas will be

(1) Increased by 100 J (2) Decreased by 200 J
(3) Increased by 400 J (4) Increased by 200 J

Q.10 A gas at initial temperature 27°C is adiabatically compressed so that its volume becomes 1/9 of the previous one. If γ =1.5 the final temperature be:

(1) 657 K (2) 627°C
(3) 543°C (4) 600°C

Q.11 For a gas C_v = 4.96 cal/mole K, the increase in internal energy of 2 mole gas in heating from 340 K to 342 K will be :-

(1) 27.80 Cal (2) 19.84 Cal
(3) 13.90 Cal (4) 9.92 Cal

Q.12 50 gm. of ice at 0° C is mixed with 50 gm. of water at 100° C. The final temperature of mixture is :–

(1) 0° C
(2) Between 0° C to 20°C
(3) 20° C
(4) Above 20° C

Q.13 One mole of an ideal monoatomic gas is heated at a constant pressure of one atmosphere from 0°C to 100°C. Then the change in the internal energy is

(1) 20.80×10^2 J (2) 12.48×10^2 J
(3) 832×10^2 J (4) 6.25×10^2 J

Q.14 A carnot engine working between 300 K and 600K has work out put of 800 J per cycle. The amount of heat and energy supplied to the engine from source per cycle will be :
(1) 800 J (2) 1600 J
(3) 1200 J (4) 900 J

Q.15 If the system takes 100 Cal. heat, and releases 80 cal to sink, if source temperature is 127°C find the sink temp. :
(1) 47° C (2) 127° C
(3) 67° C (4) 107° C

Q.16 When a system changes from one to another state the value of work done :
(1)Depends on the force acting on the system
(2)Depends on the nature of material present in a system
(3)Does not depend on the path
(4)Depends on the path

Q.17 A mass of a gas at 0°C is expanded adiabatically so that its volume becomes 4 times the original the temperature of gas will fall : (= 1.5)
(1) 136.5 K (2) 9.8 K
(3) 65 K (4) 32 K

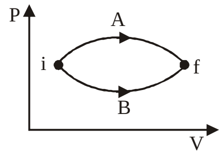
Q.18 A gas mixture contain 1 gm. H_2 and 1 gm. He. If temperature of gas mixture increases from 0°C to 100°C at isobaric process. Find heat given to gas mixture:
[$\gamma_{He} = 5/3$, $\gamma_{H2} = 7/5$, R = 2 cal/mole k]
(1) 124 Cal. (2) 327 Cal.
(3) 218 Cal. (4) 475 Cal.

Q.19 Air is filled in a tube of the wheel of a car at 27°C and 2 atm pressure if the tube is suddenly bursts, the final temp. of air will be:
($\gamma = 1.5$, $2^{1/3} = 1.251$)
(1) – 33° C (2) 0° C
(3) 21.6° C (4) 240° C

Q.20 If the coefficient of Linear expansion of a solid is 0.00009. Its coefficient of volume expansion is
(1) 0.009 (2) 0.02
(3) 0.03 (4) 0.00027

Q.21 An increase in temperature (Δt) is obtained in adiabatic compression of n moles of an ideal gas. The amount of work done in this process will be
(1) $nR\ \Delta t/\gamma$ (2) $-nR\ \Delta t/(\gamma-1)$
(3) $\Delta t/nR(\gamma-1)$ (4) $nR\Delta t/(\gamma+1)$

Q.22 A system is taken along the paths A and B as shown. If the amounts of heat given in these processes are ΔQ_A and ΔQ_B respectively then :-



(1) $\Delta Q_A = \Delta Q_B$ (2) $\Delta Q_A \geq \Delta Q_B$
(3) $\Delta Q_A < \Delta Q_B$ (4) $\Delta Q_A > \Delta Q_B$

Q.23 The volume of a metal sphere increases by 0.15 % when its temperature is raised by 24°C.The coefficient of linear expansion of metal is :
(1) 2.5×10^{-5} /°C (2) 2.0×10^{-5} /°C
(3) -1.5×10^{-5} /°C (4) 1.2×10^{-5} /°C

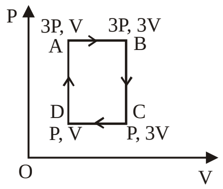
Q.24 One mole ideal gas is compressed adiabatically at 27°C. Its temperature becomes 102°C. The work done in this process will be :- ($\gamma = 1.5$)
(1) –625 J (2) 625 J
(3) 1245 J (4) –1245 J

Q.25 The volume of a gas expands by 0.25 m^3 at a constant pressure of 10^3 N/m^2 . The work done is equal to
(1) 2.5 erg (2) 250 J
(3) 250 W (4) 250 N

Q.26 The translational kinetic energy of molecules of one mole of a monoatomic gas is U=3NKT/2. The value of atomic specific heat of gas under constant pressure will be :
(1) $\frac{3}{2}$ R (2) $\frac{5}{2}$ R
(3) $\frac{7}{2}$ R (4) $\frac{9}{2}$ R

Q.27 The volume of a poly-atomic gas ($\gamma = 4/3$) compressed adiabatically to $1/8^{th}$ of the original volume. If the original pressure of the gas is P_0 the new pressure will be -
(1) 8 P_0 (2) 16 P_0
(3) 6 P_0 (4) 2 P_0

Q.28 An ideal monoatomic gas is taken round the cycle ABCDA as shown in following P - V diagram. The work done during the cycle is :



