

Answer the following questions : ( two marks for each right choice )

- A solution made from ethanol,  $C_2H_5OH$ , and water is 1.76m in ethanol. How many moles of ethanol are contained per 250g of water?  
 A. 0.142mol B. 0.44mol C. 20.24mol D. 7.04mol
- Which one of the following statements is incorrect?  
 A. Many solids dissolve more quickly in a cold solvent than in warm solvent.  
 B. Gases are generally more soluble in water at low temperature.  
 C. Aqueous solution is a mixture containing the solute soluble in water as a solvent.  
 D. The effect of stirring is similar to that of crushing a solid – contact between the solvent and the solute surface is increased.
- The boiling point of a solution is higher than that of a pure solvent because :-  
 A. Vapor-pressure lowering B. Freezing- point heightening  
 C. Vapor-pressure heightening D. none of them
- A substance that can react as an acid or a base :  
 A.  $SO_4^{2-}$  B.  $HSO_3^-$  C.  $CH_3COO^-$  D.  $NH_4^+$
- Which of the following solutions with the same concentrations has lower  $[H_3O^+]$ ?  
 A. HCl B.  $H_2O$  C.  $NH_3$  D. HF
- In the following an exothermic gaseous reaction :  $(2CO + O_2 \rightarrow 2CO_2)$ , which of the following statements is true about the reaction ?  
 A. The reaction is always spontaneous. B. The reaction is never spontaneous.  
 C. The reaction is spontaneous at low temperature. D. The reaction is spontaneous at high temperature.
- In the following hypothetical reaction :  $(A_2 + B_2 \rightarrow 2AB + 30kJ)$ , the activation energy for the forward reaction equal 50kJ/mol, the activation energy for reverse reaction is equal to  
 A. 20kJ/mol B. 80kJ/mol C. -80kJ/mol D. 10kJ/mol
- In the following reaction :  $(2HCl(g) + 184.6kJ \rightarrow H_{2(g)} + Cl_{2(g)})$ , the standard formation enthalpy of HCl equals :  
 A. 184.6kJ/mol B. -184.6kJ/mol C. -92.3kJ/mol D. 92.3kJ/mol
- Adding  $NH_4Cl$  to  $NH_3$  solution leads to:  
 A. decrease  $[NH_3]$  B. increase  $[OH^-]$  C. increase ionization of  $NH_3$  D. increase  $[H_3O^+]$
- How many moles of ammonium sulfate must be dissociate to produce 0.4 mol of sulfate ion?  
 A. 0.2 mol B. 0.4 mol C. 0.6 mol D. 0.8 mol
- The net ionic equation for the precipitation Nickel ( II )sulfide is :  
 A.  $NiS(s) \rightarrow Ni^{+2}(aq) + S^{2-}(aq)$  B.  $2Ni^{+2}(aq) + 2S^{2-}(aq) \rightarrow Ni_2S_2(s)$   
 C.  $Ni^{+2}(aq) + S^{2-}(aq) \rightarrow NiS(s)$  D. it does not have precipitate equation because it is soluble in water.
- When barium chloride solution is mixed with sodium nitrate:  
 A. sodium chloride precipitates B. barium nitrate precipitates  
 C. precipitation does not occur D. Both ( A + B ) are correct

- Aqueous solution of  $NH_3$  is an Arrhenius base because:  
 A. it is proton acceptor. B. it increases the concentration of hydronium ion.  
 C. it is an electron pair donor. D. it increases the concentration of hydroxide ion.
- While mixing a small quantity of water with a large quantity of ethanol, water considered as :-  
 A. solvent B. solute C. solution D. none of them
- The methyl orange is used to determine the equivalence point in one of the following titration: If the pH range for transition interval is (3.1- 4.4):  
 A. HCl,  $NH_3$  B.  $CH_3COOH$ , NaOH C.  $HNO_3$ , NaOH D.  $NH_3$ ,  $CH_3COOH$
- The pH of an aqueous solution composed  $2 \times 10^{-4}$  mol of  $H_3O^+$  ions in 250 mL of its solution is equal to :-  
 A. 3.1 B. 3.7 C. 10.9 D. 10.3
- The rate of the slow reaction increases by :  
 A. the addition of a catalyst. B. increasing activation energy  
 C. increasing concentration. D. Both (A+C) are correct
- All of the following statements are true about the collision theory except:  
 A. all collisions between particles of reactant leads to the occurrence of the chemical reaction  
 B. the reaction rate is directly proportional with the number of effective collision.  
 C. in order for chemical reaction to occur, the reacting particles must collide  
 D. the particles of reactants must have enough energy to initiate the reaction.
- The rate law of the following reaction:  $A + 2B \rightarrow AB_2$ , is  $R = k[B]^2$ , what happens to the reaction rate when the concentration of both reactants is doubled?  
 A. the reaction rate remains the same. B. the reaction rate increases by a factor of two.  
 C. the reaction rate increases by a factor of four. D. the reaction rate increases by a factor eight.
- A proposed mechanism for the reaction is:- slow :  $2NO + H_2 \rightarrow N_2O + H_2O$   
 fast :  $N_2O + H_2 \rightarrow N_2 + H_2O$  which of the following is correct ?  
 A.  $R = k[NO][H_2]$  B. overall balanced equation for the reaction is :  $2NO + 2H_2 \rightarrow N_2 + 2H_2O$   
 C. the reaction order is second D. Both (A+C) are correct
- The energy required to raise the reactant to the level of the activated complex is:  
 A. Activation energy B. Free energy C. Kinetic energy D. Energy of reaction
- Calculate the moles of NaOH if 100 mL of its solution neutralized with 200 mL of 0.01M HBr ?  
 A. 0.01mol B. 0.002mol C. 0.001mol D. 0.02mol
- A substance that formed when a strong acid has lost a proton  
 A. strong conjugate base B. weak conjugate acid C. weak conjugate base D. cations
- For an exothermic dissolution process, the increasing of the temperature causes:  
 A. increasing dissolution B. decreasing dissolution C. decreasing crystallization D. Both (A+C) are correct
- In equilibrium gaseous reaction:  $2NO + Cl_2 \rightleftharpoons 2NOCl + \text{energy}$ , which of the following shift the reaction to the right ?  
 A. adding catalyst B. decreasing system volume C. increasing temperature D. decreasing pressure
- Unknown liquid miscible with toluene and immiscible with water which of the following statements is correct?  
 A. an aqueous solution for the liquid conducts electric current. B. a liquid is nonpolar molecular compound.  
 C. a liquid is polar molecular compound. D. none of them

27. All of them are correct except:  
 A. An ionic compound at solid state does not conduct electric current.  
 B. Alloy is a mixture the atoms of two or more metals are uniformly mixed.  
 C. The Brownian motion is a motion due to collision rapidly moving molecules.  
 D. HCl does not soluble in water.
28. The boiling-point elevation of a solvent is  $2.4^{\circ}\text{C}$ , when the concentration of the solution containing a nonelectrolyte solute is  $3.1\text{m}$ , what is the value of molal boiling-point constant?  
 A.  $1.29^{\circ}\text{C}/\text{m}$       B.  $-0.77^{\circ}\text{C}/\text{m}$       C.  $7.44^{\circ}\text{C}/\text{m}$       D.  $0.77^{\circ}\text{C}/\text{m}$
29. The following reaction  $(2\text{A}+\text{B} \rightarrow \text{A}_2\text{B})$  is occur by one step mechanism the rate law for the reaction is:  
 A.  $\text{R}=\text{k}[\text{A}][\text{B}]$       B.  $\text{R}=\text{k}[\text{A}_2\text{B}]$       C.  $\text{R}=\text{k}[\text{A}]^2[\text{B}]$       D.  $\text{R}=\text{k}[\text{A}][\text{B}]^2$
30. When polar compound ionizes completely in water the compound is:  
 A. ionic electrolyte.    B. weak electrolyte.    C. non-electrolyte molecular.    D. strong molecular electrolyte.
31. The dilute aqueous solution of a weak acid contains:  
 A. hydronium ions.      B. acid molecules.      C. anions.      D. all of them are correct
32. Which of the following is the equilibrium constant for an anion hydrolysis reaction?  
 A.  $\frac{[\text{HB}][\text{OH}^-]}{[\text{B}^-]}$       B.  $\frac{[\text{B}^-]}{[\text{HB}][\text{OH}^-]}$       C.  $\frac{[\text{HB}]}{[\text{B}^-][\text{OH}^-]}$       D.  $\frac{[\text{B}^-][\text{OH}^-]}{[\text{HB}]}$
33. In the following reaction  $:(\text{BF}_{3(\text{aq})} + \text{F}^-_{(\text{aq})} \rightarrow \text{BF}_4^-_{(\text{aq})})$  which of the following is Lewis base?  
 A.  $\text{F}^-$       B.  $\text{BF}_3$       C.  $\text{BF}_4^-$       D. none of them is correct
34. The strength of an acid does not depend on:  
 A. The polarity of the bond between hydrogen and the element it is bonded.    B. the bond energy  
 C. the number of hydrogen atoms in the chemical acid formula.    D. both (A+B) are correct
35. The concentration of  $\text{H}_3\text{O}^+$  ions in aqueous solution of  $\text{Ba}(\text{OH})_2$  is  $1 \times 10^{-11}\text{M}$ , what is the molar concentration of solution?  
 A.  $1 \times 10^{-3}\text{M}$       B.  $2 \times 10^{-4}\text{M}$       C.  $2 \times 10^{-3}\text{M}$       D.  $5 \times 10^{-4}\text{M}$
36. How much energy would be absorbed as heat by 75g of iron when heated from 295K to 301K if its specific heat is  $0.449\text{J}/\text{g}\cdot\text{K}$ ?  
 A. 202kJ      B. 27.83J      C. 1002J      D. 202J
37. The enthalpy change that occurs during the complete combustion of one mole of an element or compound is called:  
 A. Enthalpy of formation.    B. Enthalpy of solution.    C. Enthalpy of combustion.    D. Specific Heat
38. Which of the following represents the formation equation?  
 A.  $\text{N}_2 + \text{O}_2 \rightarrow 2\text{NO}$       B.  $\text{C}_{(\text{graphite})} + \text{O}_2 \rightarrow \text{CO}_2$     C.  $\text{CO} + \frac{1}{2}\text{O}_2 \rightarrow \text{CO}_2$     D.  $\text{CO}_2 \rightarrow \text{C}_{(\text{graphite})} + \text{O}_2$
39. The entropy increases at:  
 A. evaporating of liquid    B. temperature raising.    C. increase pressure    D. both(A+B) are correct
40. The value of equilibrium constant for this gaseous reaction  $:(\text{N}_2\text{O}_4 \rightleftharpoons 2\text{NO}_2)$  is 0.1 at a specified temperature, what would be the value of that constant for the reverse reaction at the same condition?  
 A. 0.05      B. 0.1      C. 10      D. 5
41. In the following gaseous reaction:  $(\text{N}_2 + 3\text{H}_2 \rightleftharpoons 2\text{NH}_3)$  it was found the  $[\text{NH}_3]=0.62\text{M}$ ,  $[\text{H}_2]=0.14\text{M}$ ,  $[\text{N}_2]=0.45\text{M}$  the value of the equilibrium constant equals:  
 A.  $3.2 \times 10^{-3}$       B.  $3.11 \times 10^2$       C.  $3.11 \times 10^{-2}$       D. 9.84
42. The solubility product of cadmium carbonate,  $\text{CdCO}_3$ , is  $1.0 \times 10^{-12}$ . In a saturated solution of this salt, the concentration of carbonate ions is:  
 A.  $5 \times 10^{-13}\text{M}$       B.  $3 \times 10^{-6}\text{M}$       C.  $1 \times 10^{-6}\text{M}$       D.  $5 \times 10^{-7}\text{M}$
43. In aqueous solution contains,  $\text{Ca}^{+2}, \text{SO}_4^{2-}$  ions,  $\text{CaSO}_4$  precipitates if :  
 A.  $[\text{Ca}^{+2}][\text{SO}_4^{2-}] = K_{\text{sp}}$     B.  $[\text{Ca}^{+2}][\text{SO}_4^{2-}] > K_{\text{sp}}$     C.  $[\text{Ca}^{+2}][\text{SO}_4^{2-}] < K_{\text{sp}}$     D. can not be determined
44. Which of the following ions hydrolyze in aqueous solution?  
 A.  $\text{NO}_3^-$       B.  $\text{CO}_3^{2-}$       C.  $\text{SO}_4^{2-}$       D. none of them is correct
45. The common-ion causes:  
 A. increasing precipitation.      B. decreasing ionization.  
 C. shifting equilibrium to left.      D. all of them are correct.
46. Which of the following is homogenous mixture?  
 A. milk      B. 24-karat gold      C. tap water      D. oil and water
47. Which of the following is a binary acid?  
 A.  $\text{H}_2\text{S}$       B.  $\text{H}_2\text{CO}_3$       C.  $\text{H}_2\text{O}_2$       D. all of them are correct
48. The solution that contains the precisely known concentration of a solute is known as:  
 A. saturated solution      B. dilute solution      C. standard solution      D. buffer solution
49. the spectator ion in the following reaction  $(\text{Al}_{(\text{s})} + \text{H}_2\text{SO}_{4(\text{aq})} \rightarrow \quad),$  is;  
 A.  $\text{SO}_4^{2-}$       B.  $\text{Al}^{+3}$       C.  $\text{H}_3\text{O}^+$       D. all of them are correct.
50. A reaction has  $\Delta H = -74.8\text{kJ}/\text{mol}$ ,  $\Delta S = -0.081\text{kJ}/\text{mol}\cdot\text{K}$  at  $27^{\circ}\text{C}$  which of the following is correct?  
 A.  $\Delta G = 50.5\text{kJ}/\text{mol}$ , nonspontaneous.    B.  $\Delta G = -72.8\text{kJ}/\text{mol}$ , spontaneous.  
 C.  $\Delta G = 72.8\text{kJ}/\text{mol}$ , nonspontaneous    D.  $\Delta G = -50.5\text{kJ}/\text{mol}$ , spontaneous.

