

Ch 14-17 Exam Version M Key

1. E
2. B
3. C
4. D
5. A
6. D
7. D
8. A
9. B
10. C
11. E
12. C
13. C
- 14.

a. $k=1/(M \cdot \text{min})$; since rate units are M/min; $\text{rate}=k[\text{NO}_2]^2$

b. $1/[\text{A}]=kt + 1/[\text{A}]_0$
 $1/.025=.63t + 1/.100$

$t=47.6$

48 minutes

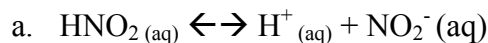
c. $\ln(k_1/k_2) = (-E_A/R)(1/T_1 - 1/T_2)$
 $\ln(.63/1.26) = (-E_A/8.314)(1/298_1 - 1/308)$

$-.693 = -E_A (1.31 \cdot 10^{-5})$

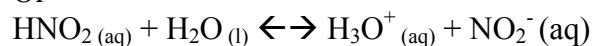
$E_A = 52843$

$E_A = 5.3 \cdot 10^4 \text{ J/mol or } 53 \text{ kJ/mol}$

15.



Or



b.

I	.500	0	0
C	-x	+x	+x
E	.500-x	X	x

$4.5 \cdot 10^{-4} = x^2/(\cdot 500-x) \approx x^2/\cdot 500$

$x=.015$

$\text{pH}=1.82$

c.

i. $(0.0300\text{L})(0.500\text{M}) = 0.0150 \text{ mol HNO}_2$

$(0.0200\text{L})(0.500\text{M}) = 0.0100 \text{ mol OH}^-$



I	.0150	.0100	0	
C	-.0100	-.0100	+.0100	
F	.0050	0	.0100	



I	.0050/.050	.0100/.050	0
C	-x	+x	+x
E	.10-x	.20-x	x

$$4.5 * 10^{-4} = (.20-x)(x)/(.10-x) \approx .20x/.10$$

$$x=2$$

$$[\text{H}_3\text{O}^+] = 2.2 * 10^{-4} \text{ M}$$

ii. $-\log [\text{H}^+]$

$$\text{pH} = 3.65$$

d. $.0150 \text{ mol HNO}_2$

$$(0.0400 \text{ L})(.500 \text{ M}) = .0200 \text{ mol OH}^-$$

$$(.0050 \text{ mol OH}^- * 5)/(.070 \text{ L}) = 0.071 \text{ M OH}^-$$

$$\text{pOH} = 1.15$$

Ch 14-17 Exam Version N Key

1. B
2. A
3. D
4. C
5. D
6. B
7. A
8. C
9. A
10. A
11. A
12. D
13. C
- 14.

a. Units of k are s^{-1} ; since rate units are M/s ; $\text{rate} = k[\text{NO}_2]^1$

b. $\ln [\text{A}] = -kt + \ln [\text{A}]_0$

$$.050 = -(0.23)t - 1.61$$

$$-3.00 = -.23t$$

$$t = 6.0 \text{ minutes or } 360 \text{ seconds}$$

c. $\ln(k_1/k_2) = (-E_A/R)(1/T_1 - 1/T_2)$

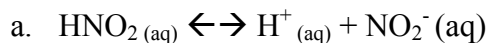
$$\ln(.23/.69) = (-E_A/8.314)(1/298_1 - 1/318)$$

$$-1.0986 = -E_A (2.538 * 10^{-5})$$

$$E_A = 43278$$

$$E_A = 4.3 * 10^4 \text{ J/mol or } 43 \text{ kJ/mol}$$

15.



b.

I	.300	0	0
C	-x	+x	+x
E	.300-x	X	x

$$4.5 * 10^{-4} = x^2/((.300-x)) \approx x^2/.300$$

$$x = .0116$$

$$\text{pH} = 1.93$$

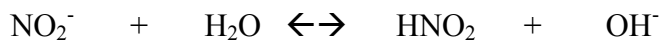
c.

i. $(0.0400\text{L})(0.300\text{M HNO}_2) = 0.0120 \text{ mol HNO}_2$

$(0.0250\text{L})(0.300\text{M OH}^-) = 0.0750 \text{ mol OH}^-$



I	.0120	.0100	0	
C	-.00750	-.00750	+.00750	
F	.00450	0	.00750	



I	.0050/.050		.0100/.050	0
C	-x		+x	+x
E	.10-x		.20-x	x

$$K_b = K_w/K_a = (1.0 * 10^{-4})/(4.5 * 10^{-4}) = 2.2 * 10^{-11}$$

$$K_b = (.0692+x)(x)/(.115-x) \approx .0692x/.115$$

$$x = [\text{OH}^-] = 3.7 * 10^{-11}$$

$$[\text{H}_3\text{O}^+] = 2.7 * 10^{-4} \text{ M}$$

ii. $-\log [\text{H}^+]$

pH = 3.57

d. .0120 mol HNO₂

$(0.0500 \text{ L})(.300 \text{ M}) = .0150 \text{ mol OH}^-$

$.0150 \text{ mol OH}^- - .0120 \text{ mol HNO}_2 = .003 \text{ mol OH}^- * 5 / .090\text{L} =$

$.033 \text{ M OH}^-$

pOH = 1.5