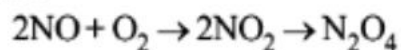


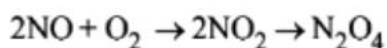
**Question 16**

At room temperature the following reactions proceed nearly to completion : *(1992 - 4 Marks)*



The dimer,  $\text{N}_2\text{O}_4$ , solidifies at 262 K. A 250 ml flask and a 100 ml. flask are separated by a stop-cock. At 300 K, the nitric oxide in the larger flask exerts a pressure of 1.053 atm. and the smaller one contains oxygen at 0.789 atm. The gases are mixed by opening the stopcock and after the end of the reaction the flasks are cooled at 220K. Neglecting the vapour pressure of the dimer, find out the pressure and composition of the gas remaining at 220 K. (Assume the gases to behave ideally).

## Question 16



Calculating the number of moles of NO and O<sub>2</sub> by applying

the formula,  $n = \frac{PV}{RT}$

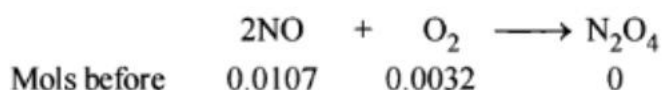
$$\text{Moles of NO in the larger flask} = \frac{1.053 \times 0.250}{0.082 \times 300} = 0.0107$$

$$[250 \text{ mL} = 0.250 \text{ L}]$$

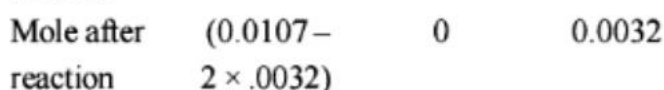
$$\text{Moles of O}_2 \text{ in the smaller flask} = \frac{0.789 \times 0.100}{0.082 \times 300} = 0.0032$$

$$[100 \text{ mL} = 0.100 \text{ L}]$$

The reaction takes place as follows.



reaction



Hence moles of NO reacting completely with 0.0032 moles of O<sub>2</sub> = 2 × 0.0032 = 0.0064

$$\text{Moles of NO left} = 0.0107 - 0.0064 = \mathbf{0.0043}$$

**NOTE :** Oxygen will be completely changed into NO<sub>2</sub> which in turn is completely converted into N<sub>2</sub>O<sub>4</sub> which solidifies at 262 K. Hence at 220 K, the dimer is in the solid state and only NO present in excess will remain in the gaseous state occupying volume equal to 350 ml.

Hence pressure (P) of NO gas left

$$= \frac{nRT}{V} = \frac{0.0043 \times 0.082 \times 220}{0.350} = \mathbf{0.221 \text{ atm}}$$

$$[\text{Total volume} = 0.250 + 0.100 = 0.350 \text{ L}]$$