**A**



B  
91285

Answer the following questions : ( two marks for each right choice )

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- Adding  $\text{NH}_4\text{Cl}$  to  $\text{NH}_3$  solution leads to:  
 A. decrease  $[\text{NH}_3]$  B. increase  $[\text{OH}^-]$  C. increase ionization of  $\text{NH}_3$  D. increase  $[\text{H}_3\text{O}^+]$
- A substance that formed when a strong acid has lost a proton  
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- For an exothermic dissolution process, the increasing of the temperature causes:  
 A. increasing dissolution B. decreasing dissolution C. decreasing crystallization D. Both (A+C) are correct
- A proposed mechanism for the reaction is:- slow :  $2\text{NO} + \text{H}_2 \rightarrow \text{N}_2\text{O} + \text{H}_2\text{O}$   
 fast :  $\text{N}_2\text{O} + \text{H}_2 \rightarrow \text{N}_2 + \text{H}_2\text{O}$  which of the following is correct ?  
 A.  $R = k[\text{NO}][\text{H}_2]$  B. overall balanced equation for the reaction is :  $2\text{NO} + 2\text{H}_2 \rightarrow \text{N}_2 + 2\text{H}_2\text{O}$   
 C. the reaction order is second D. Both (A+C) are correct

- The rate law of the following reaction:  $\text{A} + 2\text{B} \rightarrow \text{AB}_2$ , is  $R = k[\text{B}]^2$ , what happens to the reaction rate when the concentration of both reactants is doubled?  
 A. the reaction rate remains the same. B. the reaction rate increases by a factor of two.  
 C. the reaction rate increases by a factor of four. D. the reaction rate increases by a factor eight.
- How much energy would be absorbed as heat by 75g of iron when heated from 295K to 301K if its specific heat is  $0.449\text{J/g.K}$ ?  
 A. 202kJ B. 27.83J C. 1002J D. 202J
- The net ionic equation for the precipitation Nickel ( II ) sulfide is :  
 A.  $\text{NiS}_{(\text{s})} \rightarrow \text{Ni}^{2+}_{(\text{aq})} + \text{S}^{2-}_{(\text{aq})}$  B.  $2\text{Ni}^{2+}_{(\text{aq})} + 2\text{S}^{2-}_{(\text{aq})} \rightarrow \text{Ni}_2\text{S}_{2(\text{s})}$   
 C.  $\text{Ni}^{2+}_{(\text{aq})} + \text{S}^{2-}_{(\text{aq})} \rightarrow \text{NiS}_{(\text{s})}$  D. it does not have precipitate equation because it is soluble in water.
- The energy required to raise the reactant to the level of the activated complex is:  
 A. Activation energy B. Free energy C. Kinetic energy D. Energy of reaction
- Which of the following is homogenous mixture?  
 A. milk B. 24-karat gold C. tap water D. oil and water
- A substance that can react as an acid or a base :  
 A.  $\text{SO}_4^{2-}$  B.  $\text{HSO}_3^-$  C.  $\text{CH}_3\text{COO}^-$  D.  $\text{NH}_4^+$
- A reaction has  $\Delta H = -74.8\text{kJ/mol}$ ,  $\Delta S = -0.081\text{kJ/mol.K}$  at  $27^{\circ}\text{C}$  which of the following is correct?  
 A.  $\Delta G = 50.5\text{kJ/mol}$ , nonspontaneous. B.  $\Delta G = -72.8\text{kJ/mol}$ , spontaneous.  
 C.  $\Delta G = 72.8\text{kJ/mol}$ , nonspontaneous D.  $\Delta G = -50.5\text{kJ/mol}$ , spontaneous.
- The value of equilibrium constant for this gaseous reaction :  $(\text{N}_2\text{O}_4 \rightleftharpoons 2\text{NO}_2)$  is 0.1 at a specified temperature, what would be the value of that constant for the reverse reaction at the same condition?  
 A. 0.05 B. 0.1 C. 10 D. 5
- Which of the following ions hydrolyze in aqueous solution?  
 A.  $\text{NO}_3^-$  B.  $\text{CO}_3^{2-}$  C.  $\text{SO}_4^{2-}$  D. none of them is correct
- The pH of an aqueous solution composed  $2 \times 10^{-4}\text{mol}$  of  $\text{H}_3\text{O}^+$  ions in 250 mL of its solution is equal to :-  
 A. 3.1 B. 3.7 C. 10.9 D. 10.3
- the spectator ion in the following reaction  $(\text{Al}_{(\text{s})} + \text{H}_2\text{SO}_{4(\text{aq})} \rightarrow \quad)$ , is;  
 A.  $\text{SO}_4^{2-}$  B.  $\text{Al}^{+3}$  C.  $\text{H}_3\text{O}^+$  D. all of them are correct.
- All of them are correct except:  
 A. An ionic compound at solid state does not conduct electric current.  
 B. Alloy is a mixture the atoms of two or more metals are uniformly mixed.  
 C. The Brownian motion is a motion due to collision rapidly moving molecules.  
 D. HCl does not soluble in water.
- Unknown liquid miscible with toluene and immiscible with water which of the following statements is correct?  
 A. an aqueous solution for the liquid conducts electric current. B. a liquid is nonpolar molecular compound.  
 C. a liquid is polar molecular compound. D. none of them
- The boiling point of a solution is higher than that of a pure solvent because :-  
 A. Vapor-pressure lowering B. Freezing- point heightening  
 C. Vapor-pressure heightening D. none of them

28. In aqueous solution contains,  $\text{Ca}^{+2}$ ,  $\text{SO}_4^{2-}$  ions,  $\text{CaSO}_4$  precipitates if :  
 A.  $[\text{Ca}^{+2}][\text{SO}_4^{2-}] = K_{sp}$     B.  $[\text{Ca}^{+2}][\text{SO}_4^{2-}] > K_{sp}$     C.  $[\text{Ca}^{+2}][\text{SO}_4^{2-}] < K_{sp}$     D. can not be determined
29. In equilibrium gaseous reaction:  $2\text{NO} + \text{Cl}_2 \rightleftharpoons 2\text{NOCl} + \text{energy}$ , which of the following shift the reaction to the right ?  
 A. adding catalyst    B. decreasing system volume    C. increasing temperature    D. decreasing pressure
30. When barium chloride solution is mixed with sodium nitrate:  
 A. sodium chloride precipitates    B. barium nitrate precipitates  
 C. precipitation does not occur    D. Both ( A + B ) are correct
31. The solution that contains the precisely known concentration of a solute is known as:  
 A. saturated solution    B. dilute solution    C. standard solution    D. buffer solution
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33. In the following reaction :  $(2\text{HCl}_{(g)} + 184.6\text{kJ} \rightarrow \text{H}_{2(g)} + \text{Cl}_{2(g)})$ , the standard formation enthalpy of  $\text{HCl}$  equals :  
 A. 184.6kJ/mol    B. -184.6kJ/mol    C. -92.3kJ/mol    D. 92.3kJ/mol
34. Which of the following solutions with the same concentrations has lower  $[\text{H}_3\text{O}^+]$ ?  
 A.  $\text{HCl}$     B.  $\text{H}_2\text{O}$     C.  $\text{NH}_3$     D.  $\text{HF}$
35. In the following hypothetical reaction :  $(\text{A}_2 + \text{B}_2 \rightarrow 2\text{AB} + 30\text{kJ})$ , the activation energy for the forward reaction equal 50kJ/mol ,the activation energy for reverse reaction is equal to  
 A. 20kJ/mol    B. 80kJ/mol    C. -80kJ/mol    D. 10kJ/mol
36. Aqueous solution of  $\text{NH}_3$  is an Arrhenius base because:  
 A. it is proton acceptor.    B. it increases the concentration of hydronium ion.  
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37. Calculate the moles of  $\text{NaOH}$  if 100 mL of its solution neutralized with 200 mL of 0.01M  $\text{HBr}$  ?  
 A. 0.01mol    B. 0.002mol    C. 0.001mol    D. 0.02mol
38. The entropy increases at:  
 A. evaporating of liquid    B. temperature raising.    C. increase pressure    D. both(A+B) are correct
39. How many moles of ammonium sulfate must be dissociate to produce 0.4 mol of sulfate ion?  
 A. 0.2 mol    B. 0.4 mol    C. 0.6 mol    D. 0.8 mol
40. The solubility product of cadmium carbonate,  $\text{CdCO}_3$ , is  $1.0 \times 10^{-12}$ . In a saturated solution of this salt, the concentration of carbonate ions is:  
 A.  $5 \times 10^{-13}\text{M}$     B.  $3 \times 10^{-6}\text{M}$     C.  $1 \times 10^{-6}\text{M}$     D.  $5 \times 10^{-7}\text{M}$
41. In the following an exothermic gaseous reaction :  $(2\text{CO} + \text{O}_2 \rightarrow 2\text{CO}_2)$ , which of the following statements is true about the reaction ?  
 A. The reaction is always spontaneous.    B. The reaction is never spontaneous.  
 C. The reaction is spontaneous at low temperature.    D. The reaction is spontaneous at high temperature.
42. The methyl orange is used to determine the equivalence point in one of the following titration: If the pH range for transition interval is (3.1- 4.4):  
 A.  $\text{HCl}$ ,  $\text{NH}_3$     B.  $\text{CH}_3\text{COOH}$ ,  $\text{NaOH}$     C.  $\text{HNO}_3$ ,  $\text{NaOH}$     D.  $\text{NH}_3$ ,  $\text{CH}_3\text{COOH}$
43. In the following reaction :  $(\text{BF}_{3(aq)} + \text{F}^{-}_{(aq)} \rightarrow \text{BF}_4^{-}_{(aq)})$  which of the following is Lewis base?  
 A.  $\text{F}^{-}$     B.  $\text{BF}_3$     C.  $\text{BF}_4^{-}$     D. none of them is correct
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 A.  $\text{R} = k[\text{A}][\text{B}]$     B.  $\text{R} = k[\text{A}_2\text{B}]$     C.  $\text{R} = k[\text{A}]^2[\text{B}]$     D.  $\text{R} = k[\text{A}][\text{B}]^2$
47. The rate of the slow reaction increases by :  
 A. the addition of a catalyst.    B. increasing activation energy  
 C. increasing concentration.    D. Both (A+C) are correct
48. In the following gaseous reaction:  $(\text{N}_2 + 3\text{H}_2 \rightleftharpoons 2\text{NH}_3)$  it was found the  $[\text{NH}_3] = 0.62\text{M}$ ,  $[\text{H}_2] = 0.14\text{M}$ ,  $[\text{N}_2] = 0.45\text{M}$  the value of the equilibrium constant equals:  
 A.  $3.2 \times 10^{-3}$     B.  $3.11 \times 10^2$     C.  $3.11 \times 10^{-2}$     D. 9.84
49. The concentration of  $\text{H}_3\text{O}^+$  ions in aqueous solution of  $\text{Ba}(\text{OH})_2$  is  $1 \times 10^{-11}\text{M}$ , what is the molar concentration of solution?  
 A.  $1 \times 10^{-3}\text{M}$     B.  $2 \times 10^{-4}\text{M}$     C.  $2 \times 10^{-3}\text{M}$     D.  $5 \times 10^{-4}\text{M}$
50. Which one of the following statements is incorrect?  
 A. Many solids dissolve more quickly in a cold solvent than in warm solvent.  
 B. Gases are generally more soluble in water at low temperature.  
 C. Aqueous solution is a mixture containing the solute soluble in water as a solvent.  
 D. The effect of stirring is similar to that of crushing a solid – contact between the solvent and the solute surface is increased.

**B**



Answer the following questions : ( two marks for each right choice )

