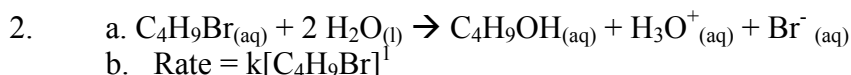


Exam Ch 14 - 17 Key (Version E)

1. a. $K_p = 109$
 $= (P_{\text{NOBr}})^2 / [(P_{\text{NO}})^2(P_{\text{Br}_2})]$
 $= (90.0768)^2 / [(P_{\text{NO}})^2(0.0159)]$
 $P_{\text{NO}} = 0.0583 \text{ atm}$

b. As temperature increases, pressure increases, which signifies a backwards shift. If increased temperature induces a backwards shift, heat must be a product, therefore the reaction is exothermic. ($\Delta H = -$)

c. Shift right since 2 moles of gas takes up less space than 3 moles of gas.



3. a. $(2.00 \text{ mL NaOH})(0.125 \text{ M}) = 2.50 \times 10^{-4} \text{ mol OH}^-$
 $\text{pH} = \text{pK}_a + \log ([\text{A}^-]/[\text{HA}])$
 $6.912 = \text{pK}_a + \log (2.5 \times 10^{-4})/(1.75 \times 10^{-3})$

	HA	+ OH ⁻	→	A ⁻	+ H ₂ O
I	2.00×10^{-3}	2.50×10^{-4}		0	
C	-2.50×10^{-4}	-2.50×10^{-4}		2.5×10^{-4}	
F	1.75×10^{-3}	0		2.5×10^{-4}	

At equilibrium point:

$(16.00 \text{ mL NaOH})(0.125 \text{ M}) = 2.00 \times 10^{-3} \text{ mol OH}^-$, so $2.00 \times 10^{-3} \text{ mol HA}$

$\text{pK}_a = 7.757$
 $\text{K}_a = 1.75 \times 10^{-8}$

4. a. $\text{AgOH} > \text{Cd}(\text{OH})_2 > \text{Al}(\text{OH})_3$
 b. $\text{Al}(\text{OH})_3: K_{\text{sp}} = 2. \times 10^{-32} = [\text{Al}^{3+}][\text{OH}^-]^3$
 $[\text{Al}(\text{OH})_3] = [\text{Al}^{3+}] = x$
 $3[\text{Al}(\text{OH})_3] = [\text{OH}^-] = 3x$
 $K_{\text{sp}} = x(3x)^3$
 $= 27x^4$
 $x = 5. (2) \times 10^{-9}$
 $3x = 2 \times 10^{-8} \text{ M OH}^-$
 $\text{Cd}(\text{OH})_2: K_{\text{sp}} = 5.9 \times 10^{-15} = [\text{Cd}^{2+}][\text{OH}^-]^2 = x(2x)^2 = 4x^3$
 $x = 1.1 \times 10^{-5}$
 $2x = 2.3 \times 10^{-5}$
 $\text{AgOH}: K_{\text{sp}} = 2.0 \times 10^{-8} = [\text{Ag}^+][\text{OH}^-] = x^2$
 $x = 1.4 \times 10^{-4} \text{ M OH}^-$

Exam Ch 14 - 17 Key (Version F)

1. a) $K_p = 109$
 $= (P_{\text{NOBr}})^2 / [(P_{\text{NO}})^2(P_{\text{Br}_2})]$
 $= (0.0568)^2 / [(P_{\text{Br}_2})^2(0.0259)]$
 $P_{\text{Br}_2} = 0.0441 \text{ atm}$
- b) When T decreases, P increases; therefore, rxn shifts backward. If T decreases shifts backward, heat must be reactant. So, ΔH is + (endothermic).

c) Backwards (left)-more moles

2. a) $\text{C}_4\text{H}_9\text{Br}_{(\text{aq})} + 2 \text{H}_2\text{O}_{(\text{l})} \rightarrow \text{C}_4\text{H}_9\text{OH}_{(\text{aq})} + \text{H}_3\text{O}^+_{(\text{aq})} + \text{Br}^-_{(\text{aq})}$
 b) $\text{Rate} = k[\text{C}_4\text{H}_9\text{Br}]^1$
3. $(15.00 \text{ mL HCl})(0.125\text{M}) = 1.87(5) \text{ mol H}^+ = 1.87(5) \text{ mol B initially}$

