

## AP CHEMISTRY SUMMER ASSIGNMENT CUMULATIVE ASSESSMENT SET #2

Name: \_\_\_\_\_

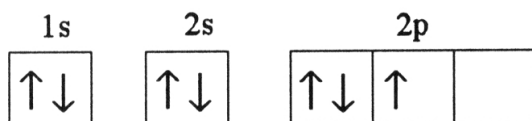
MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

- 51) A strong electrolyte is one that \_\_\_\_\_ completely in solution.
- A) disappears                      B) reacts  
C) associates                      D) ionizes
- 52) Which of the following are strong electrolytes?  
HCl HC<sub>2</sub>H<sub>3</sub>O<sub>2</sub> NH<sub>3</sub> KCl
- A) HCl, KCl  
B) HCl, HC<sub>2</sub>H<sub>3</sub>O<sub>2</sub>, NH<sub>3</sub>, KCl  
C) HCl, HC<sub>2</sub>H<sub>3</sub>O<sub>2</sub>, KCl  
D) HCl, NH<sub>3</sub>, KCl  
E) HC<sub>2</sub>H<sub>3</sub>O<sub>2</sub>, KCl
- 53) The spectator ions in the reaction between aqueous hydrofluoric acid and aqueous barium hydroxide are \_\_\_\_\_.
- A) OH<sup>-</sup>, F<sup>-</sup>, and Ba<sup>2+</sup>  
B) H<sup>+</sup>, OH<sup>-</sup>, F<sup>-</sup>, and Ba<sup>2+</sup>  
C) F<sup>-</sup> and Ba<sup>2+</sup>  
D) Ba<sup>2+</sup> only  
E) OH<sup>-</sup> and F<sup>-</sup>
- 54) Which hydroxides are strong bases?  
Sr(OH)<sub>2</sub> KOH NaOH Ba(OH)<sub>2</sub>
- A) KOH, NaOH, Ba(OH)<sub>2</sub>  
B) Sr(OH)<sub>2</sub>, KOH, NaOH, Ba(OH)<sub>2</sub>  
C) KOH, NaOH  
D) KOH, Ba(OH)<sub>2</sub>  
E) None of these is a strong base.
- 55) The concentration (M) of an aqueous methanol produced when 0.200 L of a 2.00 M solution was diluted to 0.800 L is \_\_\_\_\_.
- A) 0.400  
B) 0.800  
C) 0.200  
D) 0.500  
E) 8.00
- 56) How many grams of NaCl are there in 55.0 mL of a 1.90 M aqueous solution of NaCl?
- A) 6.11  
B) 0.105  
C) 6.11 × 10<sup>3</sup>  
D) 3.21  
E) 12.2
- 57) Which combination will produce a precipitate?
- A) AgNO<sub>3</sub> (aq) and Ca(C<sub>2</sub>H<sub>3</sub>O<sub>2</sub>)<sub>2</sub> (aq)  
B) KOH (aq) and Mg(NO<sub>3</sub>)<sub>2</sub> (aq)  
C) NaOH (aq) and HCl (aq)  
D) NaC<sub>2</sub>H<sub>3</sub>O<sub>2</sub> (aq) and HCl (aq)  
E) NaOH (aq) and HCl (aq)
- 58) Oxidation is the \_\_\_\_ and reduction is the \_\_\_\_.
- A) gain of oxygen, loss of mass  
B) gain of oxygen, loss of electrons  
C) gain of electrons, loss of electrons  
D) loss of oxygen, gain of electrons  
E) loss of electrons, gain of electrons
- 59) In which species does sulfur have the highest oxidation number?
- A) S<sub>8</sub> (elemental form of sulfur)  
B) H<sub>2</sub>SO<sub>3</sub>  
C) H<sub>2</sub>S  
D) SO<sub>2</sub>  
E) K<sub>2</sub>SO<sub>4</sub>
- 60) What volume (mL) of 0.135 M NaOH is required to neutralize 13.7 mL of 0.129 M HCl?
- A) 0.24  
B) 6.55  
C) 0.076  
D) 14.3  
E) 13.1

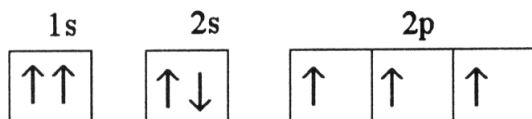
- 61) The energy of a photon of light is \_\_\_\_\_ proportional to its frequency and \_\_\_\_\_ proportional to its wavelength.
- A) directly, inversely  
 B) directly, directly  
 C) inversely, inversely  
 D) indirectly, not  
 E) inversely, directly

- 62) Which one of the following is the correct electron configuration for a ground-state nitrogen atom?

