Answer on Question #41162, Physics, Molecular Physics | Thermodynamics

X mole of diatomic gas at temp T is kept in a container. When Q amount of heat is supplied to gas its temp remains same but Y moles of it dissociates to monoatomic gas, then value of Q is??

a) 2YRT

b) YRT/2

c) 3YRT/2

d) 5YRT/2

Solution:

Since the gas is enclosed in a container, therefore, during heating process, volume of the gas remains constant. Hence, no work is done by the gas. It means heat supplied to the gas is used to increase its internal energy only.

Initial internal energy of the gas is

$$U_1 = X\left(\frac{5}{2}R\right)T$$

Since Y moles get dissociated into atoms, therefore, after heating, vessel contains (X − Y) moles of diatomic gas and 2Y moles of a monoatomic gas. Hence the internal energy for the gas, after heating, will be equal to

$$U_2 = (X - Y)\left(\frac{5}{2}R\right)T + 2Y\left(\frac{3}{2}R\right)T = \frac{5}{2}XRT + \frac{1}{2}YRT$$

Hence, the heat supplied = increase in internal energy

$$Q = U_2 - U_1 = \frac{1}{2}YRT$$

Answer. b) YRT/2.