Shiksha Classes Bhandara
CHAPTER TEST

Subject : Physics **Topic : Heat & Thermodynamics** **M.M. : 100**

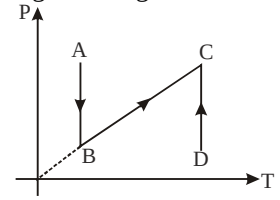
Marking Scheme:

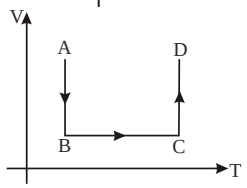
(i) Each question is allotted 4 (four) marks for each correct response.

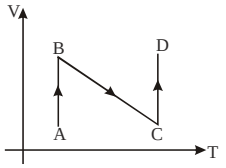
(ii) ¼ (one fourth) marks will be deducted for indicating incorrect response of each question. No deduction from the total score will be made if no response is indicated for an item in the answer sheet.

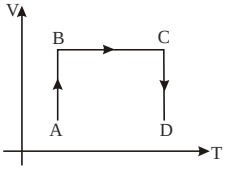
Q.1 Find the length of the steel rod which would have the same difference in length with a copper rod of length 24cm at all temperatures.
(a_{copper}= 18× $10^{-6}k^{-1}$, α_{steel} = 12 × $10^{-6}k^{-1}$) is
(A) 36 cm (B) 25 cm
(C) 18 cm (D) 50 cm

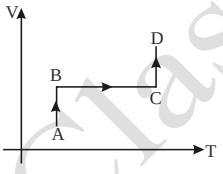
Q.2 P-T diagram is shown below then choose the corresponding V-T diagram.



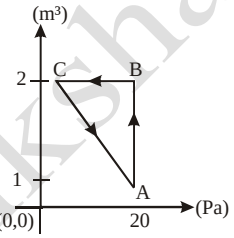
(A) 

(B) 

(C) 

(D) 

Q.3 An ideal gas is taken through a cycle A→ B→C → A as shown in figure. If the heat supplied in the cycle is 5J, then work done by the gas in the process C → A is–



(A) –5J (B) –10J
(C) –15J (D) –20J

Q.4 A Carnot's heat engine works with an ideal monoatomic gas, and an adiabatic expansion ratio 2. Determine its efficiency.
(A) 37% (B) 27%
(C) 18% (D) 20%

Q.5 Steam at 100ºC is passed into 1.1 kg of water contained in a calorimeter of water equivalent 0.02 kg at 15ºC till the temp. of the calorimeter and its contents rises to 80ºC. What is the mass of steam condensed? Latent heat of steam = 536 cal/g.
(A) 0.130 kg (B) 1.130 kg
(C) 1.30 kg (D) 5.120 kg

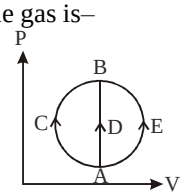
Q.6 5g ice at 0ºC is mixed with 5g of steam at 100ºC . What is the final temperature?
(A) 50ºC (B) 100ºC
(C) 80ºC (D) 150ºC

Q.7 An ideal gas with adiabatic exponent (γ = 1.5) undergoes a process in which work done by the gas is same as increase in internal energy of the gas. The molar heat capacity of gas for the process is –
(A) C = 4R (B) C = 0
(C) C = 2R (D) C = R

Q.8 On an X temperature scale, water freezes at –125.0° X and boils at 375.0°X. On a Y temperature scale, water freezes at –70.0° Y and boils at –30.0° Y. The value of temperature on X-scale equal to the temperature of 50.0°Y on Y-scale is –
(A) 455.0° X (B) –125.0° X
(C) 1375.0° X (D) 1500.0° X

Q.9 In a process the pressure of a gas is inversely proportional to the square of the volume. If temperature of the gas is increases, then work done by the gas –
(A) is positive (B) is negative
(C) is zero (D) may be positive

Q.10 One mole of an ideal gas is taken from state A to state B by three different processes, (a) ACB (b) ADB (c) AEB as shown in the P-V diagram. The heat absorbed by the gas is–



(A) greater in process (b) than in (a)
(B) the least in process (b)
(C) the same in (a) and (c)
(D) less in (c) then in (b)

Q.11 An ideal gas can be expanded from an initial state to a certain volume through two different processes,
(a) $PV^2 = K$ and
(b) $P = KV^2$, where K is a positive constant. Then, choose the correct option from the following.
(A) Final temperature in (a) will be greater than in (b).
(B) Final temperature in (b) will be greater than in (a).
(C) Work done by the gas in both the processes would be equal
(D) Total heat given to the gas in (a) is greater than in (b).

