

Q# 1-10 pg. 360



$$1. \quad r = \frac{\Delta A}{\Delta t} = \frac{0.0206 \text{ mol/L} - 0.0415 \text{ mol/L}}{882 \text{ s}}$$

$$= \frac{-0.0209 \text{ mol/L}}{882 \text{ s}}$$

$$= -2.3696 \times 10^{-5} \frac{\text{mol/L}}{\text{s}}$$

$$t = 14.7 \text{ min} \times 60$$

$$= 882 \text{ s}$$

$$r_B = -2.3696 \times 10^{-5} \frac{\text{mol A}}{\text{L s}} \times \frac{2 \text{ mol B}}{1 \text{ mol A}}$$

$$= -4.74 \times 10^{-5} \frac{\text{mol B}}{\text{L s}}$$

\(\therefore\) the rate of consumption of B is $4.74 \times 10^{-5} \frac{\text{mol}}{\text{L s}}$

$$2. \quad \text{rate} = \frac{\Delta C}{\Delta t}$$

$$= \frac{3.25 \times 10^{-2} \text{ mol/L} - 5.00 \times 10^{-2} \text{ mol/L}}{85 \text{ s} - 60 \text{ s}}$$

$$= \frac{-0.0175 \text{ mol/L}}{25 \text{ s}}$$

$$= -0.00070 \frac{\text{mol}}{\text{L s}}$$

\(\therefore\) the average rate of reaction is $-7.0 \times 10^{-4} \frac{\text{mol}}{\text{L s}}$

or $-0.00070 \frac{\text{mol}}{\text{L s}}$



$$a) \quad t = 5 \text{ min} \times \frac{60 \text{ s}}{\text{min}}$$

$$= 300 \text{ s}$$

$$n_{\text{CO}_2} = 5.50 \times 10^{-4} \frac{\text{mol}}{\text{s}} \times 300 \text{ s}$$

$$= 0.165 \text{ mol}$$

$$b) \quad r_{\text{Br}_2} = 5.50 \times 10^{-4} \frac{\text{mol}}{\text{s}} \times \frac{1 \text{ mol Br}_2}{1 \text{ mol CO}_2}$$

$$= 5.50 \times 10^{-4} \frac{\text{mol}}{\text{s}} \text{ Br}_2$$

$$n_{\text{Br}_2} = 0.165 \text{ mol}$$

\(\therefore\) 1:1 ratio it's the same

4.
$$\text{rate} = \frac{-\Delta c}{\Delta t}$$

$$\Delta c = -\text{rate} \cdot \Delta t$$

$$= -\left(0.045 \frac{\text{mol}}{\text{L}\cdot\text{s}}\right) (2.0 \text{ min} - 1.5 \text{ min})$$

$$= -\left(0.045 \frac{\text{mol}}{\text{L}\cdot\text{s}}\right) (0.5 \text{ min}) \quad \rightarrow 0.5 \text{ min} \times 60$$

$$= -0.045 \frac{\text{mol}}{\text{L}\cdot\text{s}} \times 30 \text{ s}$$

$$= -1.35 \frac{\text{mol}}{\text{L}}$$

The change in concentration from 2min to 1.5min was $-1.35 \frac{\text{mol}}{\text{L}}$

but at 2min it was $4.0 \times 10^{-2} \frac{\text{mol}}{\text{L}}$

f - 2min
i - 1.5min

$$\Delta c = C_f - C_i$$

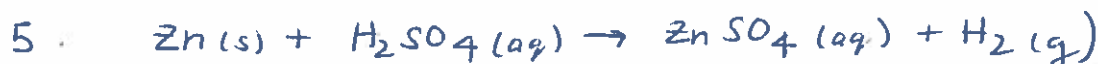
$$-1.35 \frac{\text{mol}}{\text{L}} = 4.0 \times 10^{-2} \frac{\text{mol}}{\text{L}} - C_i$$

$$C_i = 4.0 \times 10^{-2} \frac{\text{mol}}{\text{L}} + 1.35 \frac{\text{mol}}{\text{L}}$$

