CHE 116 PRACTICE EXAM 2

1) A BrØnsted-Lowry base is defined as a substance that _____.

A) increases $[H^+]$ when placed in H_2O

B) decreases $[H^+]$ when placed in H_2O

C) increases $[OH^-]$ when placed in H_2O

D) acts as a proton acceptor

E) acts as a proton donor

2) The magnitude of K_w indicates that _____.

A) water autoionizes very slowly

B) water autoionizes very quickly

C) water autoionizes only to a very small extent

D) the autoionization of water is exothermic

E) water is a weak acid

3) Of the acids in the table below, _____ is the strongest acid.

A) HOAc

B) $HCHO_2$

C) HClO

D) HF

E) HOAc and $HCHO_2$

Acid	K_a
HOAc	1.8×10^{-5}
$HCHO_2$	1.8×10^{-4}
HClO	3.0×10^{-8}
HF	6.8×10^{-4}

4) Of the acids in the table below, _____ has the strongest conjugate base.

A) HOAc

B) $HCHO_2$

C) HClO

D) HF

E) HOAc and $HCHO_2$

Acid	K_a
HOAc	1.8×10^{-5}
$HCHO_2$	1.8×10^{-4}
HClO	3.0×10^{-8}
HF	6.8×10^{-4}

5) A- is a weak base. Which equilibrium corresponds to the equilibrium constant K_a for HA?

A) $HA\,(aq) + H_2O\,(l) \rightleftharpoons H_2A^+\,(aq) + OH^-\,(aq)$

B) $A^-\,(aq) + H_3O^+\,(aq) \rightleftharpoons HA\,(aq) + H_2O\,(l)$

C) $HA\,(aq) + H_2O\,(l) \rightleftharpoons H_3O^+\,(aq) + A^-\,(aq)$

D) $A^-\,(aq) + H_2O\,(l) \rightleftharpoons HA\,(aq) + OH^-\,(aq)$

E) $A^-\,(aq) + OH^-\,(aq) \rightleftharpoons HOA^{2-}\,(aq)$

6) Calculate the concentration of sodium hydroxide in a solution that has a pH of 11.00

A) 1.0×10^{-11}

B) 1.0×10^{-3}

C) 6.0×10^{-5}

D) 3.5×10^{-4}

E) none of the above

7) Which of the following aqueous solutions has the lowest $[OH^-]$?

A) a solution with a pOH of 12.0

B) a 1×10^{-4} M solution of HNO_3

C) a solution with a pH of 3.0

D) pure water

E) a 1×10^{-3} M solution of NH_4Cl

8) A 0.0035 M aqueous solution of a particular compound has pH = 2.46. The compound is _____.

A) a weak base

B) a weak acid

C) a salt

D) a strong base

E) a strong acid

9) What is the conjugate acid of CO_3^{2-} ?

A) CO_2^{2-}

B) HCO_2^{2-}

C) H_2CO_3

D) HCO_3^-

E) none of the above

10) What is the pH of an aqueous solution at 25.0 °C that contains 3.98×10^{-9} M hydroxide ion?
A) 8.40
B) 5.60
C) 9.00
D) 3.98
E) 7.00

11) The pH of a 0.25 M aqueous solution of hydrofluoric acid, HF, at 25.0 °C is 2.03. What is the value of K_a for HF?
A) 2.0×10^{-9}
B) 1.1×10^{-9}
C) 6.0×10^{-5}
D) 3.5×10^{-4}
E) none of the above

12) The K_a of acetic acid ($HC_2H_3O_2$) is 1.8×10^{-5}. What is the pH at 25.0 °C of an aqueous solution that is 0.100 M in acetic acid?
A) +2.87
B) -2.87
C) -11.13
D) +11.13
E) +6.61

13) The pH of a 0.55 M aqueous solution ammonia, NH_3, at 25.0 °C is 11.50. What is the value of K_b for NH_3?
A) 2.0×10^{-9}
B) 1.1×10^{-9}
C) 6.0×10^{-5}
D) 1.8×10^{-5}
E) none of the above

14) The base-dissociation constant, K_b, for pyridine, C_5H_5N, is 1.4×10^{-9}. The acid-dissociation constant, K_a, for the pyridinium ion, $C_5H_5NH^+$, is _____.

A) 1.0×10^{-7}

B) 1.4×10^{-23}

C) 7.1×10^{-4}

D) 1.4×10^{-5}

E) 7.1×10^{-6}

15) What change will be caused by addition of a small amount of HCl to a solution containing fluoride ions and hydrogen fluoride?

A) The concentration of hydronium ions will increase significantly.

B) The concentration of fluoride ions will increase as will the concentration of hydronium ions.

C) The concentration of hydrogen fluoride will decrease and the concentration of fluoride ions will increase.

