

Name _____ Section Number _____

Please read the following before proceeding

1. Materials: Turn off cell phones and wireless PDA devices. Clear all papers and books from your desk. You will need a pencil, a calculator and a Scantron answer form.
2. This exam is multiple-choice. It is highly recommended that you record your work on the actual exam (this document). There is no partial credit.
3. The exam will be Scantron scored. On the Scantron card, please make sure that you **bubble-in your GTid number**. In the space provided, write your **Name**. Write the **Color** of your exam in the Subject section and bubble-in the letter for the **Test Form**. Write your **section number** in the Hour/Date section. See sample below.
4. Show your Buzz Card when you turn in your completed exam and Scantron card.
5. You must work alone. Give or take no assistance from other students. Recall the Georgia Tech Honor Code. "I pledge my honor that I have not violated the Honor Code during this examination."

Signed _____

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NAME: LAST *Last* FIRST *First* MIDDLE *Middle*
SUBJECT *Color of Exam*
DATE *DATE* HOUR/DAY *SECTION#*

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EXAM NUMBER

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PERIODIC TABLE OF THE ELEMENTS																	
1 H 1.008															2 He 4.003		
3 Li 6.941	4 Be 9.012											5 B 10.811	6 C 12.011	7 N 14.007	8 O 15.999	9 F 18.999	10 Ne 20.180
11 Na 22.989	12 Mg 24.305											13 Al 26.982	14 Si 28.0856	15 P 30.974	16 S 32.066	17 Cl 35.453	18 Ar 39.948
19 K 39.098	20 Ca 40.078	21 Sc 44.955	22 Ti 47.867	23 V 50.941	24 Cr 51.996	25 Mn 54.938	26 Fe 55.845	27 Co 58.933	28 Ni 58.693	29 Cu 63.546	30 Zn 65.39	31 Ga 69.723	32 Ge 72.61	33 As 74.922	34 Se 78.96	35 Br 79.904	36 Kr 83.80
37 Rb 85.467	38 Sr 87.62	39 Y 88.905	40 Zr 91.224	41 Nb 92.906	42 Mo 95.94	43 Tc 98	44 Ru 101.07	45 Rh 102.905	46 Pd 106.42	47 Ag 107.868	48 Cd 112.411	49 In 114.818	50 Sn 118.710	51 Sb 121.760	52 Te 127.60	53 I 126.904	54 Xe 131.29
55 Cs 132.905	56 Ba 137.327	57 to 71	72 Hf 178.49	73 Ta 180.947	74 W 183.84	75 Re 186.207	76 Os 190.23	77 Ir 192.217	78 Pt 195.078	79 Au 196.967	80 Hg 200.59	81 Tl 204.383	82 Pb 207.2	83 Bi 208.980	84 Po 209	85 At 210	86 Rn 222
87 Fr 223	88 Ra 226	89 to 103	104 Rf 261	105 Db 262	106 Sg 263	107 Bh 264	108 Hs 265	109 Mt 268	110 Uun 269	111 Uuu 272	112 Uub 277						
57 La 138.906	58 Ce 140.116	59 Pr 140.908	60 Nd 144.24	61 Pm 145	62 Sm 150.36	63 Eu 151.964	64 Gd 157.25	65 Tb 158.925	66 Dy 162.50	67 Ho 164.930	68 Er 167.26	69 Tm 168.934	70 Yb 173.04	71 Lu 174.967			
89 Ac 227	90 Th 232.038	91 Pa 231.036	92 U 238.029	93 Np 237	94 Pu 244	95 Am 243	96 Cm 247	97 Bk 247	98 Cf 251	99 Es 252	100 Fm 257	101 Md 258	102 No 259	103 Lr 262			

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1. Things that happen spontaneously
- increase the entropy of the universe. (<-hint this one is right)
 - decrease the energy of the universe. (<-hint no, this one is wrong)

Answer: a

2. Which of the following are generally true?
- Intermolecular forces are stronger than covalent bonds.
 - Intermolecular forces are more directional than covalent bonds.
 - Any molecule in a liquid experiences intermolecular forces.
 - All of these are valid generalizations.
 - None of these are valid generalizations.

Answer: c

3. In liquid mixtures of hexanol ($\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{OH}$) and methanol (CH_3OH), attractive interactions between molecules arise from

- ion-ion interactions.
- ion-dipole interactions.
- dipole-dipole interactions.
- dispersive interactions.
- both c & d are correct.

Answer: e

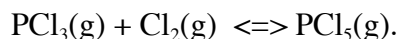
4. The water vapor pressure of a dilute solution of NaCl(aq) is
- less than that of a more concentrated NaCl(aq) solution.
 - greater than that of a more concentrated NaCl(aq) solution.
 - equal to that of a more concentrated solution of NaCl(aq) .
 - equal to that of the pure NaCl(s) .
 - none of these.

Answer: b

5. As the equilibrium state of a chemical reaction is approached,
- the rate of the forward reaction approaches zero.
 - the rate of the reverse reaction approaches zero.
 - the rates of the forward and backward reactions approach each other.
 - both a & b are correct.
 - none of these.