$$= 1.39 \frac{\text{mol}}{\text{L}}$$

$$= 1.4 \frac{\text{mol}}{\text{L}} \text{ (sf)}$$

∴ the concentration
at 1.5min was
 $1.4 \frac{\text{mol}}{\text{L}}$



$$\text{rate}_{\text{H}_2} = \frac{\Delta c}{\Delta t}$$

$$= \frac{(0.042 \text{ L} - 0.03 \text{ L})}{84 \text{ s} - 60 \text{ s}}$$

$$= \frac{0.012 \text{ L}}{24 \text{ s}}$$

$$= 0.00050 \frac{\text{L}}{\text{s}} \text{ or } 5.0 \times 10^{-4} \frac{\text{L}}{\text{s}}$$

$$t = 1.0 \text{ min} = 60 \text{ s}$$

$$V = 30.0 \text{ mL} = 0.03 \text{ L}$$

$$t = 1.4 \text{ min} = 84 \text{ s}$$

$$V = 42.0 \text{ mL} = 0.042 \text{ L}$$

∴ the average rate of formation of H_2 is

$$5.0 \times 10^{-4} \frac{\text{L}}{\text{s}}$$



$$r_{2.0 \text{ min}} = 0.12 \frac{\text{mol}}{\text{L} \cdot \text{s}}$$

$$r_{\text{BrO}_3^-} = 0.12 \frac{\text{mol}}{\text{L} \cdot \text{s}} \text{Br}^- \cancel{\text{}} \times \frac{1 \text{ mol BrO}_3^-}{2 \text{ mol Br}^- \cancel{\text{}}}$$

$$= 0.060 \frac{\text{mol}}{\text{L} \cdot \text{s}} \text{BrO}_3^-$$

∴ the rate of formation of BrO_3^- is $0.060 \frac{\text{mol}}{\text{L} \cdot \text{s}}$

$$r_{\text{BrO}^-} = -0.12 \frac{\text{mol}}{\text{L} \cdot \text{s}} \text{Br}^- \cancel{\text{}} \times \frac{3 \text{ mol BrO}^-}{2 \text{ mol Br}^- \cancel{\text{}}}$$

$$= -0.18 \frac{\text{mol}}{\text{L} \cdot \text{s}} \text{BrO}^-$$

∴ the rate of consumption of BrO^- is $0.18 \frac{\text{mol}}{\text{L} \cdot \text{s}}$



$$t = 0 \text{ s} \quad 0.42 \frac{\text{mol}}{\text{L}}$$

$$t = 50.0 \text{ s} \quad 0.26 \frac{\text{mol}}{\text{L}}$$

$$0 \frac{\text{mol}}{\text{L}}$$

?

$$a) \quad r_{\text{HBr}} = \frac{\Delta C}{\Delta t}$$

$$= \frac{0.26 \frac{\text{mol}}{\text{L}} - 0.42 \frac{\text{mol}}{\text{L}}}{50.0 \text{ s} - 0 \text{ s}}$$

$$= \frac{-0.16 \frac{\text{mol}}{\text{L}}}{50.0 \text{ s}}$$

$$= -0.0032 \frac{\text{mol}}{\text{L} \cdot \text{s}} \text{ or } -3.2 \times 10^{-3} \frac{\text{mol}}{\text{L} \cdot \text{s}}$$

$$b) \quad r_{\text{Br}_2} = 0.0032 \frac{\text{mol HBr}}{\text{L} \cdot \text{s}} \times \frac{2 \text{ mol Br}_2}{4 \text{ mol HBr}}$$

$$= 0.0016 \frac{\text{mol Br}_2}{\text{L} \cdot \text{s}}$$

$$C_{\text{at } t=50.0 \text{ s}} = 0.0016 \frac{\text{mol}}{\text{L} \cdot \text{s}} \times 50.0 \text{ s}$$

$$= 0.080 \frac{\text{mol}}{\text{L}}$$

∴ the average rate of consumption of HBr is $3.2 \times 10^{-3} \frac{\text{mol}}{\text{L} \cdot \text{s}}$