Q.12 A power radiated by a black body is P_0 and the wavelength corresponding to the maximum energy is around λ_0. On changing the temperature of the black body, it was observed that the power radiated is increased to (256/81) P_0. The shift in the wavelength corresponding to the maximum energy will be –

(A) $+\lambda_0/4$ (B) $+\lambda_0/2$

(C) $-\lambda_0/4$ (D) $-\lambda_0/2$

Q.13 There are four objects A, B, C and D. It is observed that A and B are in thermal equilibrium and C and D are also in thermal equilibrium. However, A and C are not in thermal equilibrium. We can conclude that

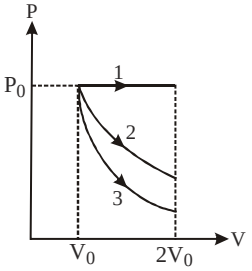
(A) B and D are in thermal equilibrium.

(B) B and D could be in thermal equilibrium but might not be A and D.

(C) B and D cannot be in thermal equilibrium.

(D) The zeroth law of thermodynamics does not apply here because there are more than three objects.

Q.14 A gas is expanded from volume V_0 to $2V_0$ under three different processes. Process 1 is isobaric process, process 2 is isothermal and process 3 is adiabatic.



Let ΔU_1, ΔU_2 and ΔU_3 be the change in internal energy of the gas is these three processes. Then –

(A) $\Delta U_1 > \Delta U_2 > \Delta U_3$ (B) $\Delta U_1 < \Delta U_2 < \Delta U_3$

(C) $\Delta U_2 < \Delta U_1 < \Delta U_3$ (D) $\Delta U_2 < \Delta U_3 < \Delta U_1$

Q.15 In an H_2 gas process , PV^2 = constant. The ratio of work done by gas to change in internal energy is :

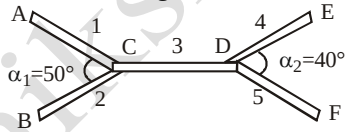
(A) 2/3 (B) 0.4

(C) – 0.4 (D) – 2/3

Q.16 All the rods are made of same material and have equal cross-sectional area. Length of rods are such that $L_1 = L_2 = L_4 = L_5 \neq L_3$.

Temperature $\theta_A = \theta_B > \theta_C > \theta_D > \theta_E = \theta_F$.

Consider the following statements for steady state.



(i) As $\alpha_1 \neq \alpha_2$, power through AC ≠ power through DF.

(ii) Power through CD = 2 (power through DF)

which of the following is correct –

(A) statement (i) is correct but (ii) is incorrect

(B) statement (i) is incorrect but (ii) is correct

(C) both are incorrect

(D) both are correct

Q.17 Calculate the number of molecules contained in a volume of 1 cm^3 at a pressure of 1.00×10^3 atm and a temperature of 200K.

(A) 3.67×10^{16} cm^{-3} (B) 2.57×10^{16} cm^{-3}

(C) 3.17×10^{16} cm^{-3} (D) 0.67×10^{16} cm^{-3}

Q.18 Find the temperature at which oxygen molecules have the same rms speed as N_2 molecules at 7°C.

(A) 47°C (B) 22°C

(C) 17°C (D) 57°C

Q.19 Which of the following will have maximum total kinetic energy at temperature 300 K –

(A) 1 kg, H_2 (B) $\frac{1}{2}$kg $H_2 + \frac{1}{2}$kg He

(C) $\frac{1}{2}$kg $H_2 + \frac{3}{4}$kg He (D) 1 kg, He

Q.20 Four particles have velocities 1, 0, 2, 3 m/s. The root mean square of the particles is (in m/s)

(A) 3.5 (B) $\sqrt{3.5}$

(C) 1.5 (D) $\sqrt{14/3}$

For Q.21-Q.25 :

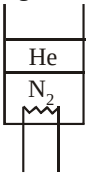
The answer to each question is a NUMERICAL VALUE.

Q.21 The specific heat of Ar at constant volume is 0.075 kg^{-1} K^{-1}. Calculate the atomic weight (R = 2 cal mol^{-1} K^{-1})

Q.22 A gas mixture consists of 2 moles of oxygen and 4 moles of a argon at temperature T. Neglecting all vibrational modes, the total internal energy of the system is (X RT). Find the value of X.–

Q.23 A body cools from 50°C to 40°C in 5 minutes. The surrounding temperature is 20°C. In further time (in minutes) will it cool to 30°C is (25/X). Find the value of X.

Q.24 5 moles of nitrogen gas are enclosed in an adiabatic cylindrical vessel. The piston itself is a rigid light cylindrical container containing 3 moles of Helium gas. There is a heater which gives out a power 100cal to the nitrogen gas. A power of 30 cal is transferred to Helium through the bottom surface of the piston. The rate (in K/sec) of increment of temperature of the nitrogen gas assuming that the piston moves slowly :



Q.25 The average velocities of particles is a gas is –