Question 1

$CH_{4(g)} + 2O_{2(g)} \longrightarrow CO_{2(g)} + 2H_2O_{(l)}$

$$\text{Rate} = -\frac{\Delta[CH_4]}{\Delta t} = -\frac{1}{2}\frac{[O_2]}{t} = \frac{\Delta[CO_2]}{\Delta t} = \frac{1}{2}\frac{[H_2O]}{\Delta t}$$

Q2.

$4PH_{3(g)} \longrightarrow P_4 + 6H_{2(g)}$

$$= -\frac{1}{4}\frac{\Delta[PH_3]}{\Delta t} = \frac{\Delta[P_4]}{\Delta t} = \frac{1}{6}\frac{\Delta[H_2]}{\Delta t}$$

$$\frac{1}{6}\frac{\Delta[H_2]}{\Delta t} = 0.078 M/s$$

Rate of formation of hydrogen

$= 0.078 \times 6$

$= 0.468 M/s$

(Q2b)

$$4x -\frac{1}{4}\frac{\Delta[PH_3]}{\Delta t} = 0.468 \times -4$$

$$\frac{\Delta PH_3}{\Delta t} = (-4 \times 0.468$$

$$= -1.872 m/s$$

Q3)

$S_2O_{8(aq)}^{2-} + 3I_{(aq)}^{-} \rightarrow 2SO_{4(aq)}^{2-} + I_{3(aq)}^{-}$

$$\frac{\text{Rate}}{R_1} = \frac{1.1\times10^{-4}}{2.2\times10^{-4}} = \frac{(0.08)^a}{(0.08)^a} \times \frac{(0.017)^b}{(0.034)^b}$$

for b

$$\frac{1.1\times10^{-4}}{2.2\times10^{-4}} = [0.5]^b$$

$\log 0.5 = [0.5]^b$

$\log 0.5 = b \log 0.5$

$b = 1$

(b) $\frac{R_3}{R_2} = \frac{2.2\times10^{-4}}{1.1\times10^{-4}} = \frac{[0.16]^a}{[0.080]^1}$

$2 = 2^a$

$\log 2 = a \log 2$

$a = 1$

Rate $= K[S_2O_8^{2-}]^1[3I^-]^1$

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Rate Constant

$2.2 \times 10^{-4} = K[0.080] \times [0.034]$

$K = 8.0 \times 10^{-3}$

Q4:

$2A \longrightarrow B$

$\ln(A)_t = -Kt + \ln[A]_0$

$\ln[0.14] = 2.8 \times 10^{-2} + \ln(0.88)$

$-1.966 = 2.8 \times 10^{-2} t - 0.1278$

$\frac{-1.966 + 0.1278}{-2.8 \times 10^{-2}} = \frac{-2.8 \times 10^{-2} t}{-2.8 \times 10^{-2}}$

$t = 65.65$

Q5) Half Life of N_2O_5

Rate $= 0.074$ M/s

$t_{1/2} = \frac{0.693}{K}$

$t_{1/2} = \frac{0.693}{0.074}$

$= 9.365$

Q6

$2A \longrightarrow B$

$\frac{1}{[A]_t} = -Kt + \frac{1}{[A]_0}$

$3.7 \times 10^{-3} = Kt + \frac{1}{0.0092}$

$3.7 \times 10^{-3} = -51t + 111.111$

$3.7 \times 10^{-3} - 111.111 = -51t$

$t = \frac{-111.107}{-51}$

$t = 2.18$ Minutes

Q 6b

$t_{\frac{1}{2}} = \frac{1}{K[A]_0} = \frac{1}{(51 \times 0.092)}$

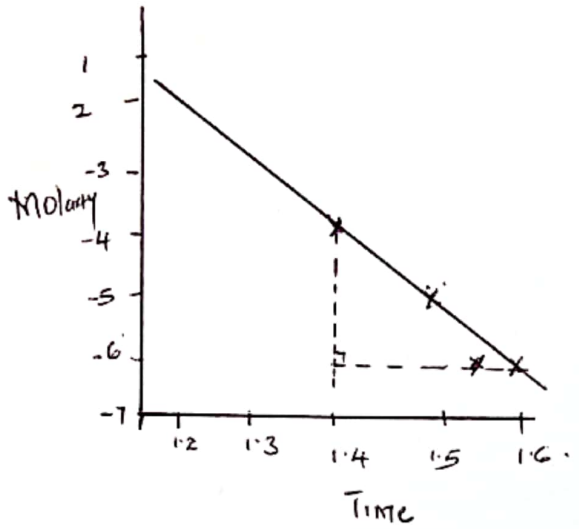
$t_{1/2} = 2.1786$ Minutes

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Q7

$$\ln K = -\frac{E_a}{R}\left(\frac{1}{T}\right) + \ln A$$

$\ln K$	$1/T$
-6.28	1.6×10^{-4}
-4.319	1.5×10^{-4}
-2.86	1.4×10^{-4}



$$\frac{-4 - -6}{1.5 - 1.6} = -20$$

$$E_a = 8.314 \times 20$$

$$= 166.28 \text{ KJ/mol.}$$

Q8

$$\ln \frac{K_1}{K_2} = \frac{E_a}{R}\left(\frac{T_1 - T_2}{T_1 \times T_2}\right)$$

$$\ln \frac{3.32 \times 10^{-10}}{K_2} = \left(\frac{116}{8.314}\right)\left(\frac{298-313}{298 \times 313}\right)$$

$$\ln \frac{3.32 \times 10^{-10}}{K_2} = 0.0022$$

$$K_2 = \frac{3.32 \times 10^{-4}}{e^{0.0022}}$$

$$K_2 = 3.39 \times 10^{-4} \text{ M/S}$$

$$4PH_{3(g)} \longrightarrow P_{4(s)} + 6H_{2(g)}$$

$$t_{1/2} = \frac{0.693}{K} \times K$$

$$\frac{35.0K}{35.0} = \frac{0.693}{35.0}$$

$$K = 0.0198 \text{ M/S}$$

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(9b)

$\ln A_{(t)} = -kt + \ln(A_0)$

But $A_0 = 0.25$

$\frac{95}{100} \times 0.25 = 0.2375$

$\ln 0.2375 = -0.0198 + \ln 0.25$

$-1.4375 = -0.0198t + -1.386$

$\frac{(-1.4375 + 1.386)}{-0.0198} = \frac{-0.0198t}{-0.0198}$

$t = 2.60\,s$