CHM 1001 General Chemistry

Assignment 5

- 20 multiple-choice questions + 5 short answer questions.
- There is only one correct answer for each multiple-choice question.
- Please write your answers in the Assignment Answers Template, which is uploaded with the assignment.
- Upload your answer into Blackboard before the deadline, you can write directly in the template, or by hand and scan it into an electronic version.
- No late submission is allowed.

Deadline: 11:59 pm, Nov 29th (UTC+8)

Chapter 16

1. A Br∅nsted-Lowry acid is defined as a substance that _____.

A) increases K_a 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 hydride ion, H^-, is a stronger base than the hydroxide ion, OH^-.

The product(s) of the reaction of hydride ion with water is/are _____.

A) H_3O^+ (aq)

B) OH^- (aq) + H_2 (g)

C) OH^- (aq) + $2H^+$ (aq)

D) no reaction occurs

E) H_2O_2 (aq)

3. Of the following acids, _____ is a strong acid.

A) HNO_2

B) H_2CO_3

C) HNO_3

D) HClO

E) HF

4. HA is a weak acid. Which equilibrium corresponds to the equilibrium constant K_b for A^-?

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) $HA\ (aq) + OH^-\ (aq) \rightleftharpoons H_2O\ (l) + H^+\ (aq)$

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

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

5. Using the data in the table, which of the conjugate bases below is the strongest base?

Acid	K_a
HOAc	1.8×10^{-5}
$HC_7H_5O_2$	6.3×10^{-5}
HNO_2	4.5×10^{-4}
HF	6.8×10^{-4}

A) OAc^-

B) $C_7H_5O_2^-$

C) NO_2^-

D) F^-

E) OAc- and $C_7H_5O_2^-$

6. Which one of the following pairs cannot be mixed together to form a buffer solution?

A) NH_3, NH_4Cl

B) $NaC_2H_3O_2$, HCl ($C_2H_3O_2^-$ = acetate)

C) RbOH, HBr

D) KOH, HF

E) H_3PO_4, KH_2PO_4

7. 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.

8. The primary buffer system that controls the pH of the blood is the _____ buffer system.

A) carbon dioxide, carbonate

B) carbonate, bicarbonate

C) carbonic acid, carbon dioxide

D) carbonate, carbonic acid

E) carbonic acid, bicarbonate

9. Which of the following could be added to a solution of potassium fluoride to prepare a buffer?

A) sodium hydroxide

B) potassium acetate

C) hydrochloric acid

D) sodium fluoride

E) ammonia

10. The K_{sp} for $Zn(OH)_2$ is 5.0×10^{-17}. Determine the molar solubility of $Zn(OH)_2$ in a buffer solution with a pH of 11.5.

A) 5.0×10^{6}

B) 1.2×10^{-12}

C) 1.6×10^{-14}

D) 5.0×10^{-12}

E) 5.0×10^{-17}

Chapter 5

11) At what velocity (m/s) must a 20.0 g object be moving in order to possess a kinetic energy of 1.00 J?

A) 1.00

B) 100×10^2

C) 10.0

D) 1.00×10^3

E) 50.0

Answer: C

12) With reference to enthalpy changes, the term standard conditions means _____.

(a) P = 1 atm

(b) some common temperature, usually 298 K

(c) V = 1 L

A) a only

B) b only

C) c only

D) a and c

E) a and b

13) Which one of the choices below is <u>not</u> considered a fossil fuel?

A) anthracite coal

B) crude oil

C) natural gas

D) hydrogen

E) petroleum

14) The molar heat capacity of a compound with the formula C2H6SO is 88.0 J/mol-K. The specific heat of this substance is _____ J/g-K.

A) 88.0

B) 1.13

C) 4.89

D) 6.88×10^3

E) -88.0

15) Which one of the following conditions would always result in an increase in the internal energy of a system?

A) The system loses heat and does work on the surroundings.

B) The system gains heat and does work on the surroundings.

C) The system loses heat and has work done on it by the surroundings.

D) The system gains heat and has work done on it by the

surroundings.

E) None of the above is correct.

Chapter 19

16) The first law of thermodynamics can be given as _____.

A) $\Delta E = q + w$

B) $\Delta H^\circ_{rxn} = \sum n\Delta H^\circ_f(\text{products}) - \sum m\Delta H^\circ_f(\text{reactants})$

C) for any spontaneous process, the entropy of the universe increases

D) the entropy of a pure crystalline substance at absolute zero is zero

E) $\Delta S = q_{rev}/T$ at constant temperature

17) Which of the following statements is false?

A) The change in entropy in a system depends on the initial and final states of the system and the path taken from one state to the other.

B) Any irreversible process results in an overall increase in entropy.

C) The total entropy of the universe increases in any spontaneous process.

D) Entropy increases with the number of microstates of the system.

18) ΔS is positive for the reaction _____.

A) $2NO\,(g) + O_2\,(g) \rightarrow 2NO_2\,(g)$

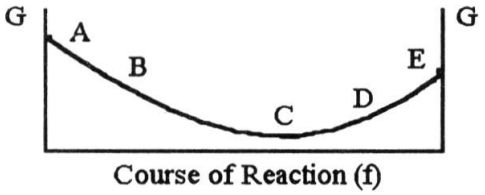
B) $2N_2\,(g) + 3H_2\,(g) \rightarrow 2NH_3\,(g)$

C) C_3H_8 (g) + $5O_2$ (g) → $3CO_2$ (g) + $4\ H_2O$ (g)

D) Mg (s) + Cl_2 (g) → $MgCl_2$ (s)

E) C_2H_4 (g) + H_2 (g) → C_2H_6 (g)

19) The equilibrium position corresponds to which letter on the graph of G vs. f (course of reaction) below?



A) A

B) B

C) C

D) D

E) E

20) Consider the reaction:

Ag+ (aq) + Cl- (aq) → AgCl (s)

Given the following table of thermodynamic data,

Substance	ΔH_f° (kJ/mol)	S° (J/mol • K)
Ag^+ (aq)	105.90	73.93
Cl^- (aq)	-167.2	56.5
AgCl (s)	-127.0	96.11

determine the temperature (in °C) above which the reaction is nonspontaneous under standard conditions.

A) 1230

B) 150

C) 432

D) 133

E) 1640

Short questions for Assignment 5

1. A glass contains 250.0 g of warm water at 78°C. A piece of gold at 2.30°C is placed in the water. The final temperature reached by this system is 76.9 °C. What was the mass of the piece of gold? The specific heat of water is 4.184J/g °C, and that of gold is 0.129J/g °C

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2. Consider the buffer system of hydrofluoric acid, HF, and its salt NaF.
   (a) What is the purpose of the buffer system?
   (b) Why is a salt of acid needed?
   (c) How does the buffer react when some H^+ is added?
   (d) How does the buffer react when some OH^- is added

3. What is the difference between STP (standard temperature and pressure) and standard state (condition)?

4. What is the molar solubility of calcium phosphate, given that K_{sp} =2.0 x 10^{-33}? Assuming that the density of the saturated solution is 1.00 g/cm^3, what is the solubility in grams of $Ca_3(PO_4)_2$ per 100 g of solvent?

5. Calculate the equilibrium constant for the following reaction at 25°C

   Given G_f^o for CH_4 = -50.75 kJ mol^{-1} ; G_f^o for CH_3OH = -166.27 kJ mol^{-1}

   $CH_4(g) + ½O_2(g) \rightleftharpoons CH_3OH(l)$