(1) PV (2) 2 PV
(3) 4 PV (4) Zero

Q.29 On a new scale of temperature (which is linear) and called the W scale, the freezing and boiling points of water are 39° W and 239° W respectively. What will be the temperature on the new scale, corresponding to a temperature of 39°C on the Celsius scale ?
(1) 200° W (2) 139° W
(3) 78° W (4) 117° W

Q.30 A monoatomic gas at pressure P_1 and volume V_1 is compressed adiabatically to $1/8^{th}$ its original volume. What is the final pressure of the gas :-
(1) P_1 (2) $16P_1$
(3) $32\ P_1$ (4) $64\ P_1$

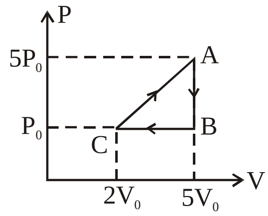
Q.31 420 joule of energy supplied to 10 gm of water will raise its temperature by nearly :-
(1) 1°C (2) 4.2°C
(3) 10°C (4) 42°C

Q.32 When 1kg of ice at 0°C melts to water at 0°C, the resulting change in its entropy, taking latent heat of ice to be 80 Cal/g, is -
(1) 273 Cal/K (2) 8×10^4 Cal/K
(3) 80 Cal/K (4) 293 Cal/K

Q.33 A mass of diatomic gas ($\gamma = 1.4$) at a pressure of 2 atmospheres is compressed adiabatically so that its temperature rises from 27°C to 927°C. The pressure of the gas in the final state is :-
(1) 8 atm (2) 28 atm
(3) 68.7 atm (4) 256 atm

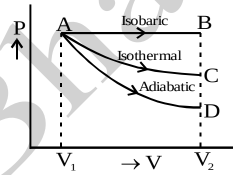
Q.34 300 calories of heat is supplied to raise the temperature of 50 gm of air from 20°C to 30°C without any change in its volume. Change in internal energy per gram of air is
(1)zero (2) 0.6 calories
(3)1.2 calories (4) 6.0 calories

Q.35 The work done by a gas taken through the closed process ABCA, see figure, is



(1)$6P_0V_0$ (2) $4P_0V_0$
(3) P_0V_0 (3) zero

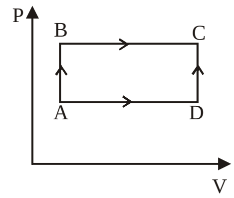
Q.36 A gas is expanded from volume V_1 to volume V_2 in three processes, shown in the figure. If U_A, $U_{B,}$ U_C and U_D represent the internal energies of the gas in state A,B, C and D respectively. **Incorrect** relation is –



(1)$U_B - U_A > 0$ (2) $U_C - U_A = 0$
(3)$U_D - U_A < 0$ (4) $U_B = U_C = U_D$

Q.37 The temperature of 5 moles of a gas which was held at constant volume was changed from 100°C to 120°C. The change in internal energy was found to be 80 joules. The total heat capacity of the gas at constant volume will be equal to:-
(1) 8 J/K (2) 0.8 J/K
(3) 4.0 J/K (4) 0.4 J/K

Q.38 A shown in the figure, the amount of heat absorbed along the path ABC is 90J and the amount of work done by the system is 30 J. If the amount of work done along the path ADC is 20 J the amount of heat absorbed will be :-



(1) 80 J (2) 90 J
(3) 110 J (4) 120 J

Q.39 The molar specific heat under constant pressure of oxygen is $C_P = 7.03$ cal/mole k. The quantity of heat required to raise the temperature from 10°C to 20°C of 5 moles of oxygen under constant volume will approximately be :-
(1) 25 cal. (2) 50 cal.
(3) 250 cal. (4) 500 cal.

Q.40 The amount of heat required in converting 1 gm ice at –10°C into steam at 100°C will be :
(1) 3030 J (2) 6056 J
(3) 721 J (4) 616 J

Q.41 1 c.c. of water at its boiling point (100°C) is converted into steam by supplying it 540 calories of heat the volume of steam is 1671 cc. If atmospheric pressure is $1.013 \times 10^5\ Nm^{-2}$ and J = 4.18 joule/cal the approximate value of heat that is required in overcoming the molecular (Change in internal energy) attraction is :–
(1) 110 cal (2) 500 cal
(3) 40 cal (4) Zero cal

Q.42 For monoatomic gas the relation between pressure of a gas and temperature T is PT^C where C is. (For adiabatic process)
(1) 5/3 (2) 2/5
(3) 3/5 (4) 5/2

Q.43 A gas for which $\gamma = 5/3$ is heated at constant pressure. The percentage of total heat given that will be used for external work is :
(1) 40% (2) 30%
(3) 60% (4) 20%

Q.44 In a thermodynamic process pressure of a fixed mass of a gas is changed in such a manner that the gas releases 20 joules of heat and 8 joules of work was done on the gas. If the initial internal energy of the gas was 30 joules, then the final internal energy will be:-
(1) 2 J (2) 42 J
(3) 18 J (4) 58 J

Q.45 If the ratio of specific heat of a gas at constant pressure to that at constant volume is γ, the change in internal energy of a mass of gas, when the volume changes from V to 2 V at constant pressure P, is :-
(1) $R / (\gamma - 1)$ (2) PV
(3) $PV / (\gamma - 1)$ (4) $\gamma PV / (\gamma - 1)$

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