AP Ch12 PR

(1) A $K[A]$ = Rate

(2) E $Rate = K[A][B]^2$

(3) D $Rate = [A]^2[B]$

$2+1=3$

(4) D Plug in Sample data

$rate = K[2]^2[2]$

$4 \cdot 2 = 8$

(5) A Trick there is no B to double $2^0 = 1$

$Rate = K[A]$

$2^1 = 2$

(6) B changing A has no impact on the rate

(7) C-C $A + B \rightarrow C + D$

$A + C \rightarrow D + E$

(8) $2NOCl \rightarrow 2NO + Cl_2$

look at ratios B

$2NOCl \rightarrow 2NO$

$1:1$

9.) rate = $k[H_2][I_2]$

(D) ↑ reactant ↑ rate

k = it's a constant!

14.) C

15.) A

10.) $A + B \rightarrow C$

rate = $k[A]$

↑T ↑rate

(A)

Be careful

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

$K = Ae^{\frac{-E_a}{RT}}$

rate law (#9) does is not influenced by T.

11.) (B) $\frac{.2}{.1} = \frac{6}{3}$ $2^x = 2$ $x = 1$

(A) $\frac{.4}{.2} = \frac{6}{6}$ $2^y = 1$ $y = 0$

(C) rate = $k[B]$

12.) C

I = ↑ [reactants] ↑ rate

III ↑T ↑rate

B is not in rate law : changes have no effect

13.) B: $\frac{.2}{.1} = 2$ $\frac{4}{2} = 2$ $2^x = 2$ $x = 1$

Be careful A = $\frac{.2}{.4} \nearrow \frac{.2}{.4}$ $\frac{4E^{-6}}{1.6E^{-5}}$ 4 $4^x = 4$ $x = 1$

2.2 = 4

not double

rate = $k[A][B]$

14.) $A + B \rightarrow C$ ②

[B]		[A]	
.2 / .1	$2.4E^{-2}$ / $6.0E^{-3}$	.4 / .1	$6E^{-3}$ / $1.5E^{-3}$
2	4	4	4

$2^B = 4$

$B = 2$

$4^A = 4$

$A = 1$

(C) rate = $[B]^2[A]$

15.) (A) Be careful think of all of the half life rxns.

using rate = $-\frac{\Delta[A]}{t}$ just gives rate

using ln just gives k.

So look at how [A] changes each time

$.4\left(\frac{1}{2}\right) = .2\left(\frac{1}{2}\right) = .1\left(\frac{1}{2}\right) = .05$

$\therefore \frac{\ln 2}{k}$ = Half life for 1st order

$\therefore$ rate = k[A]

Problems

[B]

1. $\frac{R_2}{R_1} = \frac{.1}{.05}$ $\quad \frac{6E-3}{3E-3}$ $\quad \frac{4x}{3}$ $\quad \frac{.2}{.1}$ $\quad \frac{2.4}{1.2}$

2 $\qquad$ 2 $\qquad$ 2 $\quad$ 2

$2^B = 2$ $\qquad$ $2^A = 2$

$B = 1$ $\qquad$ $A = 1$

[A]

a.) rate = $K[A][B]$

b.) Exp 1 $\quad 3E^{-3} = K[.05][.05]$

$K = 1.2\ \frac{L}{mol\ s}$

$\frac{Mol}{Ls} = \frac{mol^2}{L^2}$

$\frac{L}{mol\ s}$

c.) rate $= 1.2[.02][.02]$

rate $= 4.8E^{-4}\ \frac{mol}{L\ sec}$

d.) (A) $+ B \rightarrow C + D$ $\quad$ Rxn 1

$+ D + B \rightarrow C$ $\quad$ Rxn 2

i) $A + 2B \rightarrow 2C$

ii) Only reactants are used in rate law for rxn

rate for rxn 1 = A rate $= K[A][B]$

rate for second rxn rate $= K[D][B]$

$\therefore A + B \rightarrow C + D$ slow rxn rate

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2.) [NO] [Br_2]

[NO]	Rate	[Br_2]	Rate
.04 / .02	3.8E-1 / 9.0E-2	.04 / .02	1.9E-1 / 9.0E-2
2	4	2	2

