

Take home Exam Chapter 17 and 19
Chemistry 152

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MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

1) Calculate the percent ionization of formic acid (HCO_2H) in a solution that is 0.219 M in formic acid. 1) _____

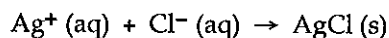
The K_a of formic acid is 1.77×10^{-4} .

- A) 0.280
- B) 3.94×10^{-5}
- C) 0.0180
- D) 2.84
- E) 12.2

2) Which one of the following correctly indicates the relationship between the entropy of a system and the number of different arrangements, W , in the system? 2) _____

- A) $S = kW$
- B) $S = \frac{k}{W}$
- C) $S = k \ln W$
- D) $S = Wk$
- E) $S = \frac{W}{k}$

3) Consider the reaction: 3) _____



Given the following table of thermodynamic data,

Substance	ΔH_f° (kJ/mol)	S° (J/mol · K)
$\text{Ag}^+ (\text{aq})$	105.90	73.93
$\text{Cl}^- (\text{aq})$	-167.2	56.5
$\text{AgCl} (\text{s})$	-127.0	96.11

determine the temperature (in $^\circ\text{C}$) above which the reaction is nonspontaneous under standard conditions.

- A) 150
- B) 432
- C) 133
- D) 1640
- E) 1230

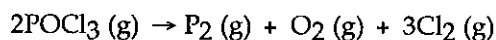
Use the table below to answer the questions that follow.

Thermodynamic Quantities for Selected Substances at 298.15 K (25°C)

Substance	ΔH°_f (kJ/mol)	ΔG°_f (kJ/mol)	S (J/K-mol)
Calcium			
Ca (s)	0	0	41.4
CaCl ₂ (s)	-795.8	-748.1	104.6
Ca ²⁺ (aq)	226.7	209.2	200.8
Chlorine			
Cl ₂ (g)	0	0	222.96
Cl ⁻ (aq)	-167.2	-131.2	56.5
Oxygen			
O ₂ (g)	0	0	205.0
H ₂ O (l)	-285.83	-237.13	69.91
Phosphorus			
P ₂ (g)	144.3	103.7	218.1
PCl ₃ (g)	-288.1	-269.6	311.7
POCl ₃ (g)	-542.2	-502.5	325
Sulfur			
S (s, rhombic)	0	0	31.88
SO ₂ (g)	-269.9	-300.4	248.5
SO ₃ (g)	-395.2	-370.4	256.2

4) The value of ΔH° for the decomposition of POCl₃ into its constituent elements,

4) _____

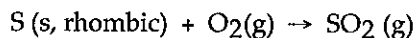


is _____ kJ/mol.

- A) -1,228.7 B) +0.00 C) +940.1 D) +1,228.7 E) -940.1

5) The value of ΔG° at 25°C for the oxidation of solid elemental sulfur to gaseous sulfur dioxide,

5) _____



is _____ kJ/mol.

- A) -300.4 B) +269.9 C) +300.4 D) +395.2 E) -269.9

- 6) For a given reaction, $\Delta H = +35.5 \text{ kJ/mol}$ and $\Delta S = +83.6 \text{ J/K}\cdot\text{mol}$. The reaction is spontaneous _____ . Assume that ΔH and ΔS do not vary with temperature. 6) _____
- A) at $T > 298 \text{ K}$
 B) at $T < 425 \text{ K}$
 C) at $T < 298 \text{ K}$
 D) at $T > 425 \text{ K}$
 E) at all temperatures

- 7) Consider the reaction: 7) _____
- $$\text{FeO (s)} + \text{Fe (s)} + \text{O}_2 \text{ (g)} \rightarrow \text{Fe}_2\text{O}_3 \text{ (s)}$$

Given the following table of thermodynamic data,

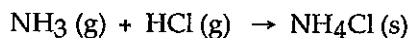
Substance	ΔH_f° (kJ/mol)	S° (J/mol \cdot K)
FeO (s)	-271.9	60.75
Fe (s)	0	27.15
O ₂ (g)	0	205.0
Fe ₂ O ₃ (s)	-822.16	89.96

determine the temperature (in $^\circ\text{C}$) above which the reaction is nonspontaneous.