- The net ionic equation for the precipitation Nickel ( II )sulfide is :  
 A.  $\text{NiS}_{(s)} \rightarrow \text{Ni}^{+2}_{(aq)} + \text{S}^{-2}_{(aq)}$  B.  $2\text{Ni}^{+2}_{(aq)} + 2\text{S}^{-2}_{(aq)} \rightarrow \text{Ni}_2\text{S}_{2(s)}$   
 C.  $\text{Ni}^{+2}_{(aq)} + \text{S}^{-2}_{(aq)} \rightarrow \text{NiS}_{(s)}$  D. it does not have precipitate equation because it is soluble in water.
- In the following reaction :  $(2\text{HCl}_{(g)} + 184.6\text{kJ} \rightarrow \text{H}_{2(g)} + \text{Cl}_{2(g)})$ , the standard formation enthalpy of HCl equals :  
 A. 184.6kJ/mol B. -184.6kJ/mol C. -92.3kJ/mol D. 92.3kJ/mol
- Which one of the following statements is incorrect?  
 A. Many solids dissolve more quickly in a cold solvent than in warm solvent.  
 B. Gases are generally more soluble in water at low temperature.  
 C. Aqueous solution is a mixture containing the solute soluble in water as a solvent.  
 D. The effect of stirring is similar to that of crushing a solid – contact between the solvent and the solute surface is increased.
- The energy required to raise the reactant to the level of the activated complex is:  
 A. Activation energy B. Free energy C. Kinetic energy D. Energy of reaction
- Which of the following is homogenous mixture?  
 A. milk B. 24-karat gold C. tap water D. oil and water
- In the following hypothetical reaction :  $(\text{A}_2 + \text{B}_2 \rightarrow 2\text{AB} + 30\text{kJ})$ , the activation energy for the forward reaction equal 50kJ/mol ,the activation energy for reverse reaction is equal to  
 A. 20kJ/mol B. 80kJ/mol C. -80kJ/mol D. 10kJ/mol
- When barium chloride solution is mixed with sodium nitrate:  
 A. sodium chloride precipitates B. barium nitrate precipitates  
 C. precipitation does not occur D. Both ( A + B ) are correct
- The value of equilibrium constant for this gaseous reaction :  $(\text{N}_2\text{O}_4 \rightleftharpoons 2\text{NO}_2)$  is 0.1 at a specified temperature, what would be the value of that constant for the reverse reaction at the same condition?  
 A. 0.05 B. 0.1 C. 10 D. 5
- The dilute aqueous solution of a weak acid contains:  
 A. hydronium ions. B. acid molecules. C. anions. D. all of them are correct
- The solubility product of cadmium carbonate,  $\text{CdCO}_3$ , is  $1.0 \times 10^{-12}$ . In a saturated solution of this salt, the concentration of carbonate ions is:  
 A.  $5 \times 10^{-13} \text{ M}$  B.  $3 \times 10^{-6} \text{ M}$  C.  $1 \times 10^{-6} \text{ M}$  D.  $5 \times 10^{-7} \text{ M}$
- For an exothermic dissolution process, the increasing of the temperature causes:  
 A. increasing dissolution B. decreasing dissolution C. decreasing crystallization D. Both (A+C) are correct
- All of them are correct except:  
 A. An ionic compound at solid state does not conduct electric current.  
 B. Alloy is a mixture the atoms of two or more metals are uniformly mixed.  
 C. The Brownian motion is a motion due to collision rapidly moving molecules.  
 D. HCl does not soluble in water.
- All of the following statements are true about the collision theory except:  
 A. all collisions between particles of reactant leads to the occurrence of the chemical reaction  
 B. the reaction rate is directly proportional with the number of effective collision.  
 C. in order for chemical reaction to occur, the reacting particles must collide  
 D. the particles of reactants must have enough energy to initiate the reaction.
- The strength of an acid does not depend on:  
 A. The polarity of the bond between hydrogen and the element it is bonded. B. the bond energy  
 C. the number of hydrogen atoms in the chemical acid formula. D. both (A+B) are correct
- Which of the following is the equilibrium constant for an anion hydrolysis reaction?  
 A.  $\frac{[\text{HB}][\text{OH}^-]}{[\text{B}^-]}$  B.  $\frac{[\text{B}^-]}{[\text{HB}][\text{OH}^-]}$  C.  $\frac{[\text{HB}]}{[\text{B}^-][\text{OH}^-]}$  D.  $\frac{[\text{B}^-][\text{OH}^-]}{[\text{HB}]}$
- The concentration of  $\text{H}_3\text{O}^+$  ions in aqueous solution of  $\text{Ba}(\text{OH})_2$  is  $1 \times 10^{-11} \text{ M}$ , what is the molar concentration of solution?  
 A.  $1 \times 10^{-3} \text{ M}$  B.  $2 \times 10^{-4} \text{ M}$  C.  $2 \times 10^{-3} \text{ M}$  D.  $5 \times 10^{-4} \text{ M}$
- How much energy would be absorbed as heat by 75g of iron when heated from 295K to 301K if its specific heat is 0.449J/g.K?  
 A. 202kJ B. 27.83J C. 1002J D. 202J
- The enthalpy change that occurs during the complete combustion of one mole of an element or compound is called:  
 A. Enthalpy of formation. B. Enthalpy of solution. C. Enthalpy of combustion. D. Specific Heat
- While mixing a small quantity of water with a large quantity of ethanol, water considered as :-  
 A. solvent B. solute C. solution D. none of them
- the spectator ion in the following reaction  $(\text{Al}_{(s)} + \text{H}_2\text{SO}_{4(aq)} \rightarrow \quad)$ , is;  
 A.  $\text{SO}_4^{2-}$  B.  $\text{Al}^{+3}$  C.  $\text{H}_3\text{O}^+$  D. all of them are correct.
- Which of the following is a binary acid?  
 A.  $\text{H}_2\text{S}$  B.  $\text{H}_2\text{CO}_3$  C.  $\text{H}_2\text{O}_2$  D. all of them are correct
- In the following gaseous reaction:  $(\text{N}_2 + 3\text{H}_2 \rightleftharpoons 2\text{NH}_3)$  it was found the  $[\text{NH}_3] = 0.62 \text{ M}$ ,  $[\text{H}_2] = 0.14 \text{ M}$ ,  $[\text{N}_2] = 0.45 \text{ M}$  the value of the equilibrium constant equals:  
 A.  $3.2 \times 10^{-3}$  B.  $3.11 \times 10^2$  C.  $3.11 \times 10^{-2}$  D. 9.84
- In equilibrium gaseous reaction:  $2\text{NO} + \text{Cl}_2 \rightleftharpoons 2\text{NOCl} + \text{energy}$ , which of the following shift the reaction to the right ?  
 A. adding catalyst B. decreasing system volume C. increasing temperature D. decreasing pressure
- The pH of an aqueous solution composed  $2 \times 10^{-4} \text{ mol}$  of  $\text{H}_3\text{O}^+$  ions in 250 mL of its solution is equal to :-  
 A. 3.1 B. 3.7 C. 10.9 D. 10.3

25. A substance that can react as an acid or a base :
- A.  $\text{SO}_4^{2-}$       B.  $\text{HSO}_3^-$       C.  $\text{CH}_3\text{COO}^-$       D.  $\text{NH}_4^+$
26. How many moles of ammonium sulfate must be dissociate to produce 0.4 mol of sulfate ion?
- A. 0.2 mol      B. 0.4 mol      C. 0.6 mol      D. 0.8 mol
27. A reaction has  $\Delta H = -74.8 \text{ kJ/mol}$ ,  $\Delta S = -0.081 \text{ kJ/mol.K}$  at  $27^\circ\text{C}$  which of the following is correct?
- A.  $\Delta G = 50.5 \text{ kJ/mol}$ , nonspontaneous.      B.  $\Delta G = -72.8 \text{ kJ/mol}$ , spontaneous.  
 C.  $\Delta G = 72.8 \text{ kJ/mol}$ , nonspontaneous      D.  $\Delta G = -50.5 \text{ kJ/mol}$ , spontaneous.
28. A solution made from ethanol,  $\text{C}_2\text{H}_5\text{OH}$ , and water is 1.76m in ethanol. How many moles of ethanol are contained per 250g of water?
- A. 0.142mol      B. 0.44mol      C. 20.24mol      D. 7.04mol
29. The boiling-point elevation of a solvent is  $2.4^\circ\text{C}$ , when the concentration of the solution containing a nonelectrolyte solute is 3.1m, what is the value of molal boiling-point constant?
- A.  $1.29^\circ\text{C/m}$       B.  $-0.77^\circ\text{C/m}$       C.  $7.44^\circ\text{C/m}$       D.  $0.77^\circ\text{C/m}$
30. The rate of the slow reaction increases by :
- A. the addition of a catalyst.      B. increasing activation energy  
 C. increasing concentration.      D. Both (A+C) are correct
31. The common-ion causes:
- A. increasing precipitation.      B. decreasing ionization.  
 C. shifting equilibrium to left.      D. all of them are correct.
32. Aqueous solution of  $\text{NH}_3$  is an Arrhenius base because:
- A. it is proton acceptor.      B. it increases the concentration of hydronium ion.  
 C. it is an electron pair donor.      D. it increases the concentration of hydroxide ion.
33. The entropy increases at:
- A. evaporating of liquid      B. temperature raising.      C. increase pressure      D. both(A+B) are correct
34. In the following an exothermic gaseous reaction :  $(2\text{CO} + \text{O}_2 \rightarrow 2\text{CO}_2)$ , which of the following statements is true about the reaction ?
- A. The reaction is always spontaneous.      B. The reaction is never spontaneous.  
 C. The reaction is spontaneous at low temperature.      D. The reaction is spontaneous at high temperature.
35. The boiling point of a solution is higher than that of a pure solvent because :-
- A. Vapor-pressure lowering      B. Freezing- point heightening  
 C. Vapor-pressure heightening      D. none of them
36. A substance that formed when a strong acid has lost a proton
- A. strong conjugate base      B. weak conjugate acid      C. weak conjugate base      D. cations
37. Which of the following ions hydrolyze in aqueous solution?
- A.  $\text{NO}_3^-$       B.  $\text{CO}_3^{2-}$       C.  $\text{SO}_4^{2-}$       D. none of them is correct
38. Which of the following represents the formation equation?
- A.  $\text{N}_2 + \text{O}_2 \rightarrow 2\text{NO}$       B.  $\text{C}_{(\text{graphite})} + \text{O}_2 \rightarrow \text{CO}_2$       C.  $\text{CO} + 1/2 \text{O}_2 \rightarrow \text{CO}_2$       D.  $\text{CO}_2 \rightarrow \text{C}_{(\text{graphite})} + \text{O}_2$
39. Which of the following solutions with the same concentrations has lower  $[\text{H}_3\text{O}^+]$ ?
- A. HCl      B.  $\text{H}_2\text{O}$       C.  $\text{NH}_3$       D. HF
40. Calculate the moles of NaOH if 100 mL of its solution neutralized with 200 mL of 0.01M HBr ?
- A. 0.01mol      B. 0.002mol      C. 0.001mol      D. 0.02mol
41. The methyl orange is used to determine the equivalence point in one of the following titration: If the pH range for transition interval is (3.1- 4.4):
- A. HCl,  $\text{NH}_3$       B.  $\text{CH}_3\text{COOH}$ , NaOH      C.  $\text{HNO}_3$ , NaOH      D.  $\text{NH}_3$ ,  $\text{CH}_3\text{COOH}$
42. The solution that contains the precisely known concentration of a solute is known as:
- A. saturated solution      B. dilute solution      C. standard solution      D. buffer solution
43. The rate law of the following reaction:  $\text{A} + 2\text{B} \rightarrow \text{AB}_2$ , is  $R = k[\text{B}]^2$ , what happens to the reaction rate when the concentration of both reactants is doubled?
- A. the reaction rate remains the same.      B. the reaction rate increases by a factor of two.  
 C. the reaction rate increases by a factor of four.      D. the reaction rate increases by a factor eight.
44. Adding  $\text{NH}_4\text{Cl}$  to  $\text{NH}_3$  solution leads to:
- A. decrease  $[\text{NH}_3]$       B. increase  $[\text{OH}^-]$       C. increase ionization of  $\text{NH}_3$       D. increase  $[\text{H}_3\text{O}^+]$
45. When polar compound ionizes completely in water the compound is:
- A. ionic electrolyte.      B. weak electrolyte.      C. non-electrolyte molecular.      D. strong molecular electrolyte.
46. The following reaction :  $(2\text{A} + \text{B} \rightarrow \text{A}_2\text{B})$  is occur by one step mechanism the rate law for the reaction is:
- A.  $R = k[\text{A}][\text{B}]$       B.  $R = k[\text{A}_2\text{B}]$       C.  $R = k[\text{A}]^2[\text{B}]$       D.  $R = k[\text{A}][\text{B}]^2$
47. Unknown liquid miscible with toluene and immiscible with water which of the following statements is correct?
- A. an aqueous solution for the liquid conducts electric current.      B. a liquid is nonpolar molecular compound.  
 C. a liquid is polar molecular compound.      D. none of them
48. In the following reaction :  $(\text{BF}_3(\text{aq}) + \text{F}^-(\text{aq}) \rightarrow \text{BF}_4^-(\text{aq}))$  which of the following is Lewis base?
- A.  $\text{F}^-$       B.  $\text{BF}_3$       C.  $\text{BF}_4^-$       D. none of them is correct
49. In aqueous solution contains,  $\text{Ca}^{+2}$ ,  $\text{SO}_4^{2-}$  ions,  $\text{CaSO}_4$  precipitates if :
- A.  $[\text{Ca}^{+2}][\text{SO}_4^{2-}] = K_{sp}$       B.  $[\text{Ca}^{+2}][\text{SO}_4^{2-}] > K_{sp}$       C.  $[\text{Ca}^{+2}][\text{SO}_4^{2-}] < K_{sp}$       D. can not be determined
50. A proposed mechanism for the reaction is:- slow :  $2\text{NO} + \text{H}_2 \rightarrow \text{N}_2\text{O} + \text{H}_2\text{O}$   
 fast :  $\text{N}_2\text{O} + \text{H}_2 \rightarrow \text{N}_2 + \text{H}_2\text{O}$  which of the following is correct ?
- A.  $R = k[\text{NO}][\text{H}_2]$       B. overall balanced equation for the reaction is :  $2\text{NO} + 2\text{H}_2 \rightarrow \text{N}_2 + 2\text{H}_2\text{O}$   
 C. the reaction order is second      D. Both (A+C) are correct

**C**



Answer the following questions : ( two marks for each right choice )

- The energy required to raise the reactant to the level of the activated complex is:  
A. Activation energy B. Free energy C. Kinetic energy D. Energy of reaction
- The value of equilibrium constant for this gaseous reaction :  $(N_2O_4 \rightleftharpoons 2NO_2)$  is 0.1 at a specified temperature, what would be the value of that constant for the reverse reaction at the same condition?  
A. 0.05 B. 0.1 C. 10 D. 5
- In the following reaction :  $(BF_3(aq) + F^-(aq) \rightarrow BF_4^-(aq))$  which of the following is Lewis base?  
A.  $F^-$  B.  $BF_3$  C.  $BF_4^-$  D. none of them is correct
- Unknown liquid miscible with toluene and immiscible with water which of the following statements is correct?  
A. an aqueous solution for the liquid conducts electric current. B. a liquid is nonpolar molecular compound.  
C. a liquid is polar molecular compound. D. none of them
- The rate of the slow reaction increases by :  
A. the addition of a catalyst. B. increasing activation energy  
C. increasing concentration. D. Both (A+C) are correct
- A solution made from ethanol,  $C_2H_5OH$ , and water is 1.76m in ethanol. How many moles of ethanol are contained per 250g of water?  
A. 0.142mol B. 0.44mol C. 20.24mol D. 7.04mol
- How many moles of ammonium sulfate must be dissociate to produce 0.4 mol of sulfate ion?  
A. 0.2 mol B. 0.4 mol C. 0.6 mol D. 0.8 mol
- A substance that formed when a strong acid has lost a proton  
A. strong conjugate base B. weak conjugate acid C. weak conjugate base D. cations
- Aqueous solution of  $NH_3$  is an Arrhenius base because:  
A. it is proton acceptor. B. it increases the concentration of hydronium ion.  
C. it is an electron pair donor. D. it increases the concentration of hydroxide ion.
- How much energy would be absorbed as heat by 75g of iron when heated from 295K to 301K if its specific heat is 0.449J/g.K?  
A. 202kJ B. 27.83J C. 1002J D. 202J
- All of them are correct except:  
A. An ionic compound at solid state does not conduct electric current.  
B. Alloy is a mixture the atoms of two or more metals are uniformly mixed.  
C. The Brownian motion is a motion due to collision rapidly moving molecules.  
D. HCl does not soluble in water.
- The common-ion causes:  
A. increasing precipitation. B. decreasing ionization.  
C. shifting equilibrium to left. D. all of them are correct.

