Single Correct Answer Type:

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

   (A) $\frac{7}{5}$ (B) $\frac{3}{5}$ (C) $\frac{3}{7}$ (D) $\frac{5}{7}$

2. An ideal gas is made to go through a cyclic thermo dynamical process in four steps. The amount of heat involved are $Q_1 = 600\,J$, $Q_2 = -400\,J$, $Q_3 = -300\,J$ and $Q_4 = 200\,J$ respectively the corresponding work involved are $W_1 = 300\,J$, $W_2 = -200\,J$, $W_3 = -150\,J$ and W_4, the value of W_4 is

   (A) $-50\,J$ (B) $100\,J$ (C) $150\,J$ (D) $50\,J$

3. One mole of an ideal gas expands at a constant temperature of 300 K from an initial volume of 10 litres to a final volume of 20 litres, the work done in expanding the gas is $(R = 8.31\,J/moleK)$

   (A) 750 J (B) 1728 J (C) 1500 J (D) 3456 J

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

   (A) 79 J (B) 90 J (C) 1 J (D) 100 J

5. 2K mole of hydrogen at NTP expands isobarically to twice its initial volume. The change in its internal energy is $(C_V = 10\ KJ/kg\,k)$ and atm pressure $= 1\times10^5\,N/m^2$)

   (A) 10.9 MJ (B) 9.10 MJ (C) 109 MJ (D) 1.09 MJ

6. $\frac{1}{2}$ mole of helium gas is contained in a container at STP, the heat energy needed to double the pressure of the gas, keeping the volume constant (heat capacity of the gas 3 J/gK) is

   (A) 3276 J (B) 1638 J (C) 819 J (C) 409.5 J

7. A gas mixture consists of 2 moles of oxygen and 4 moles of argon at temperature T. Neglecting all vibrational moles, the total internal energy of the system is

   (A) 4 RT (B) 15 RT (C) 9 RT (D) 11 RT

8. A carnot engine takes in 3000 Kcal of heat from a reservoir at $627°C$ and gives it to a sink at $27°C$. The work done by the engine is

   (A) 4.2×10^6 J (B) 8.4×10^6 J (C) 16.8×10^6 J (D) Zero

9. During the charging of a storage battery, the current is 22A and the voltage is 12V. The rate of heat transfer from the battery is 12W. The rate of change of internal energy is

   (A) 504 J/s (B) 252 J/s (C) 25.2 J/s (D) 126 J/s

10. On P.V coordinates the slope of isothermal curve of a gas at a pressure $P = 1\,MP_a$ and volume $V = 0.0025\,m^3$ is equal to $-400\ MP_a/m^3$. If $C_p/C_v = 1.4$, the slope of the adiabatic curve passing through this point is

    (A) $-56\ MP_a/m^3$ (B) $-400\ MP_a/m^3$ (C) $-560\ MP_a/m^3$ (D) None of these

11. The specific heat of a substance varies as $\left(3t^2+t\right)\times10^{-3}\,Cal/g°C$. What is the amount of heat required to rise the temperature of 1 kg of substance through $10°C$ to $20°C$?

(A) 7150 Cal (B) 8200 Cal (C) 1050 Cal (D) 9250 Cal

12. Which one of the following would rise the maximum temperature of 20 gm of water at $30°C$ when mixed with

(A) 20 gm of water at $40°C$ (B) 40 gm of water at $35°C$

(C) 10 gm of water at $50°C$ (D) 4 gm of water at $80°C$

13. One mole of a gas is put under a weightless piston of a vertical cylinder at temperature T. The space over the piston opens into atmosphere. How much work should be performed by some external force to increase isothermally the volume under the piston to twice the volume (Neglect friction of piston)

(A) $W_{ext}=RT\left(1-\log_e^{(2)}\right)$ (B) $W_{ext}=RT\left(\log_e^{(2)}-1\right)$

(C) $W_{ext}=RT\left(1-\log_e^{\left(\frac{1}{2}\right)}\right)$ (D) $W_{ext}=RT\left(\log_e^{\left(\frac{1}{2}\right)}-1\right)$

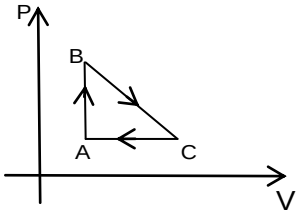
14. Water is heat on a stove. The temperature of water rises from

(i) $20°C$ to $30°C$ (ii) $30°C$ to $40°C$ (iii) $80°C$ to $90°C$.

