Q1. 21 January Shift 1

10 mole of oxygen is heated at constant volume from 30°C to 40°C. The change in the internal energy of the gas is ____ cal. (The molecular specific heat of oxygen at constant pressure, $C_P = 7\text{cal/mol.}\,^{\circ}\text{C}$ and $\text{R} = 2\text{cal/mol.}\,^{\circ}\text{C.}$)

Q2. 21 January Shift 2

A diatomic gas ($\gamma = 1.4$) does 100 J of work when it is expanded isobarically. Then the heat given to the gas ____ J.

Q3. 22 January Shift 2

An insulated cylinder of volume 60 cm^3 is filled with a gas at 27°C and 2 atmospheric pressure. Then the gas is compressed making the final volume as 20 cm^3 while allowing the temperature to rise to 77°C. The final pressure is ____ atmospheric pressure.

Q4. 23 January Shift 2

One mole of an ideal diatomic gas expands from volume V to 2 V isothermally at a temperature 27°C and does W joule of work. If the gas undergoes same magnitude of expansion adiabatically from 27°C doing the same amount of work W, then its final temperature will be (close to) ____ °C.
($\log_e 2 = 0.693$)

(1) -30 (2) -189 (3) -117 (4) -56

Q5. 23 January Shift 2

The internal energy of a monoatomic gas is 3 nRT. One mole of helium is kept in a cylinder having internal cross section area of 17 cm^2 and fitted with a light movable frictionless piston. The gas is heated slowly by suppling 126 J heat. If the temperature rises by 4°C, then the piston will move ____ cm.
(atmospheric pressure $= 10^5$ Pa)

(1) 1.45 (2) 15.5 (3) 1.55 (4) 14.5

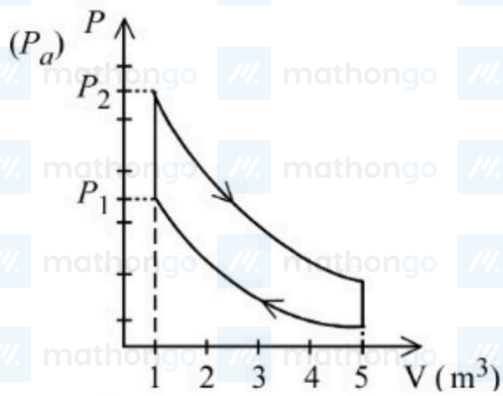
Q6. 24 January Shift 1

Density of water at 4°C and 20°C are 1000 kg/m^3 and 998 kg/m^3 respectively. The increase in internal energy of 4 kg of water when it is heated from 4°C to 20°C is ____ J.
(specific heat capacity of water $= 4.2\ \text{J/kg.}$ and 1 atmospheric pressure $= 10^5$ Pa)

(1) 234699.2 (2) 315826.2 (3) 258700.8 (4) 268799.2

Q7. 24 January Shift 2

10 mole of an ideal gas is undergoing the process shown in the figure. The heat involved in the process from P_1 to P_2 is α Joule ($P_1 = 21.7$ Pa and $P_2 = 30$ Pa, $C_v = 21$ J/K. mol, $R = 8.3$ J/mol. K). The value of α is ____.



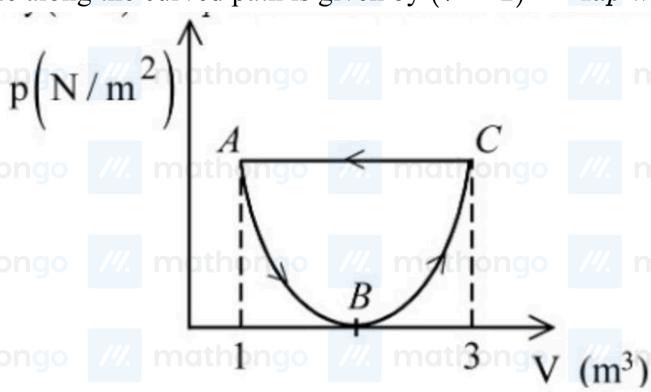
(1) 21 (2) 15 (3) 28 (4) 24

Q8. 24 January Shift 2

When 300 J of heat given to an ideal gas with $C_p = \frac{7}{2}R$ its temperature raises from 20°C to 50°C keeping its volume constant. The mass of the gas is (approximately) ____ g. (R = 8.314 J/mol. K)

Q9. 28 January Shift 1

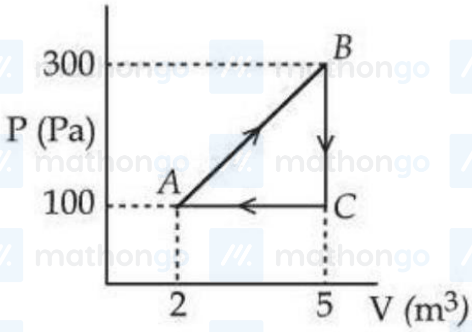
In the following $p - V$ diagram the equation of state along the curved path is given by $(V-2)^2 = 4ap$ where a is a constant. The total work done in the closed path is



(1) $+\frac{1}{3a}$ (2) $-\frac{1}{3a}$ (3) $\frac{1}{2a}$ (4) $-\frac{1}{a}$

Q10. 28 January Shift 2

A thermodynamic system is taken through the cyclic process ABC as shown in the figure. The total work done by the system during the cycle ABC is ____ J.



ANSWER KEYS

1. 500 **2.** 350 **3.** 7 **4.** (4) **5.** (2) **6.** (4) **7.** (1) **8.** 481
9. (2) **10.** 300