D) The concentration of fluoride ion will decrease and the concentration of hydrogen fluoride will increase.

E) The fluoride ions will precipitate out of solution as its acid salt.

16) Of the following solutions, which has the greatest buffering capacity?

A) 0.521 M $HC_2H_3O_2$ and 0.217 M $NaC_2H_3O_2$

B) 0.821 M $HC_2H_3O_2$ and 0.713 M $NaC_2H_3O_2$

C) 0.365M $HC_2H_3O_2$ and 0.497 M $NaC_2H_3O_2$

D) 0.121 M $HC_2H_3O_2$ and 0.116 M $NaC_2H_3O_2$

17) Which of the following could be added to a solution of acetic acid to prepare a buffer?

A) sodium acetate only

B) sodium acetate or sodium hydroxide

C) nitric acid only

D) hydrofluoric acid or nitric acid

E) sodium hydroxide only

18) Calculate the pH of a solution prepared by dissolving 0.150 mol of acetic acid and 0.300 mol of sodium acetate in water sufficient to yield 1.00 L of solution. The K_a of acetic acid is 1.76×10^{-5}.

A) 2.516
B) 3.892
C) 4.502
D) 10.158
E) 5.056

19) The concentration of fluoride ions in a saturated solution of barium fluoride is _____ M. The solubility product constant of BaF_2 is 1.7×10^{-6}.

A) 3.8×10^{-4}
B) 3.0×10^{-3}
C) 1.5×10^{-2}
D) 7.5×10^{-3}
E) 1.4×10^{-4}

20) What is the solubility of $PbCl_2$ in a 0.15 M solution of HCl? The K_{sp} of $PbCl_2$ is 1.6×10^{-5}.

A) 2.0×10^{-3}
B) 1.1×10^{-4}
C) 1.8×10^{-4}
D) 7.1×10^{-4}
E) 1.6×10^{-5}

21) Calculate the percent ionization of formic acid (HCO_2H) in a solution that is 0.322 M in formic acid and 0.178 M in sodium formate ($NaHCO_2$). The K_a of formic acid is 1.77×10^{-4}.

A) 35.6
B) 0.101
C) 10.8
D) 1.03×10^{-3}
E) 3.488

22) A solution is made by dissolving 0.23 mol of benzoic acid and 0.27 mol of sodium benzoate in water to yield 1.00 L of solution. The addition of 0.05 mol of NaOH to this buffer solution causes the pH to increase slightly. The pH does not increase drastically because the NaOH reacts with the _____ present in the buffer solution. The K_a of benzoic acid is 6.3×10^{-5}.

A) H_2O

B) H_3O^+

C) benzoate

D) benzoic acid

E) This is a buffer solution: the pH does not change upon addition of acid or base.

23) The K_a of acetic acid is 1.76×10^{-5}. The pH of a buffer prepared by combining 15.0 mL of 1.00 M potassium acetate and 50.0 mL of 1.00 M acetic acid is _____.

A) 4.232

B) 0.851

C) 3.406

D) 1.705

E) 2.383

24) In which of the following aqueous solutions would you expect CuBr to have the highest solubility?

A) 0.0100 M KBr

B) 0.040 M $CuNO_3$

C) 0.030 M NaBr

D) 0.020 M LiBr

E) CuBr will have the same solubility in all solutions.

25) What is the molar solubility of silver carbonate (Ag_2CO_3) in water? The solubility-product constant for Ag_2CO_3 is 8.1×10^{-12} at 25 °C.

A) 1.4×10^{-6}

B) 2.0×10^{-4}

C) 4.0×10^{-6}

D) 1.3×10^{-4}

E) 2.7×10^{-12}

26) Calculate the pH of a solution prepared by dissolving 0.850 mol of NH_3 and 0.300 mol of NH_4Cl in water sufficient to yield 1.00 L of solution. The K_b of ammonia is 1.77×10^{-5}.

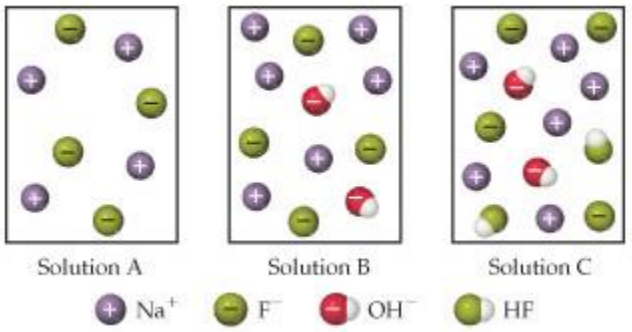
A) 5.204
B) 4.300
C) 9.700
D) 8.781
E) 8.796

27) For the following acid-base reaction, please identify the correct acid-conjugate base pair for the forward reaction.