- A) 756.3
 B) This reaction is spontaneous at all temperatures.
 C) 1235
 D) 618.1
 E) 2438
- 8) Which one of the following processes produces a decrease in the entropy of the system? 8) _____
- A) freezing water to form ice
 B) boiling water to form steam
 C) melting ice to form water
 D) dissolution of solid KCl in water
 E) mixing of two gases into one container

9) Consider the reaction:

9) _____



Given the following table of thermodynamic data,

Substance	ΔH_f° (kJ/mol)	S° (J/mol · K)
$\text{NH}_3(\text{g})$	-46.19	192.5
$\text{HCl}(\text{g})$	-92.30	186.69
$\text{NH}_4\text{Cl}(\text{s})$	-314.4	94.6

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

- A) This reaction is spontaneous at all temperatures.
- B) 345.0
- C) 618.1
- D) 1235
- E) 432.8

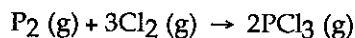
10) Which of the following statements is true?

10) _____

- A) Spontaneity can depend on the temperature.
- B) Processes are spontaneous because they occur at an observable rate.
- C) Processes that are spontaneous in one direction are spontaneous in the opposite direction.
- D) All of the statements are true.

11) The value of ΔG° at 141.0 °C for the formation of phosphorous trichloride from its constituent elements,

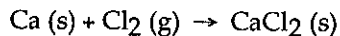
11) _____

is _____ kJ/mol. At 25.0°C for this reaction, ΔH° is -720.5 kJ/mol, ΔG° is -642.9 kJ/mol, and ΔS° is -263.7 J/K.

- A) 1.08×10^5
- B) -683.3
- C) 3.65×10^4
- D) -829.7
- E) -612.3

12) The value of ΔG° at 100.0 °C for the formation of calcium chloride from its constituent elements:

12) _____

is _____ kJ/mol. At 25.0°C for this reaction, ΔH° is -795.8 kJ/mol, ΔG° is -748.1 kJ/mol, and ΔS° is -159.8 J/K.

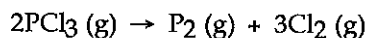
- A) -779.8
- B) 5.88×10^4
- C) -855.4
- D) -736.1
- E) 1.52×10^4

Use the table below to answer the questions that follow.

Thermodynamic Quantities for Selected Substances at 298.15 K (25°C)

Substance	ΔH°_f (kJ/mol)	ΔG°_f (kJ/mol)	S (J/K-mol)
Calcium			
Ca (s)	0	0	41.4
CaCl ₂ (s)	-795.8	-748.1	104.6
Ca ²⁺ (aq)	226.7	209.2	200.8
Chlorine			
Cl ₂ (g)	0	0	222.96
Cl ⁻ (aq)	-167.2	-131.2	56.5
Oxygen			
O ₂ (g)	0	0	205.0
H ₂ O (l)	-285.83	-237.13	69.91
Phosphorus			
P ₂ (g)	144.3	103.7	218.1
PCl ₃ (g)	-288.1	-269.6	311.7
POCl ₃ (g)	-542.2	-502.5	325
Sulfur			
S (s, rhombic)	0	0	31.88
SO ₂ (g)	-269.9	-300.4	248.5
SO ₃ (g)	-395.2	-370.4	256.2

- 13) The value of ΔG° at 25°C for the decomposition of phosphorous trichloride into its constituent elements, 13) _____



is _____ kJ/mol.

- A) -642.9 B) -373.3 C) +539.2 D) +642.9 E) -539.2

- 14) The normal boiling point of methanol is 64.7°C and the molar enthalpy of vaporization is 71.8 kJ/mol. The value of ΔS when 2.15 mol of CH₃OH (l) vaporizes at 64.7°C is _____ J/K. 14) _____

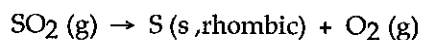
- A) 5.21×10^7 B) 0.457 C) 457 D) 2.39×10^3 E) 2.39

Use the table below to answer the questions that follow.