$2^{NO} = 4$

$NO = 2$

$2^{Br} = 2$

$Br = 1$

a.) $rate = K[NO]^2[Br]$

b.) Exp 1 $9.0E-2 = K[.02]^2[.02]$

$K = 1.2E4 \frac{L^2}{mol^2 s}$

$\frac{mol}{L^3} \cdot \frac{mol^2}{L^2} \cdot \frac{1}{s}$

$\frac{L^2}{mol^2 s}$

c.) Exp 2

[NO]	[Br_2]	Rate
.04	.02	3.8E-1
?	½ · .01 consumed	

$2NO + Br_2 \rightarrow 2NOBr$

2 : 1

2 × NO ∴ if Br = .01 consumed 2x that

i.e. 2(.01) = .02 consumed ATQ

.04 − .02 = [.02] left

d) rate = $k[NO]^2[Br_2]$

(I) $NO + NO \rightleftharpoons N_2O_2$

$N_2O_2 + Br_2 \rightarrow 2NOBr$ (slow) ← rate determining step

$2NO + Br_2 \rightarrow 2NOBr$

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Problem 4

a.) 3 / 2 — [B] .4 / .2 — Rate 6 / 3

$2^B = 2$

$B = 1$

Exp 1 + 2

Double A: .1 / .2

double B: .1 / .2

∴ rate double (no help)

Exp 2 + 3

A constant: .2 / .2

B rate: .2 / .4 ∴ double B does not affect

$\text{rate} = k[B]$

b.) Exp 1 $1.5E^{-3} = K[.1]$

$\frac{\text{mol}}{L\,\text{min}} = \frac{\text{mol}}{L}$

$K = 0.015 \frac{1}{\text{min}}$

$\frac{1}{\text{min}}$

c.) hmm... lets look at the Rxn to Find [D]

$2A + B \rightarrow C + D$

Exp 2 info: [A] .2, [B] .2, rate $3.0E^{-3}$

equal but not consumed equal

A is consumed 2x as fast ∴ we will run out of it 1st ∴ LR

∴ for 2 mol A consumed 1 mol D formed

$.2\,\text{mol A} \left| \frac{1\,\text{mol D}}{2\,\text{mol A}} \right. = 0.1\,\text{mol D formed}$

D.) rxn $2A + B \rightarrow C + D$ rate $= k[B]$

I) $A + B \rightarrow C + E$ slow → rate $= k[A][B]$

$A + E \rightarrow D$ Fast

✓ $2A + B \rightarrow C + D$

II) $B \rightarrow C + E$ slow

$A + E \rightarrow F$ Fast

$A + F \rightarrow D$ Fast

rate $= k[B]$ — II

✓ $2A + B \rightarrow D$

E.) 1st order reaction due to rate $= k[B]$

$\therefore t_{1/2} = \frac{\ln 2}{k} = \frac{\ln 2}{0.015} = \boxed{46.2 \text{ min}}$

(watch algebra signs!!) Problem 3

a.) Calculate rate constant (k)

- Given 1st order
- only given [ ] + time

$\therefore \ln[A] - \ln[A]_0 = -kt$

$\ln[.289] - \ln[.40] = -k(20)$

$-1.241 - -.916 = -k(20)$

$k = 0.01625 \text{ min}^{-1}$

b.) $[N_2O_5] = 0.350M$ find t

$\ln[.350] - \ln[.4] = -.01625t$

$-.133$

$t = 8.21 \text{ min}$

c.) $[N_2O_5]$ (typo) after 100 mins

$\ln[A] - \ln[.4] = -.01625(100)$

$\ln[A] - .916 = -1.625$

$\ln[A] + .916 = -1.625$

$\ln[A] = -2.541$

$[A] = e^{-2.541}$

$[A] = 0.0787 \text{ M}$

d.) rate = $.0163\ 1/\text{min}\left[.4\ \frac{\text{mol}}{\text{L}}\right]$

$$\text{rate} = 0.00652\ \frac{\text{mol}}{\text{L min}}$$

e.) 1st order Rxn.: $\frac{1}{2}\text{life} = \frac{\ln 2}{k}$

$$t_{1/2} = \frac{\ln 2}{.0163} = 42.5\ \text{min}$$