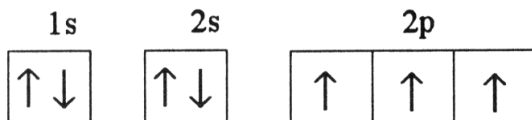
A)



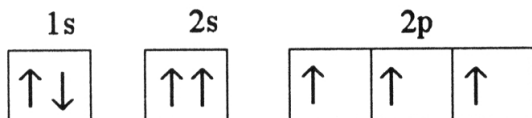
B)



C)



D)



E) None of the above is correct.

- 63) How many p-orbitals are occupied in a Ne atom?

- A) 3  
 B) 1  
 C) 5  
 D) 6  
 E) 2

- 64)  $[\text{Ar}]4s^23d^{10}4p^3$  is the electron configuration of a(n) \_\_\_\_\_ atom.

- A) Sb  
 B) Sn  
 C) P  
 D) V  
 E) As

- 65) The lowest energy shell that contains f orbitals is the shell with  $n =$  \_\_\_\_\_.

- A) 4  
 B) 3  
 C) 5  
 D) 1  
 E) 2

- 66) At maximum, an f-subshell can hold \_\_\_\_\_ electrons, a d-subshell can hold \_\_\_\_\_ electrons, and a p-subshell can hold \_\_\_\_\_ electrons.

- A) 14, 8, 2  
 B) 14, 10, 6  
 C) 2, 12, 21  
 D) 2, 6, 10  
 E) 2, 8, 18

- 67) Which of the following would have to gain two electrons in order to achieve a noble gas electron configuration?

O    Sr    Na    Se    Br

- A) Sr  
 B) Sr, O, Se  
 C) Br  
 D) Na  
 E) O, Se

- 68) In general, as you go across a period in the periodic table from left to right:

- (1) the atomic radius \_\_\_\_\_;  
 (2) the electron affinity becomes \_\_\_\_\_ negative; and  
 (3) the first ionization energy \_\_\_\_\_.
- A) decreases, decreasingly, increases  
 B) decreases, increasingly, increases  
 C) increases, increasingly, decreases  
 D) decreases, increasingly, decreases  
 E) increases, increasingly, increases

- 69) Na reacts with element X to form an ionic compound with the formula  $\text{Na}_3\text{X}$ . Ca will react with X to form \_\_\_\_\_.

- A)  $\text{Ca}_3\text{X}_2$   
 B)  $\text{Ca}_3\text{X}$   
 C)  $\text{CaX}$   
 D)  $\text{CaX}_2$   
 E)  $\text{Ca}_2\text{X}_3$

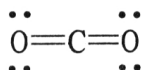
70) How many equivalent resonance forms can be drawn for  $\text{CO}_3^{2-}$  (carbon is the central atom)?

- A) 3
- B) 2
- C) 4
- D) 0
- E) 1

71) The electron-domain geometry of \_\_\_\_\_ is tetrahedral.

- A)  $\text{CBr}_4$
- B)  $\text{PH}_3$
- C)  $\text{XeF}_4$
- D)  $\text{CCl}_2\text{Br}_2$
- E) all of the above except  $\text{XeF}_4$

72) The formal charge on carbon in the molecule below is \_\_\_\_\_.

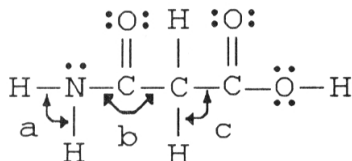


- A) +3
- B) +1
- C) 0
- D) +2
- E) -1

73) Of the following molecules, only \_\_\_\_\_ is polar.

- A)  $\text{CBr}_4$
- B)  $\text{BF}_3$
- C)  $\text{Cl}_2$
- D)  $\text{BeCl}_2$
- E)  $\text{SiH}_2\text{Cl}_2$

74) The bond angles marked a, b, and c in the molecule below are about \_\_, \_\_, and \_\_, respectively.



- A)  $90^\circ, 90^\circ, 90^\circ$
- B)  $<109.5^\circ, 120^\circ, 109.5^\circ$
- C)  $109.5^\circ, 90^\circ, 120^\circ$
- D)  $<120^\circ, 120^\circ, <109.5^\circ$
- E)  $120^\circ, <120^\circ, 90^\circ$

75) A sample of a gas originally at  $25^\circ\text{C}$  and 1.00 atm pressure in a 2.5 L container is allowed to expand until the pressure is 0.85 atm and the temperature is  $15^\circ\text{C}$ . The final volume of the gas is \_\_\_\_\_ L.