In which case the change in entropy is greatest.

(A) i (B) ii (C) iii (D) ii and iii

15. One made of a monoatomic ideal gas is taken through a reversible cycle ABC as shown in the figure. The process BC is adiabatic. The work done per cycle is (given temperatures of A, B and C are 300 K, 600 K and 450 K)



(A) 75 R (B) 150 R

(C) 112.5 R (D) 45 R

16. 2 kg of Ice at $-20°C$ is mixed with 5 kg of water at $20°C$ in an insulating vessel having a negligible heat capacity. Calculate the final mass water remaining in the container. It is given that the specific heat of water and ice are $1\,Kcal/kg°C$ and $0.5\,Kcal/kg°C$ while the latest heat of fusion of ice is 80 Kcal/kg

(A) 7 kg (B) 6 kg (C) 4 kg (D) 2 kg

17. A thermally insulated rigid container contains an ideal gas heated by a filament of resistance $100\,\Omega$ through a current of 1 A for 5 min then change in internal energy is

(A) 100 KJ (B) 10 KJ (C) 20 KJ (D) 30 KJ

18. Two kg of water is converted into steam by boiling at atmosphere pressure. The volume changes from $2\times10^{-3}\,m^3$ to $3.34\,m^3$. The work done by the system is about

(A) -340 kJ (B) -170 kJ (C) 170 kJ (D) 340 kJ

19. 1 mole of a monoatomic gas at temperature T_0 expand slowly according to the law $P^2=T$. Its final temperature is $2T_0$, then heat supplies to the gas is

(A) $\frac{RT_0}{2}$ (B) RT_0 (C) $\frac{3}{2}RT_0$ (D) $2RT_0$

20. A bubble has a volume of $3\ mm^3$ at a depth of 20 m in a lake of pure water. If the bubble slowly rises upto the surface of the lake its volume will be (atmospheric pressure is 100 KP_a)

(A) $7.24\ mm^3$ (B) $4.44\ mm^3$ (C) $8.88\ mm^3$ (D) $6.66\ mm^3$

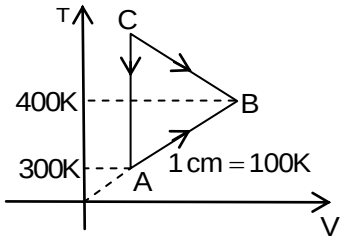
Numerical Based:

21. 6 gm of steam at $100°C$ is mixed with 6 gm of Ice at $0°C$. The mass of steam left uncondensed is

22. One mole of a diatomic gas is isothermally expanded at $27°C$ till the volume is doubled then it is adiabatically compressed to its original volume. Find the total work done $\left(2^{0.4} = 1.319\right)$

23. An ideal gas is found to obey the additional law $VP^2 = constant$ the gas is initially at a temperature T and volume V, when it expands to volume 2V, its temperature becomes $\sqrt{x}T$. Find x value is

24. Figure shows a cyclic process performed on one mole of an ideal gas. A total of 100 J of heat is withdrawn from the gas in a complete cycle. Find the workdone only by the gas in joule during the process $B \to C$. Given $R = 8.3\,Jmol^{-1}K^{-1}$.



25. A metal ball at $40°C$ is dropped from a height of 6 km, the ball is heated due to the air resistance and it completely melts before reaching the ground. Calculate the latent heat of fusion of metal in $KJ\,kg^{-1}$. Specific heat of lead is $125\,Jkg^{-1}$ melting point of metal is $200°C$ and $g = 10\,mJ^2$.

KEY

1.	D	2.	C	3.	B	4.	B	5.	C
6.	B	7.	D	8.	B	9.	B	10.	C
11.	A	12.	D	13.	A	14.	A	15.	A
16.	B	17.	D	18.	D	19.	D	20.	C
21.	4	22.	– 263.77	23.	2	24.	1830	25.	40