Exam-3 [Thermodynamics] JEE

(System, Properties, Process, FLOT, Heat capacity, Enthalpy, Isothermal, Adiabatic process)

"If you get tired, learn to rest, not to quit."

1. **A liquid when kept inside a thermally insulated closed vessel at 25°C was mechanically stirred from outside. What will be the correct option for the following thermodynamic parameters?**

(1) $\Delta U = 0, q < 0, w > 0$
(2) $\Delta U > 0, q = 0, w > 0$
(3) $\Delta U = 0, q = 0, w = 0$
(4) $\Delta U < 0, q = 0, w > 0$

2. **Match List-I with List-II**

List-I (Partial Derivatives)	List-II (Thermodynamic Quantity)
(A) $\left(\frac{\partial G}{\partial T}\right)_V$	(p) Cp
(B) $\left(\frac{\partial H}{\partial T}\right)_P$	(q) -S
(C) $\left(\frac{\partial G}{\partial P}\right)_T$	(r) C_V
(D) $\left(\frac{\partial U}{\partial T}\right)_V$	(s) V

(1) (A)-(p), (B)-(q), (C)-(s), (D)-(r)
(2) (A)-(q), (B)-(r), (C)-(p), (D)-(s)
(3) (A)-(q), (B)-(p), (C)-(s), (D)-(r)
(4) (A)-(q), (B)-(p), (C)-(r), (D)-(s)

3. **500 J of energy is transferred as heat to 0.05 mol of Argon gas at 298 K and 1 atm. The final temperature and the change in internal energy respectively are: (R = 8.3 J K^{-1} mol^{-1})**

(1) 368 K and 500 J
(2) 348 K and 300 J
(3) 378 K and 300 J
(4) 378 K and 500 J

4. **One mole of an ideal gas expands isothermally and reversibly from 10 dm^3 to 20 dm^3 at 300 K. ΔU, q and work done in the process respectively are (R = 8.3 J K^{-1} mol^{-1}, ln 10 = 2.3, log 2 = 0.30, log 3 = 0.48):**

(1) 0, 2.48 kJ, –1.726 J
(2) 0, 21.84 kJ, 21.84 kJ
(3) 0, 1.718 kJ, –1.718 kJ
(4) 0, –17.18 kJ, 1.718 J

5. **If three moles of an ideal gas at 300 K expand isothermally from 30 dm^3 to 45 dm^3 against a constant opposing pressure of 80 kPa, then the amount of heat transferred is ..... J.**

(A) 1200
(B) 1900
(C) 3200
(D) 600

6. **Choose the correct option for free expansion of an ideal gas under adiabatic condition from the following:**

(A) q = 0, $\Delta T < 0$, w = 0
(B) q ≠ 0, $\Delta T < 0$, w ≠ 0
(C) q = 0, $\Delta T = 0$, w = 0
(D) q ≠ 0, $\Delta T = 0$, w = 0

7. **1 mole of ideal gas is allowed to expand reversibly and adiabatically from a temperature of 27°C. The work done is 3 kJ mol^{-1}. The final temperature of the gas is K.(C_v = 20 J mol^{-1} K^{-1})**

(1) 50
(2) 450
(3) 150
(4) 600

8. **For complete combustion of methanol $CH_3OH(l) + \frac{3}{2} O_2(g) \rightarrow CO_2(g) + 2H_2O(l)$, the amount of heat produced as measured by bomb calorimeter is 726 kJ mol^{-1} at 27°C. The enthalpy of combustion for the reaction is –x kJ mol^{-1}, where x is ..... (Nearest integer). (R = 8.3 J K^{-1} mol^{-1})**

(1) 627
(2) 400
(3) 385
(4) 727

9. **For combustion of one mole of magnesium in an open container at 300 K and 1 bar pressure, $\Delta_c H^\circ = -601.70$ kJ mol^{-1}, the magnitude of change in internal energy for the reaction is ..... kJ (Nearest integer). (R = 8.3 J K^{-1} mol^{-1})**

(1) 100
(2) 600
(3) 400
(4) 900

10. **3.4 g of nitrous oxide (N_2O) gas is cooled at a constant pressure of 1 atm from 310 K to 270 K causing the compression of the gas from 250 mL to 150 mL. The change in internal energy of the process, ΔU is –x J. The value of 'x' is..... (Nearest integer). (Atomic mass of N = 14 g mol^{-1}, O = 16 g mol^{-1}, Molar heat capacity of N_2O = 100 J K^{-1} mol^{-1}).**

(1) 250
(2) 90
(3) 100
(4) 390

11. **The total number of intensive properties from the following is .....**
Volume, Molar heat capacity, Molarity, Density, Gibbs free energy change, Molar mass, Mole.
12. **4.0 L of an ideal gas is allowed to expand isothermally into vacuum until the total volume is 2.0 L. The amount of heat absorbed in this expansion is ..... L atm.**
13. **When 2 L of ideal gas expands isothermally into vacuum to a total volume of 6 L, the change in internal energy is ..... J. (Nearest integer)**