Two perfect gases at absolute temperature 4T and T are mixed. There is no loss of energy. The temperature of the mixture if the number of molecules in the gases are N and 2N respectively is:

(A) T (B) 2T (C) 4T (D) Masses are needed to solve

Solution

Energy of a molecule = KE + PE = $\frac{3}{2}kT_{absolute}$ + 0 = $\frac{3}{2}kT_{absolute}$

[Since there is no intermolecular force for a perfect gas, PE = 0.]

Using conservation of energy for the system of gases before and after mixing,

$$N_1E_1 + N_2E_2 = (N_1 + N_2)E$$

$$\Rightarrow N.\frac{3}{2}k(4T) + 2N.\frac{3}{2}kT = (N + 2N).\frac{3}{2}kT'$$

Where T' is the final common temperature.

$\Rightarrow 6T = 3T'$ Or T' = 2T

Hence, (B)