Exam-2 [Thermodynamics] JEE

(System, Properties, Process, FLOT, Heat capacity)

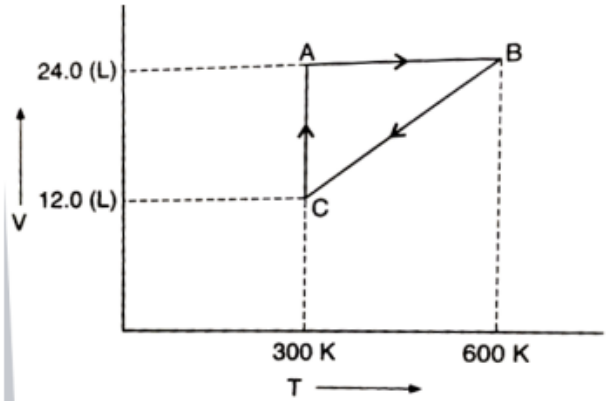
Q1. If three moles of an ideal gas at 300 K expand isothermally from 30 dm^3 to 45 dm^3 against a constant opposing pressure of 80 kPa, then the amount of heat transferred is ..... J

(a) 1200
(b) 1400
(c) 1600
(d) 1350

Q2. When a 60 W electric heater is immersed in a gas for 100 s in a constant volume container with adiabatic walls, the temperature of the gas rises by 5°C. The heat capacity of the given gas is ..... JK^{-1}. (Nearest integer)

(a) 1350
(b) 1400
(c) 1600
(d) 1200

Q3. One mole of an ideal gas is put through a series of changes as shown in the graph in which A, B, and C mark the three stages of the system. At each stage the variables are shown in the graph. Name the processes during the A to B change.



(a) Isothermal
(b) Adiabatic
(c) Isochoric
(d) Isobaric

Q4. Which of the following statement is false?

(a) Work is a state function
(b) Temperature is a state function
(c) Change of state is completely defined when initial and final states are specified
(d) Work appears at the boundary of the system

Q5. What is the change in internal energy when a gas is compressed from 377 mL to 177 mL under a constant pressure of 1520 torr, while at the same time being cooled by removing 124 J heat?

(a) –24 J

(b) –84 J
(c) –164 J
(d) –248 J

Q6. An ideal gas undergoes isothermal compression from 5 m^3 to 1 m^3 against a constant external pressure of 4 N m^{-2}. Heat released in this process is used to increase the temperature of 1 mole of Al. If molar heat capacity of Al is 24 J $mol^{-1}K^{-1}$, the temperature of Al increases by:
(a) $\frac{2}{3}$ K
(b) 2 K
(c) 1 K
(d) $\frac{3}{2}$ K

Q7. For silver, C_p (J K^{-1} mol^{-1}) = 23 + 0.01T. If the temperature (T) of 3 moles of silver is raised from 300 K to 1000 K at 1 atm pressure, the value of ΔH will be close to:
(a) 16 kJ
(b) 13 kJ
(c) 62 kJ
(d) 21 kJ

Q8. The temperature of an ideal gas increases in an:
(a) adiabatic compression
(b) adiabatic expansion
(c) isothermal expansion
(d) isothermal compression

Q9. A thermodynamic system goes from states (i) $P_1, V \rightarrow 2P_1, V$ (ii) $P, V_1 \rightarrow P, 2V_1$. Then work done in the two cases is
(a) Zero, Zero
(b) Zero, $-PV_1$
(c) $-PV_1$, Zero
(d) $-PV_1$, $-P_1V_1$

Q10. According to first law of thermodynamics (where q = heat supplied to system and $W \rightarrow$ work done by the system):
(a) $\Delta U = q - W$
(b) $\Delta U = q + W$
(c) $\Delta U = \Delta q + \Delta W$
(d) $\Delta U = q + \Delta W$

Section – B : Integer Type Questions

Q11. 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)

Q12. A system does 200 J of work and at the same time absorbs 150 J of heat. The magnitude of the change in internal energy is ..... J. (Nearest integer)

Q13. Five moles of an ideal gas at 293 K is expanded isothermally from an initial pressure of 2.1 MPa to 1.3 MPa against a constant external pressure 4.3 MPa. The heat transferred in this process is ..... kJ mol^{-1}. (Rounded off to the nearest integer) [R = 8.314 J $mol^{-1}K^{-1}$]