Answer on Question #48416, Physics, Molecular Physics | Thermodynamics

To an ideal triatomic gas 800cal heat energy is supplied at constant pressure. If vibrational mode is neglected, then energy used by as in work done against surrounding is

A) 200cal. B) 300cal. C) 400cal. D) 60cal

Solution:

According to the first law of thermodynamics,

$$Q = \Delta U - W$$

where ΔU is the change in the internal energy of the system and W is work done by the system. The work is

$$W = P\Delta V = \Delta U - Q$$

Initial internal energy of the N moles of diatomic gas is

$$U_1 = N\frac{6}{2}RT_1$$

The internal energy for the gas, after heating, will be equal to

$$U_2 = N\frac{6}{2}RT_2$$

Thus,

$$\Delta U = U_2 - U_1 = N\frac{6}{2}R(T_2 - T_1) = \frac{6}{2}P\Delta V = 3P\Delta V = 3W$$

Hence,

$$W = 3W - Q$$

$$W = \frac{Q}{2} = 400 \text{ cal}$$

Answer: C) 400cal.