13. Adding  $NH_4Cl$  to  $NH_3$  solution leads to:

- A. decrease  $[NH_3]$  B. increase  $[OH^-]$  C. increase ionization of  $NH_3$  D. increase  $[H_3O^+]$

14. Which of the following is the equilibrium constant for an anion hydrolysis reaction?

- A.  $\frac{[HB][OH^-]}{[B^-]}$  B.  $\frac{[B^-]}{[HB][OH^-]}$  C.  $\frac{[HB]}{[B^-][OH^-]}$  D.  $\frac{[B^-][OH^-]}{[HB]}$

15. The methyl orange is used to determine the equivalence point in one of the following titration: If the pH range for transition interval is (3.1- 4.4):

- A. HCl,  $NH_3$  B.  $CH_3COOH$ , NaOH C.  $HNO_3$ , NaOH D.  $NH_3$ ,  $CH_3COOH$

16. The dilute aqueous solution of a weak acid contains:

- A. hydronium ions. B. acid molecules. C. anions. D. all of them are correct

17. The following reaction :  $(2A+B \rightarrow A_2B)$  is occur by one step mechanism the rate law for the reaction is:

- A.  $R=k[A][B]$  B.  $R=k[A_2B]$  C.  $R=k[A]^2[B]$  D.  $R=k[A][B]^2$

18. The strength of an acid does not depend on:

- A. The polarity of the bond between hydrogen and the element it is bonded. B. the bond energy  
C. the number of hydrogen atoms in the chemical acid formula. D. both (A+B) are correct

19. The solution that contains the precisely known concentration of a solute is known as:

- A. saturated solution B. dilute solution C. standard solution D. buffer solution

20. In the following an exothermic gaseous reaction :  $(2CO+O_2 \rightarrow 2CO_2)$ , which of the following statements is true about the reaction ?

- A. The reaction is always spontaneous. B. The reaction is never spontaneous.  
C. The reaction is spontaneous at low temperature. D. The reaction is spontaneous at high temperature.

21. The concentration of  $H_3O^+$  ions in aqueous solution of  $Ba(OH)_2$  is  $1 \times 10^{-11} M$ , what is the molar concentration of solution?

- A.  $1 \times 10^{-3} M$  B.  $2 \times 10^{-4} M$  C.  $2 \times 10^{-3} M$  D.  $5 \times 10^{-4} M$

22. In the following hypothetical reaction :  $(A_2+B_2 \rightarrow 2AB+30kJ)$ , the activation energy for the forward reaction equal 50kJ/mol, the activation energy for reverse reaction is equal to

- A. 20kJ/mol B. 80kJ/mol C. -80kJ/mol D. 10kJ/mol

23. The net ionic equation for the precipitation Nickel ( II ) sulfide is :

- A.  $NiS(s) \rightarrow Ni^{2+}(aq) + S^{2-}(aq)$  B.  $2Ni^{2+}(aq) + 2S^{2-}(aq) \rightarrow Ni_2S_2(s)$   
C.  $Ni^{2+}(aq) + S^{2-}(aq) \rightarrow NiS(s)$  D. it does not have precipitate equation because it is soluble in water.

24. A substance that can react as an acid or a base :

- A.  $SO_4^{2-}$  B.  $HSO_3^-$  C.  $CH_3COO^-$  D.  $NH_4^+$

25. In aqueous solution contains,  $Ca^{+2}$ ,  $SO_4^{2-}$  ions,  $CaSO_4$  precipitates if :

- A.  $[Ca^{+2}][SO_4^{2-}] = K_{sp}$  B.  $[Ca^{+2}][SO_4^{2-}] > K_{sp}$  C.  $[Ca^{+2}][SO_4^{2-}] < K_{sp}$  D. can not be determined

26. Which of the following solutions with the same concentrations has lower  $[H_3O^+]$ ?

- A. HCl B.  $H_2O$  C.  $NH_3$  D. HF

27. All of the following statements are true about the collision theory except:  
 A. all collisions between particles of reactant leads to the occurrence of the chemical reaction  
 B. the reaction rate is directly proportional with the number of effective collision.  
 C. in order for chemical reaction to occur, the reacting particles must collide  
 D. the particles of reactants must have enough energy to initiate the reaction.
28. While mixing a small quantity of water with a large quantity of ethanol, water considered as :-  
 A. solvent B. solute C. solution D. none of them
29. The rate law of the following reaction:  $A+2B \rightarrow AB_2$ , is  $R=k[B]^2$ , what happens to the reaction rate when the concentration of both reactants is doubled?  
 A. the reaction rate remains the same. B. the reaction rate increases by a factor of two.  
 C. the reaction rate increases by a factor of four. D. the reaction rate increases by a factor eight.
30. For an exothermic dissolution process, the increasing of the temperature causes:  
 A. increasing dissolution B. decreasing dissolution C. decreasing crystallization D. Both (A+C) are correct
31. The boiling point of a solution is higher than that of a pure solvent because :-  
 A. Vapor-pressure lowering B. Freezing- point heightening  
 C. Vapor-pressure heightening D. none of them
32. the spectator ion in the following reaction  $(Al_{(s)} + H_2SO_{4(aq)} \rightarrow \quad)$ , is;  
 A.  $SO_4^{2-}$  B.  $Al^{+3}$  C.  $H_3O^+$  D. all of them are correct.
33. Calculate the moles of NaOH if 100 mL of its solution neutralized with 200 mL of 0.01M HBr ?  
 A. 0.01mol B. 0.002mol C. 0.001mol D. 0.02mol
34. When polar compound ionizes completely in water the compound is:  
 A. ionic electrolyte. B. weak electrolyte. C. non-electrolyte molecular. D. strong molecular electrolyte.
35. The pH of an aqueous solution composed  $2 \times 10^{-4}$  mol of  $H_3O^+$  ions in 250 mL of its solution is equal to :-  
 A. 3.1 B. 3.7 C. 10.9 D. 10.3
36. When barium chloride solution is mixed with sodium nitrate:  
 A. sodium chloride precipitates B. barium nitrate precipitates  
 C. precipitation does not occur D. Both ( A + B ) are correct
37. A reaction has  $\Delta H = -74.8 \text{ kJ/mol}$ ,  $\Delta S = -0.081 \text{ kJ/mol.K}$  at  $27^\circ\text{C}$  which of the following is correct?  
 A.  $\Delta G = 50.5 \text{ kJ/mol}$ , nonspontaneous. B.  $\Delta G = -72.8 \text{ kJ/mol}$ , spontaneous.  
 C.  $\Delta G = 72.8 \text{ kJ/mol}$ , nonspontaneous D.  $\Delta G = -50.5 \text{ kJ/mol}$ , spontaneous.
38. Which one of the following statements is incorrect?  
 A. Many solids dissolve more quickly in a cold solvent than in warm solvent.  
 B. Gases are generally more soluble in water at low temperature.  
 C. Aqueous solution is a mixture containing the solute soluble in water as a solvent.  
 D. The effect of stirring is similar to that of crushing a solid – contact between the solvent and the solute surface is increased.
39. The entropy increases at:  
 A. evaporating of liquid B. temperature raising. C. increase pressure D. both(A+B) are correct
40. Which of the following ions hydrolyze in aqueous solution?  
 A.  $NO_3^-$  B.  $CO_3^{2-}$  C.  $SO_4^{2-}$  D. none of them is correct
41. In the following reaction :  $(2HCl_{(g)} + 184.6 \text{ kJ} \rightarrow H_{2(g)} + Cl_{2(g)})$ , the standard formation enthalpy of HCl equals :  
 A. 184.6kJ/mol B. -184.6kJ/mol C. -92.3kJ/mol D. 92.3kJ/mol
42. In the following gaseous reaction:  $(N_2 + 3H_2 \rightleftharpoons 2NH_3)$  it was found the  $[NH_3] = 0.62 \text{ M}$ ,  $[H_2] = 0.14 \text{ M}$ ,  $[N_2] = 0.45 \text{ M}$  the value of the equilibrium constant equals:  
 A.  $3.2 \times 10^{-3}$  B.  $3.11 \times 10^2$  C.  $3.11 \times 10^{-2}$  D. 9.84
43. The enthalpy change that occurs during the complete combustion of one mole of an element or compound is called:  
 A. Enthalpy of formation. B. Enthalpy of solution. C. Enthalpy of combustion. D. Specific Heat
44. A proposed mechanism for the reaction is:- slow :  $2NO + H_2 \rightarrow N_2O + H_2O$   
 fast :  $N_2O + H_2 \rightarrow N_2 + H_2O$  which of the following is correct ?  
 A.  $R = k[NO][H_2]$  B. overall balanced equation for the reaction is :  $2NO + 2H_2 \rightarrow N_2 + 2H_2O$   
 C. the reaction order is second D. Both (A+C) are correct
45. The solubility product of cadmium carbonate,  $CdCO_3$ , is  $1.0 \times 10^{-12}$ . In a saturated solution of this salt, the concentration of carbonate ions is:  
 A.  $5 \times 10^{-13} \text{ M}$  B.  $3 \times 10^{-6} \text{ M}$  C.  $1 \times 10^{-6} \text{ M}$  D.  $5 \times 10^{-7} \text{ M}$
46. Which of the following represents the formation equation?  
 A.  $N_2 + O_2 \rightarrow 2NO$  B.  $C_{(graphite)} + O_2 \rightarrow CO_2$  C.  $CO + 1/2 O_2 \rightarrow CO_2$  D.  $CO_2 \rightarrow C_{(graphite)} + O_2$
47. Which of the following is a binary acid?  
 A.  $H_2S$  B.  $H_2CO_3$  C.  $H_2O_2$  D. all of them are correct
48. Which of the following is homogenous mixture?  
 A. milk B. 24-karat gold C. tap water D. oil and water
49. In equilibrium gaseous reaction:  $2NO + Cl_2 \rightleftharpoons 2NOCl + \text{energy}$ , which of the following shift the reaction to the right ?  
 A. adding catalyst B. decreasing system volume C. increasing temperature D. decreasing pressure
50. The boiling-point elevation of a solvent is  $2.4^\circ\text{C}$ , when the concentration of the solution containing a nonelectrolyte solute is 3.1m, what is the value of molal boiling-point constant?  
 A.  $1.29^\circ\text{C/m}$  B.  $-0.77^\circ\text{C/m}$  C.  $7.44^\circ\text{C/m}$  D.  $0.77^\circ\text{C/m}$

**D**



Answer the following questions : ( two marks for each right choice )

