

1. (5 Pts) The rate law for the reaction  $A + B \rightarrow C + D$  is first order in  $[A]$  and second order in  $[B]$ . If  $[A]$  is halved and  $[B]$  is doubled. What will be the effect on the rate of the reaction? (i.e. doubled, halved, etc.)

rate =  $k[A][B]^2$  so:  $[\frac{1}{2}][2]^2 \Rightarrow 2$  so doubled

2a. (5 Pts) The table presents data for the reaction:  $2H_2(g) + 2NO(g) \xrightarrow{k_1} 2H_2O(g) + N_2(g)$

Exp.	Initial Concentration (mol·L <sup>-1</sup> )		Initial Rate M/s	
	[NO] × 10 <sup>-3</sup>	[H <sub>2</sub> ] × 10 <sup>-3</sup>		
I	6.0	1.0	18	General rate law: rate = $k[H_2]^x [NO]^y$
II	6.0	2.0	36	
III	1.0	6.0	3	
IV	2.0	6.0	12	

Determine the rate law for this reaction?

For H<sub>2</sub>:  
 (use Exp I + II)  $\frac{36}{18} = \left(\frac{2.0 \times 10^{-3}}{1.0 \times 10^{-3}}\right)^x$   
 $2 = 2^x$  so  $x = 1$

rate =  $k[H_2][NO]^2$

for NO:  
 (use Exp III + IV)  $\frac{12}{3} = \left(\frac{2.0 \times 10^{-3}}{1.0 \times 10^{-3}}\right)^y$   
 $4 = (2)^y$   
 $y = 2$

2b. (5 Pts) Determine the value of the rate constant and its units for problem 2a.  
 use any data set  $18 \frac{M}{s} = k \frac{M}{M} [1.0 \times 10^{-3}] \frac{M}{M^2} [6.0 \times 10^{-3}]^2$   $k = 5 \times 10^8 s^{-1} M^{-2}$

3. (3 Pts) The correct unit(s) for the rate constant in the rate law having: rate =  $k[D][X]$  is  $time^{-1} M^{-1}$

4. (3 Pts) Which one of the following is not a valid expression for the of the reaction below?



- a.  $-\frac{\Delta[O_2]}{7\Delta t}$     b.  $\frac{\Delta[NO_2]}{4\Delta t}$     c.  $-\frac{\Delta[H_2O]}{6\Delta t}$     d.  $-\frac{\Delta[NH_3]}{4\Delta t}$     e. rate =  $k[NH_3]^x [O_2]^y$

4b. (2 Pts) Explain you answer:

Water is a product, so it is appearing and would have a (+) sign

5. (2 Pts) The rate expression for a second order reaction is

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