Answer: c

For the next three questions consider the chemical reaction, at 250°C , at fixed volume.



6. The equilibrium expression for the reaction is: $K =$

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a. $\frac{P_{\text{PCl}_3}P_{\text{Cl}_2}}{P_{\text{PCl}_5}}$

b. $\frac{P_{\text{PCl}_5}}{P_{\text{PCl}_3}P_{\text{Cl}_2}}$

c. $\frac{P_{\text{PCl}_5}}{P_{\text{Cl}_2}}$

d. $P_{\text{PCl}_3}P_{\text{Cl}_2}$

e. none of these.

Answer: b

7. The equilibrium partial pressures are $P_{\text{PCl}_3} = 0.400$ atm, $P_{\text{Cl}_2} = 0.500$ atm, and $P_{\text{PCl}_5} = 0.0930$ atm. Therefore the equilibrium constant K for the reaction at 250°C

a. 0.12

b. 0.47

c. 2.2

d. 8.6

e. none of these.

Answer: b

8. If $\text{Cl}_2(\text{g})$ is injected into this system at equilibrium, the partial pressure of PCl_3 will

a. increase.

b. decrease.

c. not change.

d. cannot be predicted

Answer: b

9. The conjugate base of HPO_4^{2-} is

a. H_3PO_4 b. H_2PO_4^- c. PO_4^{3-} d. PO_3^-

e. none of these.

Answer: c

10. For an aqueous solution at 25°C , if $[\text{H}^+] = 0.050$ M, then $[\text{OH}^-] =$

a. 2.0×10^{-12} Mb. 1.0×10^{-7} Mc. 2.0×10^{-6} Md. 5.0×10^{-2} M

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e. none of these.

Answer: e

11. What is the pH of a 0.001 M HCl(aq) solution at 25°C?

a. 10^{-3} b. 10^{-4}

c. 4

d. 3

e. None of these.

Answer: d

12. What is the pH of a 2.6×10^{-11} M NaOH(aq) solution at 25°C?

a. 2.8

b. 3.4

c. 7.0

d. 10.6

e. None of these.

Answer: c

The next three questions concern the weak base hydroxylamine (HONH_2), for which $K_b = 1.1 \times 10^{-8}$ at 25°C.

13. What is the pH of a 0.60 M aqueous hydroxylamine solution at 25°C?

a. 6.9

b. 7.9

c. 8.9

d. 9.9

e. None of these.

Answer: d

14. At which pH would hydroxylamine be the best buffer?

a. 6.0

b. 7.4

c. 8.5

d. 9.9

e. None of these.

Answer: a

15. At the pH specified in the previous question, what is $-\log_{10} \frac{[\text{HONH}_3^+]}{[\text{HONH}_2]}$?a. 10^{-7}

b. 7

c. 1

d. 0

e. None of these.

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Answer: d

16. Which of the following K_a values belongs to the strongest acid?

- a. 6.6×10^{-4}
- b. 4.6×10^{-4}
- c. 9.1×10^{-8}
- d. 3.0×10^{-8}
- e. Cannot be determined from the given information.

Answer: a

17. If an acid has $K_a = 4.93 \times 10^{-10}$, then K_b for the conjugate base is

- a. 5.17×10^{-10}
- b. 9.95×10^{-8}
- c. 2.03×10^{-4}
- d. 5.17×10^{-4}
- e. none of these.

Answer: e

18. For $\text{AgCl}(s)$, $K_{sp} = 1.6 \times 10^{-10}$. As the pH is lowered, the solubility of AgCl in water will

- a. increase.
- b. decrease.
- c. remain unchanged.
- d. This cannot be predicted.

Answer: c

For the next question, consider cadmium hydroxide $[\text{Cd}(\text{OH})_2]$, for which the solubility in water at 25°C is $1.7 \times 10^{-5} \text{ M}$.

19. The solubility product expression for the dissolution of $\text{Cd}(\text{OH})_2(s)$ in water is $K_{sp} =$

- a. $[\text{Cd}^{2+}][\text{OH}^-]^2/[\text{Cd}(\text{OH})_2]$
- b. $[\text{Cd}^{2+}][2\text{OH}^-]^2$
- c. $[\text{Cd}^{2+}][2\text{OH}^-]$
- d. $[\text{Cd}^{2+}][\text{OH}^-]^2$
- e. None of these.

Answer: d

For the next question, consider the following solubility product data for various chromates at 25°C :

$$K_{sp} \text{ Ag}_2\text{CrO}_4 = 1.9 \times 10^{-12}$$

$$K_{sp} \text{ BaCrO}_4 = 2.1 \times 10^{-10}$$

$$K_{sp} \text{ PbCrO}_4 = 1.8 \times 10^{-14}$$

20. The chromate that is least soluble in water at 25°C is

- a. Ag_2CrO_4

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- b. BaCrO_4
- c. PbCrO_4
- d. impossible to determine.
- e. all are equivalent.

Answer: c

21. The value of the equilibrium constant for a chemical reaction with two gas phase reactants is dependent upon

- a. temperature.
- b. initial amounts of reactants present.
- c. total pressure.
- d. all of these.
- e. none of these.

Answer: a