Thermodynamic Quantities for Selected Substances at 298.15 K (25°C)

Substance	ΔH°_f (kJ/mol)	ΔG°_f (kJ/mol)	S (J/K-mol)
Calcium			
Ca (s)	0	0	41.4
CaCl ₂ (s)	-795.8	-748.1	104.6
Ca ²⁺ (aq)	226.7	209.2	200.8
Chlorine			
Cl ₂ (g)	0	0	222.96
Cl ⁻ (aq)	-167.2	-131.2	56.5
Oxygen			
O ₂ (g)	0	0	205.0
H ₂ O (l)	-285.83	-237.13	69.91
Phosphorus			
P ₂ (g)	144.3	103.7	218.1
PCl ₃ (g)	-288.1	-269.6	311.7
POCl ₃ (g)	-542.2	-502.5	325
Sulfur			
S (s, rhombic)	0	0	31.88
SO ₂ (g)	-269.9	-300.4	248.5
SO ₃ (g)	-395.2	-370.4	256.2

- 15) The value of ΔH° for the decomposition of gaseous sulfur dioxide to solid elemental sulfur and gaseous oxygen, 15) _____



is _____ kJ/mol.

- A) +135.0 B) +0.0 C) +269.9 D) -269.9 E) -135.90

- 16) The value of ΔS° for the formation of calcium chloride from its constituent elements, 16) _____



is _____ J/K•mol.

- A) -104.6 B) +369.0 C) +104.6 D) +159.8 E) -159.8

- 17) If ΔG° for a reaction is greater than zero, then _____ 17) _____
- A) $K = 0$
 B) $K < 1$
 C) $K = 1$
 D) $K > 1$
 E) More information is needed.
- 18) ΔS is positive for the reaction _____ 18) _____
- A) $\text{CO}_2(\text{g}) \rightarrow \text{CO}_2(\text{s})$
 B) $\text{BaF}_2(\text{s}) \rightarrow \text{Ba}^{2+}(\text{aq}) + 2\text{F}^-(\text{aq})$
 C) $2\text{Hg}(\text{l}) + \text{O}_2(\text{g}) \rightarrow 2\text{HgO}(\text{s})$
 D) $2\text{H}_2(\text{g}) + \text{O}_2(\text{g}) \rightarrow 2\text{H}_2\text{O}(\text{g})$
 E) $2\text{NO}_2(\text{g}) \rightarrow \text{N}_2\text{O}_4(\text{g})$

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

- 19) Find the temperature (in K) above which a reaction with a ΔH of 123.0 kJ/mol and a ΔS of 90.00 J/K·mol becomes spontaneous. 19) _____

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

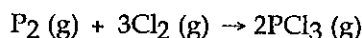
- 20) The normal boiling point of water is 100.0°C and its molar enthalpy of vaporization is 40.67 kJ/mol. What is the change in entropy in the system in J/K when 39.3 grams of steam at 1 atm condenses to a liquid at the normal boiling point? 20) _____
- A) -40.7 B) 88.8 C) -238 D) 373 E) -88.8
- 21) Of the following, the entropy of gaseous _____ is the largest at 25°C and 1 atm. 21) _____
- A) C_2H_6 B) H_2 C) C_2H_2 D) CH_4 E) C_2H_4

Use the table below to answer the questions that follow.