- A substance that formed when a strong acid has lost a proton  
 A. strong conjugate base B. weak conjugate acid C. weak conjugate base D. cations
- In aqueous solution contains,  $\text{Ca}^{+2}$ ,  $\text{SO}_4^{2-}$  ions,  $\text{CaSO}_4$  precipitates if :  
 A.  $[\text{Ca}^{+2}][\text{SO}_4^{2-}] = K_{sp}$  B.  $[\text{Ca}^{+2}][\text{SO}_4^{2-}] > K_{sp}$  C.  $[\text{Ca}^{+2}][\text{SO}_4^{2-}] < K_{sp}$  D. can not be determined
- Which one of the following statements is incorrect?  
 A. Many solids dissolve more quickly in a cold solvent than in warm solvent.  
 B. Gases are generally more soluble in water at low temperature.  
 C. Aqueous solution is a mixture containing the solute soluble in water as a solvent.  
 D. The effect of stirring is similar to that of crushing a solid – contact between the solvent and the solute surface is increased.
- A substance that can react as an acid or a base :  
 A.  $\text{SO}_4^{2-}$  B.  $\text{HSO}_3^-$  C.  $\text{CH}_3\text{COO}^-$  D.  $\text{NH}_4^+$
- How much energy would be absorbed as heat by 75g of iron when heated from 295K to 301K if its specific heat is 0.449J/g.K?  
 A. 202kJ B. 27.83J C. 1002J D. 202J
- The solubility product of cadmium carbonate,  $\text{CdCO}_3$ , is  $1.0 \times 10^{-12}$ . In a saturated solution of this salt, the concentration of carbonate ions is:  
 A.  $5 \times 10^{-13}$  M B.  $3 \times 10^{-6}$  M C.  $1 \times 10^{-6}$  M D.  $5 \times 10^{-7}$  M
- In the following hypothetical reaction :  $(\text{A}_2 + \text{B}_2 \rightarrow 2\text{AB} + 30\text{kJ})$ , the activation energy for the forward reaction equal 50kJ/mol, the activation energy for reverse reaction is equal to  
 A. 20kJ/mol B. 80kJ/mol C. -80kJ/mol D. 10kJ/mol
- The rate of the slow reaction increases by :  
 A. the addition of a catalyst. B. increasing activation energy  
 C. increasing concentration. D. Both (A+C) are correct
- In equilibrium gaseous reaction:  $2\text{NO} + \text{Cl}_2 \rightleftharpoons 2\text{NOCl} + \text{energy}$ , which of the following shift the reaction to the right ?  
 A. adding catalyst B. decreasing system volume C. increasing temperature D. decreasing pressure
- The rate law of the following reaction:  $\text{A} + 2\text{B} \rightarrow \text{AB}_2$ , is  $R = k[\text{B}]^2$ , what happens to the reaction rate when the concentration of both reactants is doubled?  
 A. the reaction rate remains the same. B. the reaction rate increases by a factor of two.  
 C. the reaction rate increases by a factor of four. D. the reaction rate increases by a factor eight.
- Which of the following represents the formation equation?  
 A.  $\text{N}_2 + \text{O}_2 \rightarrow 2\text{NO}$  B.  $\text{C}(\text{graphite}) + \text{O}_2 \rightarrow \text{CO}_2$  C.  $\text{CO} + 1/2 \text{O}_2 \rightarrow \text{CO}_2$  D.  $\text{CO}_2 \rightarrow \text{C}(\text{graphite}) + \text{O}_2$
- A reaction has  $\Delta H = -74.8 \text{ kJ/mol}$ ,  $\Delta S = -0.081 \text{ kJ/mol.K}$  at  $27^\circ\text{C}$  which of the following is correct?  
 A.  $\Delta G = 50.5 \text{ kJ/mol}$ , nonspontaneous. B.  $\Delta G = -72.8 \text{ kJ/mol}$ , spontaneous.  
 C.  $\Delta G = 72.8 \text{ kJ/mol}$ , nonspontaneous D.  $\Delta G = -50.5 \text{ kJ/mol}$ , spontaneous.
- The net ionic equation for the precipitation Nickel ( II ) sulfide is :  
 A.  $\text{NiS}_{(s)} \rightarrow \text{Ni}^{+2}_{(aq)} + \text{S}^{2-}_{(aq)}$  B.  $2\text{Ni}^{+2}_{(aq)} + 2\text{S}^{2-}_{(aq)} \rightarrow \text{Ni}_2\text{S}_{2(s)}$   
 C.  $\text{Ni}^{+2}_{(aq)} + \text{S}^{2-}_{(aq)} \rightarrow \text{NiS}_{(s)}$  D. it does not have precipitate equation because it is soluble in water.
- Unknown liquid miscible with toluene and immiscible with water which of the following statements is correct?  
 A. an aqueous solution for the liquid conducts electric current. B. a liquid is nonpolar molecular compound.  
 C. a liquid is polar molecular compound. D. none of them
- All of the following statements are true about the collision theory except:  
 A. all collisions between particles of reactant leads to the occurrence of the chemical reaction  
 B. the reaction rate is directly proportional with the number of effective collision.  
 C. in order for chemical reaction to occur, the reacting particles must collide  
 D. the particles of reactants must have enough energy to initiate the reaction.
- The pH of an aqueous solution composed  $2 \times 10^{-4}$  mol of  $\text{H}_3\text{O}^+$  ions in 250 mL of its solution is equal to :-  
 A. 3.1 B. 3.7 C. 10.9 D. 10.3
- the spectator ion in the following reaction  $(\text{Al}_{(s)} + \text{H}_2\text{SO}_{4(aq)} \rightarrow \quad)$ , is;  
 A.  $\text{SO}_4^{2-}$  B.  $\text{Al}^{+3}$  C.  $\text{H}_3\text{O}^+$  D. all of them are correct.
- How many moles of ammonium sulfate must be dissociate to produce 0.4 mol of sulfate ion?  
 A. 0.2 mol B. 0.4 mol C. 0.6 mol D. 0.8 mol
- The boiling point of a solution is higher than that of a pure solvent because :-  
 A. Vapor-pressure lowering B. Freezing- point heightening  
 C. Vapor-pressure heightening D. none of them
- For an exothermic dissolution process, the increasing of the temperature causes:  
 A. increasing dissolution B. decreasing dissolution C. decreasing crystallization D. Both (A+C) are correct
- The following reaction :  $(2\text{A} + \text{B} \rightarrow \text{A}_2\text{B})$  is occur by one step mechanism the rate law for the reaction is:  
 A.  $R = k[\text{A}][\text{B}]$  B.  $R = k[\text{A}_2\text{B}]$  C.  $R = k[\text{A}]^2[\text{B}]$  D.  $R = k[\text{A}][\text{B}]^2$
- The solution that contains the precisely known concentration of a solute is known as:  
 A. saturated solution B. dilute solution C. standard solution D. buffer solution
- In the following reaction :  $(\text{BF}_{3(aq)} + \text{F}^{-}_{(aq)} \rightarrow \text{BF}_4^{-}_{(aq)})$  which of the following is Lewis base?  
 A.  $\text{F}^-$  B.  $\text{BF}_3$  C.  $\text{BF}_4^-$  D. none of them is correct
- The concentration of  $\text{H}_3\text{O}^+$  ions in aqueous solution of  $\text{Ba}(\text{OH})_2$  is  $1 \times 10^{-11}$  M, what is the molar concentration of solution?  
 A.  $1 \times 10^{-3}$  M B.  $2 \times 10^{-4}$  M C.  $2 \times 10^{-3}$  M D.  $5 \times 10^{-4}$  M
- Adding  $\text{NH}_4\text{Cl}$  to  $\text{NH}_3$  solution leads to:  
 A. decrease  $[\text{NH}_3]$  B. increase  $[\text{OH}^-]$  C. increase ionization of  $\text{NH}_3$  D. increase  $[\text{H}_3\text{O}^+]$
- The entropy increases at:  
 A. evaporating of liquid B. temperature raising. C. increase pressure D. both(A+B) are correct



Answer the following questions : ( two marks for each right choice )

- The methyl orange is used to determine the equivalence point in one of the following titration: If the pH range for transition interval is (3.1- 4.4):  
 A. HCl, NH<sub>3</sub>      B. CH<sub>3</sub>COOH, NaOH      C. HNO<sub>3</sub>, NaOH      D. NH<sub>3</sub>, CH<sub>3</sub>COOH
- The common-ion causes:  
 A. increasing precipitation.      B. decreasing ionization.  
 C. shifting equilibrium to left.      D. all of them are correct.
- Unknown liquid miscible with toluene and immiscible with water which of the following statements is correct?  
 A. an aqueous solution for the liquid conducts electric current.      B. a liquid is nonpolar molecular compound.  
 C. a liquid is polar molecular compound.      D. none of them
- In the following reaction : (  $BF_{3(aq)} + F_{(aq)}^- \rightarrow BF_{4(aq)}^-$  ) which of the following is Lewis base?  
 A. F<sup>-</sup>      B. BF<sub>3</sub>      C. BF<sub>4</sub><sup>-</sup>      D. none of them is correct
- In equilibrium gaseous reaction:  $2NO + Cl_2 \rightleftharpoons 2NOCl + \text{energy}$ , which of the following shift the reaction to the right ?  
 A. adding catalyst      B. decreasing system volume      C. increasing temperature      D. decreasing pressure
- Which of the following solutions with the same concentrations has lower [H<sub>3</sub>O<sup>+</sup>]?  
 A. HCl      B. H<sub>2</sub>O      C. NH<sub>3</sub>      D. HF
- Which of the following is the equilibrium constant for an anion hydrolysis reaction?  
 A.  $\frac{[HB][OH^-]}{[B^-]}$       B.  $\frac{[B^-]}{[HB][OH^-]}$       C.  $\frac{[HB]}{[B^-][OH^-]}$       D.  $\frac{[B^-][OH^-]}{[HB]}$
- A reaction has  $\Delta H = -74.8 \text{ kJ/mol}$ ,  $\Delta S = -0.081 \text{ kJ/mol.K}$  at 27°C which of the following is correct?  
 A.  $\Delta G = 50.5 \text{ kJ/mol}$ , nonspontaneous.      B.  $\Delta G = -72.8 \text{ kJ/mol}$ , spontaneous.  
 C.  $\Delta G = 72.8 \text{ kJ/mol}$ , nonspontaneous      D.  $\Delta G = -50.5 \text{ kJ/mol}$ , spontaneous.
- A substance that formed when a strong acid has lost a proton  
 A. strong conjugate base      B. weak conjugate acid      C. weak conjugate base      D. cations
- All of them are correct except:  
 A. An ionic compound at solid state does not conduct electric current.  
 B. Alloy is a mixture the atoms of two or more metals are uniformly mixed.  
 C. The Brownian motion is a motion due to collision rapidly moving molecules.  
 D. HCl does not soluble in water.
- The strength of an acid does not depend on:  
 A. The polarity of the bond between hydrogen and the element it is bonded.      B. the bond energy  
 C. the number of hydrogen atoms in the chemical acid formula.      D. both (A+B) are correct
- The pH of an aqueous solution composed  $2 \times 10^{-4} \text{ mol}$  of H<sub>3</sub>O<sup>+</sup> ions in 250 mL of its solution is equal to :-  
 A. 3.1      B. 3.7      C. 10.9      D. 10.3
- While mixing a small quantity of water with a large quantity of ethanol, water considered as :-  
 A. solvent      B. solute      C. solution      D. none of them
- Adding NH<sub>4</sub>Cl to NH<sub>3</sub> solution leads to:  
 A. decrease [NH<sub>3</sub>]      B. increase [OH<sup>-</sup>]      C. increase ionization of NH<sub>3</sub>      D. increase [H<sub>3</sub>O<sup>+</sup>]
- Which of the following ions hydrolyze in aqueous solution?  
 A. NO<sub>3</sub><sup>-</sup>      B. CO<sub>3</sub><sup>2-</sup>      C. SO<sub>4</sub><sup>2-</sup>      D. none of them is correct
- The solubility product of cadmium carbonate, CdCO<sub>3</sub>, is  $1.0 \times 10^{-12}$ . In a saturated solution of this salt, the concentration of carbonate ions is:  
 A.  $5 \times 10^{-13} \text{ M}$       B.  $3 \times 10^{-6} \text{ M}$       C.  $1 \times 10^{-6} \text{ M}$       D.  $5 \times 10^{-7} \text{ M}$
- Which of the following represents the formation equation?  
 A.  $N_2 + O_2 \rightarrow 2NO$       B.  $C_{(\text{graphite})} + O_2 \rightarrow CO_2$       C.  $CO + \frac{1}{2} O_2 \rightarrow CO_2$       D.  $CO_2 \rightarrow C_{(\text{graphite})} + O_2$
- Which of the following is a binary acid?  
 A. H<sub>2</sub>S      B. H<sub>2</sub>CO<sub>3</sub>      C. H<sub>2</sub>O<sub>2</sub>      D. all of them are correct
- When barium chloride solution is mixed with sodium nitrate:  
 A. sodium chloride precipitates      B. barium nitrate precipitates  
 C. precipitation does not occur      D. Both ( A + B ) are correct
- In aqueous solution contains, Ca<sup>2+</sup>, SO<sub>4</sub><sup>2-</sup> ions, CaSO<sub>4</sub> precipitates if :  
 A.  $[Ca^{2+}][SO_4^{2-}] = K_{sp}$       B.  $[Ca^{2+}][SO_4^{2-}] > K_{sp}$       C.  $[Ca^{2+}][SO_4^{2-}] < K_{sp}$       D. can not be determined
- Aqueous solution of NH<sub>3</sub> is an Arrhenius base because:  
 A. it is proton acceptor.      B. it increases the concentration of hydronium ion.  
 C. it is an electron pair donor.      D. it increases the concentration of hydroxide ion.
- In the following hypothetical reaction : (  $A_2 + B_2 \rightarrow 2AB + 30 \text{ kJ}$  ), the activation energy for the forward reaction equal 50 kJ/mol, the activation energy for reverse reaction is equal to  
 A. 20 kJ/mol      B. 80 kJ/mol      C. -80 kJ/mol      D. 10 kJ/mol
- The solution that contains the precisely known concentration of a solute is known as:  
 A. saturated solution      B. dilute solution      C. standard solution      D. buffer solution
- The net ionic equation for the precipitation Nickel ( II ) sulfide is :  
 A.  $NiS_{(s)} \rightarrow Ni^{2+}_{(aq)} + S^{2-}_{(aq)}$       B.  $2Ni^{2+}_{(aq)} + 2S^{2-}_{(aq)} \rightarrow Ni_2S_{2(s)}$   
 C.  $Ni^{2+}_{(aq)} + S^{2-}_{(aq)} \rightarrow NiS_{(s)}$       D. it does not have precipitate equation because it is soluble in water.
- How many moles of ammonium sulfate must be dissociate to produce 0.4 mol of sulfate ion?  
 A. 0.2 mol      B. 0.4 mol      C. 0.6 mol      D. 0.8 mol
- A substance that can react as an acid or a base :  
 A. SO<sub>4</sub><sup>2-</sup>      B. HSO<sub>3</sub><sup>-</sup>      C. CH<sub>3</sub>COO<sup>-</sup>      D. NH<sub>4</sub><sup>+</sup>
- Which one of the following statements is incorrect?  
 A. Many solids dissolve more quickly in a cold solvent than in warm solvent.  
 B. Gases are generally more soluble in water at low temperature.  
 C. Aqueous solution is a mixture containing the solute soluble in water as a solvent.  
 D. The effect of stirring is similar to that of crushing a solid – contact between the solvent and the solute surface is increased.