	B	+	H⁺	\rightarrow	BH⁺
I	$1.87(5) \cdot 10^{-3}$		$3.75 \cdot 10^{-4}$		0
Δ	-		-		+
F	$1.5 \cdot 10^{-3}$		0		$3.75 \cdot 10^{-4} \text{ mol}$

$$\text{pH} = \text{pK}_a + \log\left(\frac{[\text{B}]}{[\text{BH}^+]}\right)$$

$$7.008 = \text{pK}_a + \log\left(\frac{0.0015}{3.75 \cdot 10^{-8}}\right)$$

$$\text{K}_a = 2.5 \cdot 10^{-8}$$

4. a) $\text{CaSO}_4 > \text{Ag}_2\text{SO}_4 > \text{Cu}_2(\text{SO}_4)_3$
 b) Ag_2SO_4
 $\text{K}_{\text{sp}} = [\text{SO}_4^{2-}][\text{Ag}^+]^2 = 1.2 \cdot 10^{-5}$
 $x(2x)^2 = 4x^3 = 1.2 \cdot 10^{-5}$
 $x = 0.0144$
 $[\text{SO}_4^{2-}] = 0.0144$

CuSO_4

$$\text{K}_{\text{sp}} = [\text{SO}_4^{2-}][\text{Ca}^{2+}]$$

$$6.1 \cdot 10^{-5} = x^2$$

$$x = 7.8 \cdot 10^{-3}$$

$$[\text{SO}_4^{2-}] = 0.0078$$

$\text{Cu}_2(\text{SO}_4)_3$

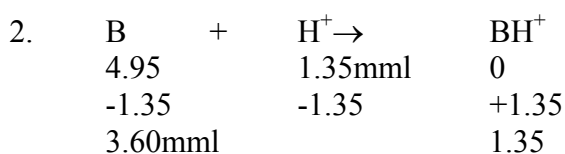
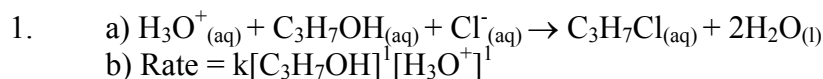
$$5.7 \cdot 10^{-3} = (2x^2)(3x)^3$$

$$= 36x^5$$

$$x = 0.0139$$

$$3x = 0.0418$$

Exam Ch 14 - 17 Key (Version G)



$$(6.00\text{mL})(0.225\text{M HNO}_3) = 1.35 \times 10^{-3} \text{mol H}^+$$
$$(22.00\text{mL})(0.225\text{M HNO}_3) = 4.95 \times 10^{-3} \text{mol H}^+ \rightarrow 4.95 \times 10^{-3} \text{mol B}$$

$$\text{pOH} = \text{pK}_b + \log(\text{H}^+/\text{B})$$
$$6.892 = \text{pK}_b + \log([1.35]/[3.60])$$
$$= \text{pK}_b + (-0.426)$$
$$\text{pK}_b = 7.318$$
$$\text{K}_b = 4.81 \times 10^{-8}$$

3. a) T decrease, P increase—P increase means shift right, so heat if product, so exothermic

b) \rightarrow

c) $K_p = (\text{P}_{\text{NO}})^2 \text{P}_{\text{Br}_2} / (\text{P}_{\text{NOBr}_2}) = (0.0459)^2 \text{P}_{\text{Br}_2} / 0.468^2$
 $9.17 \times 10^{-3} = 0.962 \text{P}_{\text{Br}_2}$
 $\text{P}_{\text{Br}_2} = 9.53 \times 10^{-3} \text{ atm}$

4. a) $\text{BeSO}_4 < \text{Fe}_2(\text{SO}_4)_3 < (\text{NH}_4)_2\text{SO}_4$

b) BeSO_4

$$1.2 \times 10^{-7} = [\text{Be}^{2+}][\text{SO}_4^{2-}]$$
$$= x^2$$
$$x = 3.46 \times 10^{-4} \text{M}$$

$(\text{NH}_4)_2\text{SO}_4$

$$6.1 \times 10^{-3} = [\text{NH}_4]^2[\text{SO}_4^{2-}]$$
$$= (2x)^2 x$$
$$= 4x^3$$

$$x = 0.115 \text{ M or } x = 0.0781 \text{ M (wrong formula)}$$

$\text{Fe}_2(\text{SO}_4)_3$

$$3.7 \times 10^{-6} = (2x)^2(3x)^3$$
$$= 0.0400$$

$$[\text{SO}_4^{2-}] = 0.120 \text{ M}$$

Thanks to Tina Zhou, Class of 2006 for typing this. Please let Mr. Hambleton know if you find any typos or other mistakes.