Thermodynamic Quantities for Selected Substances at 298.15 K (25°C)

Substance	ΔH°_f (kJ/mol)	ΔG°_f (kJ/mol)	S (J/K-mol)
Calcium			
Ca (s)	0	0	41.4
CaCl ₂ (s)	-795.8	-748.1	104.6
Ca ²⁺ (aq)	226.7	209.2	200.8
Chlorine			
Cl ₂ (g)	0	0	222.96
Cl ⁻ (aq)	-167.2	-131.2	56.5
Oxygen			
O ₂ (g)	0	0	205.0
H ₂ O (l)	-285.83	-237.13	69.91
Phosphorus			
P ₂ (g)	144.3	103.7	218.1
PCl ₃ (g)	-288.1	-269.6	311.7
POCl ₃ (g)	-542.2	-502.5	325
Sulfur			
S (s, rhombic)	0	0	31.88
SO ₂ (g)	-269.9	-300.4	248.5
SO ₃ (g)	-395.2	-370.4	256.2

22) The value of ΔS° for the formation of phosphorous trichloride from its constituent elements, 22) _____



is _____ J/K·mol.

A) -129.4

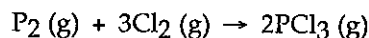
B) +311.7

C) -263.6

D) +129.4

E) -311.7

23) The value of ΔG° at 25°C for the formation of phosphorous trichloride from its constituent elements, 23) _____



is _____ kJ/mol.

A) -373.3

B) -539.2

C) +642.9

D) -642.9

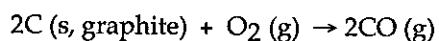
E) +539.2

Use the table below to answer the questions that follow.

Thermodynamic Quantities for Selected Substances at 298.15 K (25°C)

Substance	ΔH°_f (kJ/mol)	ΔG°_f (kJ/mol)	S (J/K-mol)
Carbon			
C (s, diamond)	1.88	2.84	2.43
C (s, graphite)	0	0	5.69
C ₂ H ₂ (g)	226.7	209.2	200.8
C ₂ H ₄ (g)	52.30	68.11	219.4
C ₂ H ₆ (g)	-84.68	-32.89	229.5
CO (g)	-110.5	-137.2	197.9
CO ₂ (g)	-393.5	-394.4	213.6
Hydrogen			
H ₂ (g)	0	0	130.58
Oxygen			
O ₂ (g)	0	0	205.0
H ₂ O (l)	-285.83	-237.13	69.91

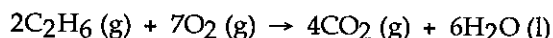
24) The value of ΔS° for the oxidation of carbon to carbon monoxide, 24) _____



is _____ J/K·mol. Carbon monoxide is produced in the combustion of carbon with limited oxygen.

- A) -408.6 B) +408.6 C) -12.8 D) +395.8 E) +179.4

25) The combustion of ethane in the presence of excess oxygen yields carbon dioxide and water: 25) _____



The value of ΔS° for this reaction is _____ J/K·mol.

- A) -151.0 B) +718.0 C) -620.1 D) -718.0 E) +151.0

26) The standard Gibbs free energy of formation of _____ is zero. 26) _____

- (a) H₂O (l)
 (b) O (g)
 (c) H₂ (g)

- A) (a) only
 B) (b) only
 C) (c) only
 D) (b) and (c)
 E) (a), (b), and (c)

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

27) _____

- A) the entropy of a pure crystalline substance at absolute zero is zero
 B) $\Delta H^\circ_{\text{rxn}} = \sum n\Delta H^\circ_f(\text{products}) - \sum m\Delta H^\circ_f(\text{reactants})$
 C) $\Delta E = q + w$
 D) for any spontaneous process, the entropy of the universe increases
 E) $\Delta S = q_{\text{rev}}/T$ at constant temperature

Use the table below to answer the questions that follow.

Thermodynamic Quantities for Selected Substances at 298.15 K (25°C)

Substance	ΔH°_f (kJ/mol)	ΔG°_f (kJ/mol)	S (J/K-mol)
Calcium			
Ca (s)	0	0	41.4
CaCl ₂ (s)	-795.8	-748.1	104.6
Ca ²⁺ (aq)	226.7	209.2	200.8
Chlorine			
Cl ₂ (g)	0	0	222.96
Cl ⁻ (aq)	-167.2	-131.2	56.5
Oxygen			
O ₂ (g)	0	0	205.0
H ₂ O (l)	-285.83	-237.13	69.91
Phosphorus			
P ₂ (g)	144.3	103.7	218.1
PCl ₃ (g)	-288.1	-269.6	311.7
POCl ₃ (g)	-542.2	-502.5	325
Sulfur			
S (s, rhombic)	0	0	31.88
SO ₂ (g)	-269.9	-300.4	248.5
SO ₃ (g)	-395.2	-370.4	256.2

28) The value of ΔG° at 25°C for the formation of calcium chloride from its constituent elements,

28) _____



is _____ kJ/mol.