- A) 3.0
- B) 2.6
- C) 2.1
- D) 2.8
- E) 0.38

76) The amount of gas that occupies 60.82 L at  $31^\circ\text{C}$  and 367 mmHg is \_\_\_\_\_ mol.

- A) 11.6
- B) 894
- C) 1.18
- D) 0.120
- E) 0.850

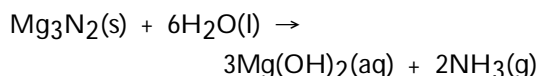
77) Which of the following is not part of the kinetic-molecular theory?

- A) Collisions between gas molecules do not result in the loss of energy.
- B) Atoms are neither created nor destroyed by ordinary chemical reactions.
- C) Attractive and repulsive forces between gas molecules are negligible.
- D) Gases consist of molecules in continuous, random motion.
- E) The volume occupied by all of the gas molecules in a container is negligible compared to the volume of the container.

78) Standard temperature and pressure (STP), in the context of gases, refers to \_\_\_\_\_.

- A) 273.15 K and 1 pascal
- B) 298.15 K and 1 atm
- C) 273.15 K and 1 torr
- D) 273.15 K and 1 atm
- E) 298.15 K and 1 torr

79) What volume (L) of  $\text{NH}_3$  gas at STP is produced by the complete reaction of 7.5 g of  $\text{H}_2\text{O}$  according to the following reaction?



- A) 3.1
- B) 0.32
- C) 28
- D) 9.3
- E) 19

80) Of the following gases, \_\_\_\_\_ will have the greatest rate of effusion at a given temperature.

- A)  $\text{HBr}$
- B)  $\text{NH}_3$
- C)  $\text{HCl}$
- D)  $\text{Ar}$
- E)  $\text{CH}_4$

81) Of the following substances, only \_\_\_\_\_ has London dispersion forces as its only intermolecular force.

- A)  $\text{CH}_3\text{OH}$
- B)  $\text{NH}_3$
- C)  $\text{HCl}$
- D)  $\text{H}_2\text{S}$
- E)  $\text{CH}_4$

82) Of the following substances, \_\_\_\_\_ has the highest boiling point.

- A)  $\text{CH}_4$
- B)  $\text{NH}_3$
- C)  $\text{CO}_2$
- D)  $\text{Kr}$
- E)  $\text{H}_2\text{O}$

83) The phrase "like dissolves like" refers to the fact that \_\_\_\_\_.

- A) polar solvents dissolve polar solutes and nonpolar solvents dissolve nonpolar solutes
- B) condensed phases can only dissolve other condensed phases
- C) gases can only dissolve other gases
- D) solvents can only dissolve solutes of similar molar mass
- E) polar solvents dissolve nonpolar solutes and vice versa

84) Which one of the following substances would be the most soluble in  $\text{CCl}_4$ ?

- A)  $\text{NH}_3$
- B)  $\text{C}_{10}\text{H}_{22}$
- C)  $\text{NaCl}$
- D)  $\text{CH}_3\text{CH}_2\text{OH}$
- E)  $\text{H}_2\text{O}$

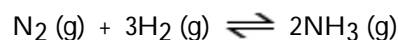
85) Which of the following substances is more likely to dissolve in  $\text{CH}_3\text{OH}$ ?

- A)  $\text{CCl}_4$
- B)  $\text{H}_2$
- C)  $\text{N}_2$
- D)  $\text{CH}_3\text{CH}_2\text{OH}$
- E)  $\text{Kr}$

86) At equilibrium, \_\_\_\_\_.

- A) the rates of the forward and reverse reactions are equal
- B) the rate constants of the forward and reverse reactions are equal
- C) all chemical reactions have ceased
- D) the value of the equilibrium constant is 1
- E) the limiting reagent has been consumed

87) The equilibrium constant for the gas phase reaction

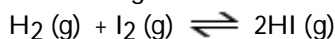


is  $K_{\text{eq}} = 4.34 \times 10^{-3}$  at  $300^\circ\text{C}$ . At equilibrium,

\_\_\_\_\_.

- A) roughly equal amounts of products and reactants are present
- B) products predominate
- C) only products are present
- D) only reactants are present
- E) reactants predominate

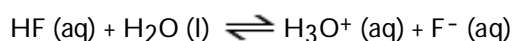
88) Consider the following chemical reaction:



At equilibrium in a particular experiment, the concentrations of  $\text{H}_2$ ,  $\text{I}_2$ , and  $\text{HI}$  were 0.15 M, 0.033 M, and 0.55 M, respectively. The value of  $K_{\text{eq}}$  for this reaction is \_\_\_\_\_.