∴ the concentration of Br_2 at 50.0 s is $0.080 \frac{\text{mol}}{\text{L}}$



$$t = 1.80 \text{ min}$$

$$r_{\text{NO}} = 1.04 \frac{\text{mol}}{\text{L} \cdot \text{s}}$$

$$t = 1.80 \text{ min} \times 60$$

$$= 108 \text{ s}$$

$$r_{\text{O}_2} = 1.04 \frac{\text{mol}}{\text{L} \cdot \text{s}} \text{NO} \times \frac{5 \text{ mol O}_2}{4 \text{ mol NO}}$$

$$= 1.30 \frac{\text{mol}}{\text{L} \cdot \text{s}}$$

$$C_{\text{O}_2} = 1.30 \frac{\text{mol}}{\text{L} \cdot \text{s}} \times 108 \text{ s}$$

$$= 1.40 \times 10^2 \frac{\text{mol}}{\text{L}}$$

* can find concentration not moles (n)

∴ the concentration of oxygen consumed is $1.40 \times 10^{-2} \frac{\text{mol}}{\text{L}}$



$m = 0.50\text{g}$

$t = 90.0\text{s}$

$M = 22.990 \frac{\text{g}}{\text{mol}}$

$T = 30.0^\circ\text{C} + 273.15$

$= 303.15\text{K}$

$P = 102.4\text{kPa}$

$$r_{\text{Na}} = 0.50\text{g} \times \frac{1\text{mol}}{22.990\text{g}} \times \frac{1}{90.0\text{s}}$$

$$= 2.42 \times 10^{-4} \frac{\text{mol}}{\text{s}}$$

OR calculate

r_{H_2} first
and sub into
 $V = \frac{nRT}{P}$

b) $n_{\text{H}_2} = 0.50\text{g Na} \times \frac{1\text{mol Na}}{22.990\text{g Na}} \times \frac{1\text{mol H}_2}{2\text{mol Na}}$

$= 0.010874\text{mol}$

$PV = nRT$

$V = \frac{nRT}{P}$

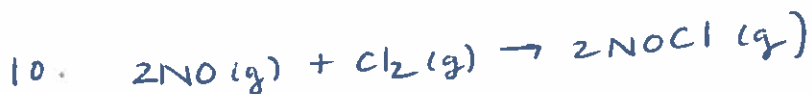
$= \frac{(0.010874\text{mol})(8.314 \frac{\text{L}\cdot\text{kPa}}{\text{mol}\cdot\text{K}})(303.15\text{K})}{102.4\text{kPa}}$

$= 0.26765\text{L}$

$r_{\text{H}_2} = \frac{0.26765\text{L}}{90.0\text{s}}$

$= 2.97 \times 10^{-3} \frac{\text{L}}{\text{s}}$

∴ the rate at which H_2 is generated is $2.97 \times 10^{-3} \frac{\text{L}}{\text{s}}$



$1.4 \frac{\text{mol}}{\text{L}\cdot\text{s}}$

$r_{\text{Cl}_2} = 1.4 \frac{\text{mol NO}}{\text{L}\cdot\text{s}} \times \frac{1\text{mol Cl}_2}{2\text{mol NO}}$

$= 0.70 \frac{\text{mol Cl}_2}{\text{L}\cdot\text{s}}$

$r_{\text{NOCl}} = 1.4 \frac{\text{mol NO}}{\text{L}\cdot\text{s}} \times \frac{2\text{mol NOCl}}{2\text{mol NO}}$

$= 1.4 \frac{\text{mol NOCl}}{\text{L}\cdot\text{s}}$

∴ the rate of consumption of Cl_2 is $0.70 \frac{\text{mol}}{\text{L}\cdot\text{s}}$

∴ the rate of formation of NOCl is $1.4 \frac{\text{mol}}{\text{L}\cdot\text{s}}$