- A) -748.1 B) -795.8 C) +748.1 D) +795.8 E) +763.7

29) The second law of thermodynamics states that _____.

29) _____

- A) $\Delta S = q_{\text{rev}}/T$ at constant temperature
 B) $\Delta E = q + w$
 C) for any spontaneous process, the entropy of the universe increases
 D) $\Delta H^\circ_{\text{rxn}} = \sum n\Delta H^\circ_f(\text{products}) - \sum m\Delta H^\circ_f(\text{reactants})$
 E) the entropy of a pure crystalline substance is zero at absolute zero

- 30) The thermodynamic quantity that expresses the degree of disorder in a system is _____. 30) _____
 A) bond energy
 B) enthalpy
 C) entropy
 D) heat flow
 E) internal energy

- 31) For a reaction to be spontaneous under standard conditions at all temperatures, the signs of ΔH° and ΔS° must be _____ and _____, respectively. 31) _____
 A) +, + B) +, - C) -, + D) -, - E) +, 0

TRUE/FALSE. Write 'T' if the statement is true and 'F' if the statement is false.

- 32) The solubility product of a compound is numerically equal to the product of the concentration of the ions involved in the equilibrium, each multiplied by its coefficient in the equilibrium reaction. 32) _____

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

- 33) In which of the following aqueous solutions would you expect AgCl to have the highest solubility? 33) _____
 A) 0.020 KCl
 B) 0.020 M BaCl₂
 C) 0.015 NaCl
 D) 0.020 AgNO₃
 E) pure water

- 34) The molar solubility of _____ is not affected by the pH of the solution. 34) _____
 A) MnS B) KNO₃ C) AlCl₃ D) NaF E) Na₃PO₄

- 35) A 25.0 mL sample of 0.723 M HClO₄ is titrated with a 0.273 M KOH solution. What is the [H⁺] (molarity) before any base is added? 35) _____
 A) 0.723
 B) 0.273
 C) 1.00×10^{-7}
 D) 0.439
 E) 2.81×10^{-13}

- 36) Which of the following could be added to a solution of potassium fluoride to prepare a buffer? 36) _____
 A) sodium fluoride
 B) ammonia
 C) sodium hydroxide
 D) potassium acetate
 E) hydrochloric acid

- 37) The Henderson-Hasselbalch equation is _____ 37) _____
- A) $[H^+] = K_a + \frac{[base]}{[acid]}$
- B) $pH = pK_a + \log \frac{[acid]}{[base]}$
- C) $pH = pK_a + \log \frac{[base]}{[acid]}$
- D) $pH = \log \frac{[acid]}{[base]}$
- E) $pH = pK_a - \log \frac{[base]}{[acid]}$

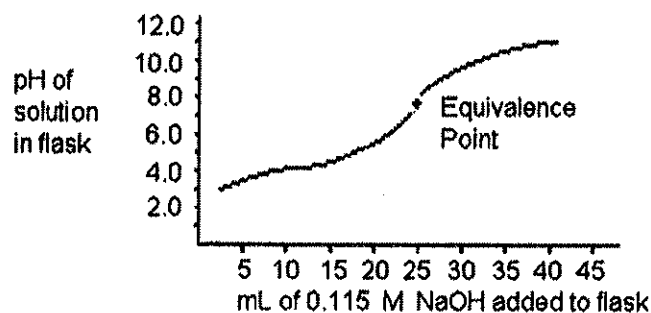
SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

- 38) Suppose you have just added 100.0 ml of a solution containing 0.5000 moles of acetic acid per liter to 400.0 ml of 0.5000 M NaOH. What is the final pH? The K_a of acetic acid is 1.77×10^{-5} . 38) _____