28. The rate of the slow reaction increases by :  
 A. the addition of a catalyst. B. increasing activation energy  
 C. increasing concentration. D. Both (A+C) are correct
29. The value of equilibrium constant for this gaseous reaction :( $N_2O_4 \rightleftharpoons 2NO_2$ ) is 0.1 at a specified temperature, what would be the value of that constant for the reverse reaction at the same condition?  
 A. 0.05 B. 0.1 C. 10 D. 5
30. The dilute aqueous solution of a weak acid contains:  
 A. hydronium ions. B. acid molecules. C. anions. D. all of them are correct
31. The entropy increases at:  
 A. evaporating of liquid B. temperature raising. C. increase pressure D. both(A+B) are correct
32. The energy required to raise the reactant to the level of the activated complex is:  
 A. Activation energy B. Free energy C. Kinetic energy D. Energy of reaction
33. In the following reaction :( $2HCl_{(g)} + 184.6kJ \rightarrow H_{2(g)} + Cl_{2(g)}$ ), the standard formation enthalpy of HCl equals :  
 A. 184.6kJ/mol B. -184.6kJ/mol C. -92.3kJ/mol D. 92.3kJ/mol
34. In the following an exothermic gaseous reaction :( $2CO + O_2 \rightarrow 2CO_2$ ) , which of the following statements is true about the reaction ?  
 A. The reaction is always spontaneous. B. The reaction is never spontaneous.  
 C. The reaction is spontaneous at low temperature. D. The reaction is spontaneous at high temperature.
35. the spectator ion in the following reaction ( $Al_{(s)} + H_2SO_{4(aq)} \rightarrow$  ), is;  
 A.  $SO_4^{2-}$  B.  $Al^{+3}$  C.  $H_3O^+$  D. all of them are correct.
36. For an exothermic dissolution process, the increasing of the temperature causes:  
 A. increasing dissolution B. decreasing dissolution C. decreasing crystallization D. Both (A+C) are correct
37. Which of the following is homogenous mixture?  
 A. milk B. 24-karat gold C. tap water D. oil and water
38. The boiling-point elevation of a solvent is  $2.4^\circ C$ , when the concentration of the solution containing a nonelectrolyte solute is  $3.1m$ , what is the value of molal boiling-point constant?  
 A.  $1.29^\circ C/m$  B.  $-0.77^\circ C/m$  C.  $7.44^\circ C/m$  D.  $0.77^\circ C/m$
39. All of the following statements are true about the collision theory except:  
 A. all collisions between particles of reactant leads to the occurrence of the chemical reaction  
 B. the reaction rate is directly proportional with the number of effective collision.  
 C. in order for chemical reaction to occur, the reacting particles must collide  
 D. the particles of reactants must have enough energy to initiate the reaction.
40. The boiling point of a solution is higher than that of a pure solvent because :-  
 A. Vapor-pressure lowering B. Freezing- point heightening  
 C. Vapor-pressure heightening D. none of them
41. The concentration of  $H_3O^+$  ions in aqueous solution of  $Ba(OH)_2$  is  $1 \times 10^{-11} M$ , what is the molar concentration of solution?  
 A.  $1 \times 10^{-3} M$  B.  $2 \times 10^{-4} M$  C.  $2 \times 10^{-3} M$  D.  $5 \times 10^{-4} M$
42. A proposed mechanism for the reaction is:- slow : $2NO + H_2 \rightarrow N_2O + H_2O$   
 fast : $N_2O + H_2 \rightarrow N_2 + H_2O$  which of the following is correct ?  
 A.  $R = k[NO][H_2]$  B. overall balanced equation for the reaction is : $2NO + 2H_2 \rightarrow N_2 + 2H_2O$   
 C. the reaction order is second D. Both (A+C) are correct
43. In the following gaseous reaction: ( $N_2 + 3H_2 \rightleftharpoons 2NH_3$ ) it was found the  $[NH_3] = 0.62 M$ ,  $[H_2] = 0.14 M$ ,  $[N_2] = 0.45 M$  the value of the equilibrium constant equals:  
 A.  $3.2 \times 10^{-3}$  B.  $3.11 \times 10^2$  C.  $3.11 \times 10^{-2}$  D. 9.84
44. The enthalpy change that occurs during the complete combustion of one mole of an element or compound is called:  
 A. Enthalpy of formation. B. Enthalpy of solution. C. Enthalpy of combustion. D. Specific Heat
45. How much energy would be absorbed as heat by 75g of iron when heated from 295K to 301K if its specific heat is  $0.449 J/g.K$ ?  
 A. 202kJ B. 27.83J C. 1002J D. 202J
46. A solution made from ethanol,  $C_2H_5OH$ , and water is  $1.76m$  in ethanol .How many moles of ethanol are contained per 250g of water?  
 A. 0.142mol B. 0.44mol C. 20.24mol D. 7.04mol
47. Calculate the moles of NaOH if 100 mL of its solution neutralized with 200 mL of 0.01M HBr ?  
 A. 0.01mol B. 0.002mol C. 0.001mol D. 0.02mol
48. The rate law of the following reaction:  $A + 2B \rightarrow AB_2$ , is  $R = k[B]^2$ , what happens to the reaction rate when the concentration of both reactants is doubled?  
 A. the reaction rate remains the same. B. the reaction rate increases by a factor of two.  
 C. the reaction rate increases by a factor of four. D. the reaction rate increases by a factor eight.
49. When polar compound ionizes completely in water the compound is:  
 A. ionic electrolyte. B. weak electrolyte. C. non-electrolyte molecular. D. strong molecular electrolyte.
50. The following reaction :( $2A + B \rightarrow A_2B$ ) is occur by one step mechanism the rate law for the reaction is:  
 A.  $R = k[A][B]$  B.  $R = k[A_2B]$  C.  $R = k[A]^2[B]$  D.  $R = k[A][B]^2$



Answer the following questions : ( two marks for each right choice )

- Which of the following is homogenous mixture?  
 A. milk B. 24-karat gold C. tap water D. oil and water
- Which one of the following statements is incorrect?  
 A. Many solids dissolve more quickly in a cold solvent than in warm solvent.  
 B. Gases are generally more soluble in water at low temperature.  
 C. Aqueous solution is a mixture containing the solute soluble in water as a solvent.  
 D. The effect of stirring is similar to that of crushing a solid – contact between the solvent and the solute surface is increased.
- The net ionic equation for the precipitation Nickel ( II )sulfide is :  
 A.  $\text{NiS}_{(s)} \rightarrow \text{Ni}^{+2}_{(aq)} + \text{S}^{-2}_{(aq)}$  B.  $2\text{Ni}^{+2}_{(aq)} + 2\text{S}^{-2}_{(aq)} \rightarrow \text{Ni}_2\text{S}_{2(s)}$   
 C.  $\text{Ni}^{+2}_{(aq)} + \text{S}^{-2}_{(aq)} \rightarrow \text{NiS}_{(s)}$  D. it does not have precipitate equation because it is soluble in water.
- Which of the following is a binary acid?  
 A.  $\text{H}_2\text{S}$  B.  $\text{H}_2\text{CO}_3$  C.  $\text{H}_2\text{O}_2$  D. all of them are correct
- All of the following statements are true about the collision theory except:  
 A. all collisions between particles of reactant leads to the occurrence of the chemical reaction  
 B. the reaction rate is directly proportional with the number of effective collision.  
 C. in order for chemical reaction to occur, the reacting particles must collide  
 D. the particles of reactants must have enough energy to initiate the reaction.
- When barium chloride solution is mixed with sodium nitrate:  
 A. sodium chloride precipitates B. barium nitrate precipitates  
 C. precipitation does not occur D. Both ( A + B ) are correct
- All of them are correct except:  
 A. An ionic compound at solid state does not conduct electric current.  
 B. Alloy is a mixture the atoms of two or more metals are uniformly mixed.  
 C. The Brownian motion is a motion due to collision rapidly moving molecules.  
 D. HCl does not soluble in water.
- In the following reaction :  $(\text{BF}_{3(aq)} + \text{F}^{-}_{(aq)} \rightarrow \text{BF}_4^{-}_{(aq)})$  which of the following is Lewis base?  
 A.  $\text{F}^{-}$  B.  $\text{BF}_3$  C.  $\text{BF}_4^{-}$  D. none of them is correct
- Which of the following represents the formation equation?  
 A.  $\text{N}_2 + \text{O}_2 \rightarrow 2\text{NO}$  B.  $\text{C}_{(\text{graphite})} + \text{O}_2 \rightarrow \text{CO}_2$  C.  $\text{CO} + \frac{1}{2} \text{O}_2 \rightarrow \text{CO}_2$  D.  $\text{CO}_2 \rightarrow \text{C}_{(\text{graphite})} + \text{O}_2$
- Which of the following is the equilibrium constant for an anion hydrolysis reaction?  
 A.  $\frac{[\text{HB}][\text{OH}^{-}]}{[\text{B}^{-}]}$  B.  $\frac{[\text{B}^{-}]}{[\text{HB}][\text{OH}^{-}]}$  C.  $\frac{[\text{HB}]}{[\text{B}^{-}][\text{OH}^{-}]}$  D.  $\frac{[\text{B}^{-}][\text{OH}^{-}]}{[\text{HB}]}$

- A proposed mechanism for the reaction is:- slow :  $2\text{NO} + \text{H}_2 \rightarrow \text{N}_2\text{O} + \text{H}_2\text{O}$   
 fast :  $\text{N}_2\text{O} + \text{H}_2 \rightarrow \text{N}_2 + \text{H}_2\text{O}$  which of the following is correct ?  
 A.  $R = k[\text{NO}][\text{H}_2]$  B. overall balanced equation for the reaction is :  $2\text{NO} + 2\text{H}_2 \rightarrow \text{N}_2 + 2\text{H}_2\text{O}$   
 C. the reaction order is second D. Both (A+C) are correct
- In the following an exothermic gaseous reaction :  $(2\text{CO} + \text{O}_2 \rightarrow 2\text{CO}_2)$  , which of the following statements is true about the reaction ?  
 A. The reaction is always spontaneous. B. The reaction is never spontaneous.  
 C. The reaction is spontaneous at low temperature. D. The reaction is spontaneous at high temperature.
- Which of the following ions hydrolyze in aqueous solution?  
 A.  $\text{NO}_3^{-}$  B.  $\text{CO}_3^{2-}$  C.  $\text{SO}_4^{2-}$  D. none of them is correct
- The common-ion causes:  
 A. increasing precipitation. B. decreasing ionization.  
 C. shifting equilibrium to left. D. all of them are correct.
- In the following hypothetical reaction :  $(\text{A}_2 + \text{B}_2 \rightarrow 2\text{AB} + 30\text{kJ})$ , the activation energy for the forward reaction equal  $50\text{kJ/mol}$  ,the activation energy for reverse reaction is equal to  
 A.  $20\text{kJ/mol}$  B.  $80\text{kJ/mol}$  C.  $-80\text{kJ/mol}$  D.  $10\text{kJ/mol}$
- Unknown liquid miscible with toluene and immiscible with water which of the following statements is correct?  
 A. an aqueous solution for the liquid conducts electric current. B. a liquid is nonpolar molecular compound.  
 C. a liquid is polar molecular compound. D. none of them
- The solubility product of cadmium carbonate,  $\text{CdCO}_3$  , is  $1.0 \times 10^{-12}$  .In a saturated solution of this salt, the concentration of carbonate ions is:  
 A.  $5 \times 10^{-13} \text{ M}$  B.  $3 \times 10^{-6} \text{ M}$  C.  $1 \times 10^{-6} \text{ M}$  D.  $5 \times 10^{-7} \text{ M}$
- The energy required to raise the reactant to the level of the activated complex is:  
 A. Activation energy B. Free energy C. Kinetic energy D. Energy of reaction
- For an exothermic dissolution process, the increasing of the temperature causes:  
 A. increasing dissolution B. decreasing dissolution C. decreasing crystallization D. Both (A+C) are correct
- The concentration of  $\text{H}_3\text{O}^{+}$  ions in aqueous solution of  $\text{Ba}(\text{OH})_2$  is  $1 \times 10^{-11} \text{ M}$ , what is the molar concentration of solution?  
 A.  $1 \times 10^{-3} \text{ M}$  B.  $2 \times 10^{-4} \text{ M}$  C.  $2 \times 10^{-3} \text{ M}$  D.  $5 \times 10^{-4} \text{ M}$
- Adding  $\text{NH}_4\text{Cl}$  to  $\text{NH}_3$  solution leads to:  
 A. decrease  $[\text{NH}_3]$  B. increase  $[\text{OH}^{-}]$  C. increase ionization of  $\text{NH}_3$  D. increase  $[\text{H}_3\text{O}^{+}]$
- The boiling-point elevation of a solvent is  $2.4^{\circ}\text{C}$ , when the concentration of the solution containing a nonelectrolyte solute is  $3.1\text{m}$ , what is the value of molal boiling-point constant?  
 A.  $1.29^{\circ}\text{C/m}$  B.  $-0.77^{\circ}\text{C/m}$  C.  $7.44^{\circ}\text{C/m}$  D.  $0.77^{\circ}\text{C/m}$
- The solution that contains the precisely known concentration of a solute is known as:  
 A. saturated solution B. dilute solution C. standard solution D. buffer solution
- A substance that formed when a strong acid has lost a proton  
 A. strong conjugate base B. weak conjugate acid C. weak conjugate base D. cations

