Problem 1 Reaction rate

The decomposition of nitrous acid is described by the following stoichiometric equation:

$$3\ HNO_2 = H^+ + NO_3^- + 2\ NO + H_2O$$

For the reaction rate in certain moment from the beginning of the reaction we have found the value $J = 0.15$ mol min^{-1}. Calculate the rate of change of mole number of

(a) HNO_2, (b) NO, (c) H_2O.

[(a) –0.45 mol min^{-1} , (b) +0.30 mol min^{-1} , (c) +0.15 mol min^{-1}]

Solution:

$$3\ HNO_2 = H^+ + NO_3^- + 2\ NO + H_2O$$

$$J = \frac{1}{\nu_i} \cdot \frac{\mathrm{d}n_i}{\mathrm{d}\tau} = 0.15 \text{ mol min}^{-1}$$

$$\frac{\mathrm{d}n_i}{\mathrm{d}\tau} = \nu_i \cdot J$$

$\nu_{HNO_2} = -3$ $\quad \frac{\mathrm{d}n_{HNO_2}}{\mathrm{d}\tau} = (-3) \cdot 0.15 = \underline{-0.45 \text{ mol min}^{-1}}$

$\nu_{NO} = +2$ $\quad \frac{\mathrm{d}n_{NO}}{\mathrm{d}\tau} = (+2) \cdot 0.15 = \underline{+0.30 \text{ mol min}^{-1}}$

$\nu_{H_2O} = +1$ $\quad \frac{\mathrm{d}n_{H_2O}}{\mathrm{d}\tau} = (+1) \cdot 0.15 = \underline{+0.15 \text{ mol min}^{-1}}$