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

- 39) A 25.0-mL sample of 0.150 M butanoic acid is titrated with a 0.150 M NaOH solution. What is the pH before any base is added? The K_a of butanoic acid is 1.5×10^{-5} . 39) _____
- A) 1.5×10^{-3} B) 4.82 C) 1.0×10^4 D) 4.00 E) 2.83
- 40) Which one of the following is not amphoteric? 40) _____
- A) $Cr(OH)_3$ B) $Zn(OH)_2$ C) $Ca(OH)_2$ D) $Al(OH)_3$ E) $Sn(OH)_2$
- 41) Why does fluoride treatment render teeth more resistant to decay? 41) _____
- A) Fluoride stimulates production of tooth enamel to replace that lost to decay.
- B) Fluoride dissolves plaque, reducing its decaying contact with teeth.
- C) Fluoride kills the bacteria in the mouth that make the acids that decay teeth.
- D) Fluoride reduces saliva production, keeping teeth drier and thus reducing decay.
- E) Fluoride converts hydroxyapatite to fluoroapatite that is less reactive with acids.
- 42) A 25.0-mL sample of 0.150 M hydrazoic acid is titrated with a 0.150 M NaOH solution. What is the pH after 13.3 mL of base is added? The K_a of hydrazoic acid is 1.9×10^{-5} . 42) _____
- A) 1.34 B) 3.03 C) 4.66 D) 4.78 E) 4.45
- 43) Calculate the percent ionization of nitrous acid in a solution that is 0.249 M in nitrous acid. The acid dissociation constant of nitrous acid is 4.50×10^{-4} . 43) _____
- A) 1.12×10^{-4}
- B) 0.342
- C) 4.25
- D) 0.0450
- E) 5.53

- 44) Calculate the pH of a solution prepared by dissolving 0.750 mol of NH_3 and 0.250 mol of NH_4Cl in water sufficient to yield 1.00 L of solution. The K_b of ammonia is 1.77×10^{-5} . 44) _____
A) 4.27 B) 0.89 C) 8.78 D) 9.73 E) 5.22
- 45) How many milliliters of 0.120 M NaOH are required to titrate 50.0 mL of 0.0998 M butanoic acid to the equivalence point? The K_a of butanoic acid is 1.5×10^{-5} . 45) _____
A) 4.90 B) 41.6 C) 4.65 D) 50.0 E) 60.1
- 46) Which one of the following will cause hemoglobin to release oxygen? 46) _____
A) decrease in CO_2 concentration
B) increase in pH
C) increase in O_2 concentration
D) decrease in pH
E) decrease in temperature
- 47) What are the principal organs that regulate the pH of the carbonic acid-bicarbonate buffer system in the blood? 47) _____
A) lungs, skin
B) brain stem, heart
C) lungs, kidneys
D) kidneys, liver
E) spleen, liver
- 48) The K_a of acetic acid is 1.76×10^{-5} . The pH of a buffer prepared by combining 50.0 mL of 1.00 M potassium acetate and 50.0 mL of 1.00 M acetic acid is _____. 48) _____
A) 1.705 B) 2.383 C) 4.754 D) 0.851 E) 3.406
- 49) The solubility of lead (II) chloride (PbCl_2) is 1.6×10^{-2} M. What is the K_{sp} of PbCl_2 ? 49) _____
A) 4.1×10^{-6} B) 1.6×10^{-2} C) 1.6×10^{-5} D) 3.1×10^{-7} E) 5.0×10^{-4}
- 50) Human blood is _____. 50) _____
A) very acidic
B) neutral
C) slightly basic
D) very basic
E) slightly acidic
- 51) The solubility of manganese (II) hydroxide ($\text{Mn}(\text{OH})_2$) is 2.2×10^{-5} M. What is the K_{sp} of $\text{Mn}(\text{OH})_2$? 51) _____
A) 4.3×10^{-14}
B) 4.8×10^{-10}
C) 1.1×10^{-14}
D) 2.2×10^{-5}
E) 2.1×10^{-14}