- A)  $9.0 \times 10^{-3}$
- B) 111
- C) 23
- D) 61
- E) 6.1

89) Which of the following expressions is the correct equilibrium-constant expression for the reaction below?

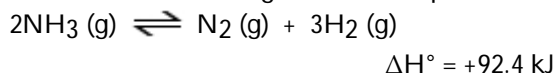


- A)  $[\text{H}_3\text{O}^+][\text{F}^-] / [\text{HF}]$
- B)  $[\text{HF}][\text{H}_2\text{O}] / \{\text{H}_3\text{O}^+\}[\text{F}^-]$
- C)  $1 / [\text{HF}]$
- D)  $[\text{H}_3\text{O}^+][\text{F}^-] / [\text{HF}][\text{H}_2\text{O}]$
- E)  $[\text{F}^-] / [\text{HF}]$

90)  $\Delta H$  for an endothermic process is \_\_\_\_\_ while  $\Delta H$  for an exothermic process is \_\_\_\_\_.

- A) zero, positive
- B) zero, negative
- C) positive, negative
- D) negative, positive
- E) positive, zero

91) Consider the following reaction at equilibrium:



Le Châtelier's principle predicts that adding  $\text{N}_2(\text{g})$  to the system at equilibrium will result in \_\_\_\_\_.

- A) removal of all of the  $\text{H}_2(\text{g})$
- B) a lower partial pressure of  $\text{N}_2$
- C) a decrease in the concentration of  $\text{H}_2(\text{g})$
- D) an increase in the value of the equilibrium constant
- E) a decrease in the concentration of  $\text{NH}_3(\text{g})$

92) According to the Arrhenius concept, an acid is a substance that \_\_\_\_\_.

- A) tastes bitter
- B) causes an increase in the concentration of  $\text{H}^+$  in aqueous solutions
- C) is capable of donating one or more  $\text{H}^+$
- D) reacts with the solvent to form the cation formed by autoionization of that solvent
- E) can accept a pair of electrons to form a coordinate covalent bond

93) A Brønsted-Lowry acid is defined as a substance that \_\_\_\_\_.

- A) increases  $[\text{OH}^-]$  when placed in  $\text{H}_2\text{O}$
- B) increases  $K_a$  when placed in  $\text{H}_2\text{O}$
- C) acts as a proton donor
- D) acts as a proton acceptor
- E) decreases  $[\text{H}^+]$  when placed in  $\text{H}_2\text{O}$

94) In basic solution, \_\_\_\_\_.

- A)  $[\text{H}_3\text{O}^+] > [\text{OH}^-]$
- B)  $[\text{OH}^-] > 7.00$
- C)  $[\text{H}_3\text{O}^+] < [\text{OH}^-]$
- D)  $[\text{H}_3\text{O}^+] = 0 \text{ M}$
- E)  $[\text{H}_3\text{O}^+] = [\text{OH}^-]$

95) What is the pH of an aqueous solution at 25.0 °C in which  $[\text{H}^+]$  is 0.0025 M?

- A) 3.40
- B) 2.60
- C) 2.25
- D) -2.60
- E) -3.40

96) What is the conjugate acid of  $\text{NH}_3$ ?

- A)  $\text{NH}_2^+$
- B)  $\text{NH}_3^+$
- C)  $\text{NH}_3$
- D)  $\text{NH}_4^+$
- E)  $\text{NH}_4\text{OH}$

97) The conjugate base of  $\text{HSO}_4^-$  is

- A)  $\text{HSO}_4^+$
- B)  $\text{H}_3\text{SO}_4^+$
- C)  $\text{SO}_4^{2-}$
- D)  $\text{H}_2\text{SO}_4$
- E)  $\text{OH}^-$

98) The  $K_a$  of hydrofluoric acid (HF) at  $25.0^\circ\text{C}$  is

$6.8 \times 10^{-4}$ . What is the pH of a 0.35 M aqueous solution of HF?

- A) 3.2
- B) 12
- C) 0.46
- D) 1.8
- E) 3.6

99) Which solution below has the highest concentration of hydroxide ions?

- A) pH = 7.00
- B) pH = 12.6
- C) pH = 9.82
- D) pH = 3.21
- E) pH = 7.93

100) Of the following acids, \_\_\_\_\_ is not a strong acid.

- A)  $\text{HClO}_4$
- B)  $\text{HNO}_2$
- C)  $\text{HCl}$
- D)  $\text{H}_2\text{SO}_4$
- E)  $\text{HNO}_3$