25. the spectator ion in the following reaction ( $Al_{(s)} + H_2SO_{4(aq)} \rightarrow$  ), is;  
 A.  $SO_4^{2-}$  B.  $Al^{+3}$  C.  $H_3O^+$  D. all of them are correct.
26. A substance that can react as an acid or a base :  
 A.  $SO_4^{2-}$  B.  $HSO_3^-$  C.  $CH_3COO^-$  D.  $NH_4^+$
27. When polar compound ionizes completely in water the compound is:  
 A. ionic electrolyte. B. weak electrolyte. C. non-electrolyte molecular. D. strong molecular electrolyte.
28. The entropy increases at:  
 A. evaporating of liquid B. temperature raising. C. increase pressure D. both(A+B) are correct
29. In the following reaction :( $2HCl_{(g)} + 184.6kJ \rightarrow H_{2(g)} + Cl_{2(g)}$ ), the standard formation enthalpy of HCl equals :  
 A. 184.6kJ/mol B. -184.6kJ/mol C. -92.3kJ/mol D. 92.3kJ/mol
30. How much energy would be absorbed as heat by 75g of iron when heated from 295K to 301K if its specific heat is 0.449J/g.K?  
 A. 202kJ B. 27.83J C. 1002J D. 202J
31. The rate law of the following reaction:  $A + 2B \rightarrow AB_2$ , is  $R = k[B]^2$ , what happens to the reaction rate when the concentration of both reactants is doubled?  
 A. the reaction rate remains the same. B. the reaction rate increases by a factor of two.  
 C. the reaction rate increases by a factor of four. D. the reaction rate increases by a factor eight.
32. The enthalpy change that occurs during the complete combustion of one mole of an element or compound is called:  
 A. Enthalpy of formation. B. Enthalpy of solution. C. Enthalpy of combustion. D. Specific Heat
33. A reaction has  $\Delta H = -74.8kJ/mol$ ,  $\Delta S = -0.081kJ/mol.K$  at  $27^\circ C$  which of the following is correct?  
 A.  $\Delta G = 50.5 kJ/mol$ , nonspontaneous. B.  $\Delta G = -72.8 kJ/mol$ , spontaneous.  
 C.  $\Delta G = 72.8 kJ/mol$ , nonspontaneous D.  $\Delta G = -50.5 kJ/mol$ , spontaneous.
34. The pH of an aqueous solution composed  $2 \times 10^{-4} mol$  of  $H_3O^+$  ions in 250 mL of its solution is equal to :-  
 A. 3.1 B. 3.7 C. 10.9 D. 10.3
35. The strength of an acid does not depend on:  
 A. The polarity of the bond between hydrogen and the element it is bonded. B. the bond energy  
 C. the number of hydrogen atoms in the chemical acid formula. D. both (A+B) are correct
36. The dilute aqueous solution of a weak acid contains:  
 A. hydronium ions. B. acid molecules. C. anions. D. all of them are correct
37. The value of equilibrium constant for this gaseous reaction :( $N_2O_4 \rightleftharpoons 2NO_2$ ) is 0.1 at a specified temperature, what would be the value of that constant for the reverse reaction at the same condition?  
 A. 0.05 B. 0.1 C. 10 D. 5
38. A solution made from ethanol,  $C_2H_5OH$ , and water is 1.76m in ethanol. How many moles of ethanol are contained per 250g of water?  
 A. 0.142mol B. 0.44mol C. 20.24mol D. 7.04mol
39. The methyl orange is used to determine the equivalence point in one of the following titration: If the pH range for transition interval is (3.1- 4.4):  
 A. HCl,  $NH_3$  B.  $CH_3COOH$ , NaOH C.  $HNO_3$ , NaOH D.  $NH_3$ ,  $CH_3COOH$
40. In equilibrium gaseous reaction:  $2NO + Cl_2 \rightleftharpoons 2NOCl + \text{energy}$ , which of the following shift the reaction to the right ?  
 A. adding catalyst B. decreasing system volume C. increasing temperature D. decreasing pressure
41. Aqueous solution of  $NH_3$  is an Arrhenius base because:  
 A. it is proton acceptor. B. it increases the concentration of hydronium ion.  
 C. it is an electron pair donor. D. it increases the concentration of hydroxide ion.
42. While mixing a small quantity of water with a large quantity of ethanol, water considered as :-  
 A. solvent B. solute C. solution D. none of them
43. In aqueous solution contains,  $Ca^{+2}$ ,  $SO_4^{2-}$  ions,  $CaSO_4$  precipitates if :  
 A.  $[Ca^{+2}][SO_4^{2-}] = K_{sp}$  B.  $[Ca^{+2}][SO_4^{2-}] > K_{sp}$  C.  $[Ca^{+2}][SO_4^{2-}] < K_{sp}$  D. can not be determined
44. Calculate the moles of NaOH if 100 mL of its solution neutralized with 200 mL of 0.01M HBr ?  
 A. 0.01mol B. 0.002mol C. 0.001mol D. 0.02mol
45. The following reaction :( $2A + B \rightarrow A_2B$ ) is occur by one step mechanism the rate law for the reaction is:  
 A.  $R = k[A][B]$  B.  $R = k[A_2B]$  C.  $R = k[A]^2[B]$  D.  $R = k[A][B]^2$
46. In the following gaseous reaction: ( $N_2 + 3H_2 \rightleftharpoons 2NH_3$ ) it was found the  $[NH_3] = 0.62 M$ ,  $[H_2] = 0.14 M$ ,  $[N_2] = 0.45 M$  the value of the equilibrium constant equals:  
 A.  $3.2 \times 10^{-3}$  B.  $3.11 \times 10^2$  C.  $3.11 \times 10^{-2}$  D. 9.84
47. Which of the following solutions with the same concentrations has lower  $[H_3O^+]$ ?  
 A. HCl B.  $H_2O$  C.  $NH_3$  D. HF
48. The rate of the slow reaction increases by :  
 A. the addition of a catalyst. B. increasing activation energy  
 C. increasing concentration. D. Both (A+C) are correct
49. How many moles of ammonium sulfate must be dissociate to produce 0.4 mol of sulfate ion?  
 A. 0.2 mol B. 0.4 mol C. 0.6 mol D. 0.8 mol
50. The boiling point of a solution is higher than that of a pure solvent because :-  
 A. Vapor-pressure lowering B. Freezing- point heightening  
 C. Vapor-pressure heightening D. none of them



Answer the following questions : ( two marks for each right choice )

- How much energy would be absorbed as heat by 75g of iron when heated from 295K to 301K if its specific heat is 0.449J/g.K?  
A. 202kJ B. 27.83J C. 1002J D. 202J
- Adding  $\text{NH}_4\text{Cl}$  to  $\text{NH}_3$  solution leads to:  
A. decrease  $[\text{NH}_3]$  B. increase  $[\text{OH}^-]$  C. increase ionization of  $\text{NH}_3$  D. increase  $[\text{H}_3\text{O}^+]$
- How many moles of ammonium sulfate must be dissociate to produce 0.4 mol of sulfate ion?  
A. 0.2 mol B. 0.4 mol C. 0.6 mol D. 0.8 mol
- In the following an exothermic gaseous reaction :  $(2\text{CO} + \text{O}_2 \rightarrow 2\text{CO}_2)$  , which of the following statements is true about the reaction ?  
A. The reaction is always spontaneous. B. The reaction is never spontaneous.  
C. The reaction is spontaneous at low temperature. D. The reaction is spontaneous at high temperature.
- When barium chloride solution is mixed with sodium nitrate:  
A. sodium chloride precipitates B. barium nitrate precipitates  
C. precipitation does not occur D. Both ( A + B ) are correct
- A solution made from ethanol ,  $\text{C}_2\text{H}_5\text{OH}$ , and water is 1.76m in ethanol .How many moles of ethanol are contained per 250g of water?  
A. 0.142mol B. 0.44mol C. 20.24mol D. 7.04mol
- In equilibrium gaseous reaction:  $2\text{NO} + \text{Cl}_2 \rightleftharpoons 2\text{NOCl} + \text{energy}$ , which of the following shift the reaction to the right ?  
A. adding catalyst B. decreasing system volume C. increasing temperature D. decreasing pressure
- For an exothermic dissolution process, the increasing of the temperature causes:  
A. increasing dissolution B. decreasing dissolution C. decreasing crystallization D. Both (A+C) are correct
- Which of the following is the equilibrium constant for an anion hydrolysis reaction?  
A.  $\frac{[\text{HB}][\text{OH}^-]}{[\text{B}^-]}$  B.  $\frac{[\text{B}^-]}{[\text{HB}][\text{OH}^-]}$  C.  $\frac{[\text{HB}]}{[\text{B}^-][\text{OH}^-]}$  D.  $\frac{[\text{B}^-][\text{OH}^-]}{[\text{HB}]}$
- The pH of an aqueous solution composed  $2 \times 10^{-4}$  mol of  $\text{H}_3\text{O}^+$  ions in 250 mL of its solution is equal to :-  
A. 3.1 B. 3.7 C. 10.9 D. 10.3
- Which of the following ions hydrolyze in aqueous solution?  
A.  $\text{NO}_3^-$  B.  $\text{CO}_3^{2-}$  C.  $\text{SO}_4^{2-}$  D. none of them is correct
- Which of the following is homogenous mixture?  
A. milk B. 24-karat gold C. tap water D. oil and water

13. Which one of the following statements is incorrect?

- Many solids dissolve more quickly in a cold solvent than in warm solvent.
- Gases are generally more soluble in water at low temperature.
- Aqueous solution is a mixture containing the solute soluble in water as a solvent.
- The effect of stirring is similar to that of crushing a solid – contact between the solvent and the solute surface is increased.

14. In the following reaction :  $(2\text{HCl}_{(g)} + 184.6\text{kJ} \rightarrow \text{H}_{2(g)} + \text{Cl}_{2(g)})$ , the standard formation enthalpy of HCl equals :

- 184.6kJ/mol B. -184.6kJ/mol C. -92.3kJ/mol D. 92.3kJ/mol

15. The boiling point of a solution is higher than that of a pure solvent because :-

- Vapor-pressure lowering B. Freezing- point heightening  
C. Vapor-pressure heightening D. none of them

16. the spectator ion in the following reaction  $(\text{Al}_{(s)} + \text{H}_2\text{SO}_{4(aq)} \rightarrow \quad)$ , is;

- $\text{SO}_4^{2-}$  B.  $\text{Al}^{+3}$  C.  $\text{H}_3\text{O}^+$  D. all of them are correct.

17. Calculate the moles of NaOH if 100 mL of its solution neutralized with 200 mL of 0.01M HBr ?

- 0.01mol B. 0.002mol C. 0.001mol D. 0.02mol

18. The energy required to raise the reactant to the level of the activated complex is:

- Activation energy B. Free energy C. Kinetic energy D. Energy of reaction

19. Which of the following solutions with the same concentrations has lower  $[\text{H}_3\text{O}^+]$ ?

- HCl B.  $\text{H}_2\text{O}$  C.  $\text{NH}_3$  D. HF

20. In the following gaseous reaction:  $(\text{N}_2 + 3\text{H}_2 \rightleftharpoons 2\text{NH}_3)$  it was found the  $[\text{NH}_3] = 0.62 \text{ M}$ ,  $[\text{H}_2] = 0.14 \text{ M}$ ,  $[\text{N}_2] = 0.45 \text{ M}$  the value of the equilibrium constant equals:

- $3.2 \times 10^{-3}$  B.  $3.11 \times 10^2$  C.  $3.11 \times 10^{-2}$  D. 9.84

21. The entropy increases at:

- evaporating of liquid B. temperature raising. C. increase pressure D. both(A+B) are correct

22. A substance that can react as an acid or a base :

- $\text{SO}_4^{2-}$  B.  $\text{HSO}_3^-$  C.  $\text{CH}_3\text{COO}^-$  D.  $\text{NH}_4^+$

23. A substance that formed when a strong acid has lost a proton

- strong conjugate base B. weak conjugate acid C. weak conjugate base D. cations

24. Which of the following represents the formation equation?

- $\text{N}_2 + \text{O}_2 \rightarrow 2\text{NO}$  B.  $\text{C}_{(\text{graphite})} + \text{O}_2 \rightarrow \text{CO}_2$  C.  $\text{CO} + 1/2 \text{O}_2 \rightarrow \text{CO}_2$  D.  $\text{CO}_2 \rightarrow \text{C}_{(\text{graphite})} + \text{O}_2$

25. All of the following statements are true about the collision theory except:

- all collisions between particles of reactant leads to the occurrence of the chemical reaction
- the reaction rate is directly proportional with the number of effective collision.
- in order for chemical reaction to occur, the reacting particles must collide
- the particles of reactants must have enough energy to initiate the reaction.

26. In the following reaction :  $(\text{BF}_{3(aq)} + \text{F}^-_{(aq)} \rightarrow \text{BF}_4^-_{(aq)})$  which of the following is Lewis base?

- $\text{F}^-$  B.  $\text{BF}_3$  C.  $\text{BF}_4^-$  D. none of them is correct