Indicator	pK _a
methyl orange	3.46
methyl red	5.00
bromocresol purple	6.12
bromthymol blue	7.10
thymol blue	8.90
phenolphthalein	9.10

- 52) A 25.0 mL sample of a solution of a monoprotic acid is titrated with a 0.115 M NaOH solution. The titration curve above was obtained. Which of the following indicators would be best for this titration? 52) _____
- A) methyl red
 B) bromocresol purple
 C) thymol blue
 D) phenolphthalein
 E) bromthymol blue
- 53) The K_b of ammonia is 1.77×10^{-5} . The pH of a buffer prepared by combining 50.0 mL of 1.00 M ammonia and 50.0 mL of 1.00 M ammonium nitrate is _____. 53) _____
- A) 9.25 B) 4.74 C) 9.37 D) 4.63 E) 7.00
- 54) The primary buffer system that controls the pH of the blood is the _____ buffer system. 54) _____
- A) carbonic acid, bicarbonate
 B) carbonic acid, carbon dioxide
 C) carbonate, bicarbonate
 D) carbonate, carbonic acid
 E) carbon dioxide, carbonate
- 55) Determine the K_{sp} for magnesium hydroxide ($Mg(OH)_2$) where the solubility of $Mg(OH)_2$ is 1.4×10^{-4} M. 55) _____
- A) 1.1×10^{-11}
 B) 2.7×10^{-12}
 C) 2.0×10^{-8}
 D) 1.4×10^{-4}
 E) 3.9×10^{-8}

- 56) A solution is prepared by dissolving 0.23 mol of chloroacetic acid and 0.27 mol of sodium chloroacetate in water sufficient to yield 1.00 L of solution. The addition of 0.05 mol of HCl to this buffer solution causes the pH to drop slightly. The pH does not decrease drastically because the HCl reacts with the _____ present in the buffer solution. The K_a of chloroacetic acid is 1.36×10^{-3} . 56) _____
- A) chloroacetate ion
 B) This is a buffer solution: the pH does not change upon addition of acid or base.
 C) H_3O^+
 D) H_2O
 E) chloroacetic acid

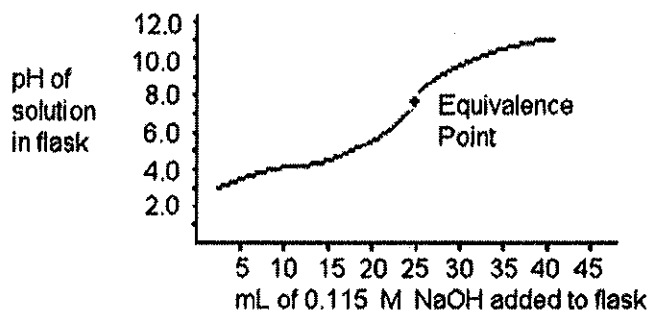
- 57) Of the substances below, _____ will decrease the solubility of $Pb(OH)_2$ in a saturated solution. 57) _____
- A) $Pb(NO_3)_2$ B) NaCl C) $NaNO_3$ D) HNO_3 E) H_2O_2

- 58) What is the molar solubility of magnesium carbonate ($MgCO_3$) in water? The solubility-product constant for $MgCO_3$ is 3.5×10^{-8} at $25^\circ C$. 58) _____
- A) 7.46 B) 2.6×10^{-4} C) 1.9×10^{-4} D) 7.0×10^{-8} E) 1.8×10^{-8}

TRUE/FALSE. Write 'T' if the statement is true and 'F' if the statement is false.

- 59) The solubility of slightly soluble salts containing basic anions is proportional to the pH of the solution. 59) _____

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.



- 60) A 25.0 mL sample of a solution of an unknown compound is titrated with a 0.115 M NaOH solution. The titration curve above was obtained. The unknown compound is _____. 60) _____
- A) a strong acid
 B) a weak base
 C) a strong base
 D) a weak acid
 E) neither an acid nor a base