H_3PO_4 (aq) + H_2O (l) $\rightleftharpoons$ _____ (aq) + _____ (aq)

A) Acid: H_3PO_4 (aq) Conjugate Base: OH^- (aq)
B) Acid: H_2O (l) Conjugate Base: OH^-
C) Acid: H_3O^+ (aq) Conjugate Base: OH^- (aq)
D) Acid: H_3PO_4 (aq) Conjugate Base: $H_2PO_4^-$ (aq)
E) Acid: H_3PO_4 (aq) Conjugate Base: H_3O^+ (aq)

28) Which of the following diagrams represents a solution of NaF.



A) solution A
B) solution B
C) solution C
D) solution B and C
E) none of the above

Key Equations:

$$K_w = [H_3O^+][OH^-] = 1.0\ x\ 10^{-14}$$

$$pH = -log[H_3O^+]$$

$$pOH = -log[OH^-]$$

$$pH + pOH = 14$$

$$K_a = \frac{[H_3O^+][A^-]}{[HA]}$$

$$K_b = \frac{[BH^+][OH^-]}{[B]}$$

$$Percent\ Ionization = \frac{[H_3O^+]equilibrium}{[HA]initial}\ x\ 100$$

$$K_a\ x\ K_b = K_w$$

$$pH = pK_a + log\frac{[Base]}{[Acid]}$$

Periodic Table of the Elements

Main Group Representative Elements													Main Group Representative Elements					
1A[a] 1																		8A 18
1 H 1.00794	2A 2												3A 13	4A 14	5A 15	6A 16	7A 17	2 He 4.002602
2 Li 6.941	4 Be 9.012182												5 B 10.811	6 C 12.0107	7 N 14.0067	8 O 15.9994	9 F 18.998403	10 Ne 20.1797
3 Na 22.989770	12 Mg 24.3050	3B 3	4B 4	5B 5	6B 6	7B 7	8B 8	8B 9	8B 10	1B 11	2B 12		13 Al 26.981538	14 Si 28.0855	15 P 30.973761	16 S 32.065	17 Cl 35.453	18 Ar 39.948
4 K 39.0983	20 Ca 40.078	21 Sc 44.955910	22 Ti 47.867	23 V 50.9415	24 Cr 51.9961	25 Mn 54.938049	26 Fe 55.845	27 Co 58.933200	28 Ni 58.6934	29 Cu 63.546	30 Zn 65.39	31 Ga 69.723	32 Ge 72.64	33 As 74.92160	34 Se 78.96	35 Br 79.904	36 Kr 83.80	
5 Rb 85.4678	38 Sr 87.62	39 Y 88.90585	40 Zr 91.224	41 Nb 92.90638	42 Mo 95.94	43 Tc [98]	44 Ru 101.07	45 Rh 102.90550	46 Pd 106.42	47 Ag 107.8682	48 Cd 112.411	49 In 114.818	50 Sn 118.710	51 Sb 121.760	52 Te 127.60	53 I 126.90447	54 Xe 131.293	
6 Cs 132.90545	56 Ba 137.327	71 Lu 174.967	72 Hf 178.49	73 Ta 180.9479	74 W 183.84	75 Re 186.207	76 Os 190.23	77 Ir 192.217	78 Pt 195.078	79 Au 196.96655	80 Hg 200.59	81 Tl 204.3833	82 Pb 207.2	83 Bi 208.98038	84 Po [208.98]	85 At [209.99]	86 Rn [222.02]	
7 87 Fr [223.02]	88 Ra [226.03]	103 Lr [262.11]	104 Rf [261.11]	105 Db [262.11]	106 Sg [266.12]	107 Bh [264.12]	108 Hs [269.13]	109 Mt [268.14]	110 Ds [281.15]	111 Rg [272.15]	112 Cn [285]	113 [284]	114 [289]	115 [288]	116 [292]	117 ** [294]	118 [294]	

Metals Metalloids Nonmetals

Transition metals

Lanthanide series	57 La 138.9055	58 Ce 140.116	59 Pr 140.90765	60 Nd 144.24	61 Pm [145]	62 Sm 150.36	63 Eu 151.964	64 Gd 157.25	65 Tb 158.92534	66 Dy 162.50	67 Ho 164.93032	68 Er 167.259	69 Tm 168.93421	70 Yb 173.04
Actinide series	89 Ac [227.03]	90 Th 232.0381	91 Pa 231.03588	92 U 238.02891	93 Np [237.05]	94 Pu [244.06]	95 Am [243.06]	96 Cm [247.07]	97 Bk [247.07]	98 Cf [251.08]	99 Es [252.08]	100 Fm [257.10]	101 Md [258.10]	102 No [259.10]