27. The common-ion causes:  
 A. increasing precipitation. B. decreasing ionization.  
 C. shifting equilibrium to left. D. all of them are correct.
28. The solubility product of cadmium carbonate,  $\text{CdCO}_3$ , is  $1.0 \times 10^{-12}$ . In a saturated solution of this salt, the concentration of carbonate ions is:  
 A.  $5 \times 10^{-13} \text{ M}$  B.  $3 \times 10^{-6} \text{ M}$  C.  $1 \times 10^{-6} \text{ M}$  D.  $5 \times 10^{-7} \text{ M}$
29. The dilute aqueous solution of a weak acid contains:  
 A. hydronium ions. B. acid molecules. C. anions. D. all of them are correct
30. The enthalpy change that occurs during the complete combustion of one mole of an element or compound is called:  
 A. Enthalpy of formation. B. Enthalpy of solution. C. Enthalpy of combustion. D. Specific Heat
31. The solution that contains the precisely known concentration of a solute is known as:  
 A. saturated solution B. dilute solution C. standard solution D. buffer solution
32. In the following hypothetical reaction :  $(\text{A}_2 + \text{B}_2 \rightarrow 2\text{AB} + 30\text{kJ})$ , the activation energy for the forward reaction equal  $50\text{kJ/mol}$ , the activation energy for reverse reaction is equal to  
 A.  $20\text{kJ/mol}$  B.  $80\text{kJ/mol}$  C.  $-80\text{kJ/mol}$  D.  $10\text{kJ/mol}$
33. The following reaction :  $(2\text{A} + \text{B} \rightarrow \text{A}_2\text{B})$  is occur by one step mechanism the rate law for the reaction is:  
 A.  $\text{R} = k[\text{A}][\text{B}]$  B.  $\text{R} = k[\text{A}_2\text{B}]$  C.  $\text{R} = k[\text{A}]^2[\text{B}]$  D.  $\text{R} = k[\text{A}][\text{B}]^2$
34. Unknown liquid miscible with toluene and immiscible with water which of the following statements is correct?  
 A. an aqueous solution for the liquid conducts electric current. B. a liquid is nonpolar molecular compound.  
 C. a liquid is polar molecular compound. D. none of them
35. The rate law of the following reaction:  $\text{A} + 2\text{B} \rightarrow \text{AB}_2$ , is  $\text{R} = k[\text{B}]^2$ , what happens to the reaction rate when the concentration of both reactants is doubled?  
 A. the reaction rate remains the same. B. the reaction rate increases by a factor of two.  
 C. the reaction rate increases by a factor of four. D. the reaction rate increases by a factor eight.
36. The strength of an acid does not depend on:  
 A. The polarity of the bond between hydrogen and the element it is bonded. B. the bond energy  
 C. the number of hydrogen atoms in the chemical acid formula. D. both (A+B) are correct
37. While mixing a small quantity of water with a large quantity of ethanol, water considered as :-  
 A. solvent B. solute C. solution D. none of them
38. In aqueous solution contains,  $\text{Ca}^{+2}, \text{SO}_4^{2-}$  ions,  $\text{CaSO}_4$  precipitates if :  
 A.  $[\text{Ca}^{+2}][\text{SO}_4^{2-}] = K_{sp}$  B.  $[\text{Ca}^{+2}][\text{SO}_4^{2-}] > K_{sp}$  C.  $[\text{Ca}^{+2}][\text{SO}_4^{2-}] < K_{sp}$  D. can not be determined
39. The boiling-point elevation of a solvent is  $2.4^\circ\text{C}$ , when the concentration of the solution containing a nonelectrolyte solute is  $3.1\text{m}$ , what is the value of molal boiling-point constant?  
 A.  $1.29^\circ\text{C}/\text{m}$  B.  $-0.77^\circ\text{C}/\text{m}$  C.  $7.44^\circ\text{C}/\text{m}$  D.  $0.77^\circ\text{C}/\text{m}$
40. A proposed mechanism for the reaction is:- slow :  $2\text{NO} + \text{H}_2 \rightarrow \text{N}_2\text{O} + \text{H}_2\text{O}$   
 fast :  $\text{N}_2\text{O} + \text{H}_2 \rightarrow \text{N}_2 + \text{H}_2\text{O}$  which of the following is correct ?  
 A.  $\text{R} = k[\text{NO}][\text{H}_2]$  B. overall balanced equation for the reaction is :  $2\text{NO} + 2\text{H}_2 \rightarrow \text{N}_2 + 2\text{H}_2\text{O}$   
 C. the reaction order is second D. Both (A+C) are correct
41. The value of equilibrium constant for this gaseous reaction :  $(\text{N}_2\text{O}_4 \rightleftharpoons 2\text{NO}_2)$  is 0.1 at a specified temperature, what would be the value of that constant for the reverse reaction at the same condition?  
 A. 0.05 B. 0.1 C. 10 D. 5
42. All of them are correct except:  
 A. An ionic compound at solid state does not conduct electric current.  
 B. Alloy is a mixture the atoms of two or more metals are uniformly mixed.  
 C. The Brownian motion is a motion due to collision rapidly moving molecules.  
 D. HCl does not soluble in water.
43. When polar compound ionizes completely in water the compound is:  
 A. ionic electrolyte. B. weak electrolyte. C. non-electrolyte molecular. D. strong molecular electrolyte.
44. Which of the following is a binary acid?  
 A.  $\text{H}_2\text{S}$  B.  $\text{H}_2\text{CO}_3$  C.  $\text{H}_2\text{O}_2$  D. all of them are correct
45. The rate of the slow reaction increases by :  
 A. the addition of a catalyst. B. increasing activation energy  
 C. increasing concentration. D. Both (A+C) are correct
46. The methyl orange is used to determine the equivalence point in one of the following titration: If the pH range for transition interval is (3.1- 4.4):  
 A.  $\text{HCl}, \text{NH}_3$  B.  $\text{CH}_3\text{COOH}, \text{NaOH}$  C.  $\text{HNO}_3, \text{NaOH}$  D.  $\text{NH}_3, \text{CH}_3\text{COOH}$
47. The concentration of  $\text{H}_3\text{O}^+$  ions in aqueous solution of  $\text{Ba}(\text{OH})_2$  is  $1 \times 10^{-11} \text{ M}$ , what is the molar concentration of solution?  
 A.  $1 \times 10^{-3} \text{ M}$  B.  $2 \times 10^{-4} \text{ M}$  C.  $2 \times 10^{-3} \text{ M}$  D.  $5 \times 10^{-4} \text{ M}$
48. Aqueous solution of  $\text{NH}_3$  is an Arrhenius base because:  
 A. it is proton acceptor. B. it increases the concentration of hydronium ion.  
 C. it is an electron pair donor. D. it increases the concentration of hydroxide ion.
49. The net ionic equation for the precipitation Nickel ( II )sulfide is :  
 A.  $\text{NiS}_{(s)} \rightarrow \text{Ni}^{+2}_{(aq)} + \text{S}^{-2}_{(aq)}$  B.  $2\text{Ni}^{+2}_{(aq)} + 2\text{S}^{-2}_{(aq)} \rightarrow \text{Ni}_2\text{S}_{2(s)}$   
 C.  $\text{Ni}^{+2}_{(aq)} + \text{S}^{-2}_{(aq)} \rightarrow \text{NiS}_{(s)}$  D. it does not have precipitate equation because it is soluble in water.
50. A reaction has  $\Delta H = -74.8\text{kJ/mol}$ ,  $\Delta S = -0.081\text{kJ/mol.K}$  at  $27^\circ\text{C}$  which of the following is correct?  
 A.  $\Delta G = 50.5\text{kJ/mol}$ , nonspontaneous . B.  $\Delta G = -72.8\text{kJ/mol}$ , spontaneous.  
 C.  $\Delta G = 72.8\text{kJ/mol}$ , nonspontaneous D.  $\Delta G = -50.5\text{kJ/mol}$ , spontaneous.



Answer the following questions : ( two marks for each right choice )

- The rate of the slow reaction increases by :  
 A. the addition of a catalyst. B. increasing activation energy  
 C. increasing concentration. D. Both (A+C) are correct
- Which of the following solutions with the same concentrations has lower  $[H_3O^+]$ ?  
 A. HCl B.  $H_2O$  C.  $NH_3$  D. HF
- While mixing a small quantity of water with a large quantity of ethanol, water considered as :-  
 A. solvent B. solute C. solution D. none of them
- The boiling point of a solution is higher than that of a pure solvent because :-  
 A. Vapor-pressure lowering B. Freezing- point heightening  
 C. Vapor-pressure heightening D. none of them
- The value of equilibrium constant for this gaseous reaction :  $(N_2O_4 \rightleftharpoons 2NO_2)$  is 0.1 at a specified temperature, what would be the value of that constant for the reverse reaction at the same condition?  
 A. 0.05 B. 0.1 C. 10 D. 5
- In aqueous solution contains,  $Ca^{+2}, SO_4^{2-}$  ions,  $CaSO_4$  precipitates if :  
 A.  $[Ca^{+2}][SO_4^{2-}] = K_{sp}$  B.  $[Ca^{+2}][SO_4^{2-}] > K_{sp}$  C.  $[Ca^{+2}][SO_4^{2-}] < K_{sp}$  D. can not be determined
- The strength of an acid does not depend on:  
 A. The polarity of the bond between hydrogen and the element it is bonded. B. the bond energy  
 C. the number of hydrogen atoms in the chemical acid formula. D. both (A+B) are correct
- In the following hypothetical reaction :  $(A_2 + B_2 \rightarrow 2AB + 30kJ)$ , the activation energy for the forward reaction equal 50kJ/mol, the activation energy for reverse reaction is equal to  
 A. 20kJ/mol B. 80kJ/mol C. -80kJ/mol D. 10kJ/mol
- Adding  $NH_4Cl$  to  $NH_3$  solution leads to:  
 A. decrease  $[NH_3]$  B. increase  $[OH^-]$  C. increase ionization of  $NH_3$  D. increase  $[H_3O^+]$
- The solubility product of cadmium carbonate,  $CdCO_3$ , is  $1.0 \times 10^{-12}$ . In a saturated solution of this salt, the concentration of carbonate ions is:  
 A.  $5 \times 10^{-13} M$  B.  $3 \times 10^{-6} M$  C.  $1 \times 10^{-6} M$  D.  $5 \times 10^{-7} M$
- Which one of the following statements is incorrect?  
 A. Many solids dissolve more quickly in a cold solvent than in warm solvent.  
 B. Gases are generally more soluble in water at low temperature.  
 C. Aqueous solution is a mixture containing the solute soluble in water as a solvent.  
 D. The effect of stirring is similar to that of crushing a solid – contact between the solvent and the solute surface is increased.
- The enthalpy change that occurs during the complete combustion of one mole of an element or compound is called:  
 A. Enthalpy of formation. B. Enthalpy of solution. C. Enthalpy of combustion. D. Specific Heat

- Which of the following is a binary acid?  
 A.  $H_2S$  B.  $H_2CO_3$  C.  $H_2O_2$  D. all of them are correct
- The solution that contains the precisely known concentration of a solute is known as:  
 A. saturated solution B. dilute solution C. standard solution D. buffer solution
- Calculate the moles of NaOH if 100 mL of its solution neutralized with 200 mL of 0.01M HBr ?  
 A. 0.01mol B. 0.002mol C. 0.001mol D. 0.02mol
- In the following an exothermic gaseous reaction :  $(2CO + O_2 \rightarrow 2CO_2)$ , which of the following statements is true about the reaction ?  
 A. The reaction is always spontaneous. B. The reaction is never spontaneous.  
 C. The reaction is spontaneous at low temperature. D. The reaction is spontaneous at high temperature.
- In the following reaction :  $(BF_3(aq) + F^-(aq) \rightarrow BF_4^-(aq))$  which of the following is Lewis base?  
 A.  $F^-$  B.  $BF_3$  C.  $BF_4^-$  D. none of them is correct
- The pH of an aqueous solution composed  $2 \times 10^{-4}$  mol of  $H_3O^+$  ions in 250 mL of its solution is equal to :-  
 A. 3.1 B. 3.7 C. 10.9 D. 10.3
- A reaction has  $\Delta H = -74.8 kJ/mol$ ,  $\Delta S = -0.081 kJ/mol.K$  at  $27^\circ C$  which of the following is correct?  
 A.  $\Delta G = 50.5 kJ/mol$ , nonspontaneous. B.  $\Delta G = -72.8 kJ/mol$ , spontaneous.  
 C.  $\Delta G = 72.8 kJ/mol$ , nonspontaneous D.  $\Delta G = -50.5 kJ/mol$ , spontaneous.
- In equilibrium gaseous reaction:  $2NO + Cl_2 \rightleftharpoons 2NOCl + \text{energy}$ , which of the following shift the reaction to the right ?  
 A. adding catalyst B. decreasing system volume C. increasing temperature D. decreasing pressure
- How much energy would be absorbed as heat by 75g of iron when heated from 295K to 301K if its specific heat is  $0.449 J/g.K$ ?  
 A. 202kJ B. 27.83J C. 1002J D. 202J
- How many moles of ammonium sulfate must be dissociate to produce 0.4 mol of sulfate ion?  
 A. 0.2 mol B. 0.4 mol C. 0.6 mol D. 0.8 mol
- Aqueous solution of  $NH_3$  is an Arrhenius base because:  
 A. it is proton acceptor. B. it increases the concentration of hydronium ion.  
 C. it is an electron pair donor. D. it increases the concentration of hydroxide ion.
- The boiling-point elevation of a solvent is  $2.4^\circ C$ , when the concentration of the solution containing a nonelectrolyte solute is 3.1m, what is the value of molal boiling-point constant?  
 A.  $1.29^\circ C/m$  B.  $-0.77^\circ C/m$  C.  $7.44^\circ C/m$  D.  $0.77^\circ C/m$
- When polar compound ionizes completely in water the compound is:  
 A. ionic electrolyte. B. weak electrolyte. C. non-electrolyte molecular. D. strong molecular electrolyte.
- A proposed mechanism for the reaction is:- slow :  $2NO + H_2 \rightarrow N_2O + H_2O$   
 fast :  $N_2O + H_2 \rightarrow N_2 + H_2O$  which of the following is correct ?  
 A.  $R = k[NO][H_2]$  B. overall balanced equation for the reaction is :  $2NO + 2H_2 \rightarrow N_2 + 2H_2O$   
 C. the reaction order is second D. Both (A+C) are correct

27. The entropy increases at:  
 A. evaporating of liquid    B. temperature raising.    C. increase pressure    D. both(A+B) are correct
28. All of the following statements are true about the collision theory except:  
 A. all collisions between particles of reactant leads to the occurrence of the chemical reaction  
 B. the reaction rate is directly proportional with the number of effective collision.  
 C. in order for chemical reaction to occur, the reacting particles must collide  
 D. the particles of reactants must have enough energy to initiate the reaction.
29. The concentration of  $H_3O^+$  ions in aqueous solution of  $Ba(OH)_2$  is  $1 \times 10^{-11} M$ , what is the molar concentration of solution?  
 A.  $1 \times 10^{-3} M$     B.  $2 \times 10^{-4} M$     C.  $2 \times 10^{-3} M$     D.  $5 \times 10^{-4} M$
30. For an exothermic dissolution process, the increasing of the temperature causes:  
 A. increasing dissolution    B. decreasing dissolution    C. decreasing crystallization    D. Both (A+C) are correct
31. A substance that formed when a strong acid has lost a proton  
 A. strong conjugate base    B. weak conjugate acid    C. weak conjugate base    D. cations
32. The rate law of the following reaction:  $A + 2B \rightarrow AB_2$ , is  $R = k[B]^2$ , what happens to the reaction rate when the concentration of both reactants is doubled?  
 A. the reaction rate remains the same.    B. the reaction rate increases by a factor of two.  
 C. the reaction rate increases by a factor of four.    D. the reaction rate increases by a factor eight.
33. All of them are correct except:  
 A. An ionic compound at solid state does not conduct electric current.  
 B. Alloy is a mixture the atoms of two or more metals are uniformly mixed.  
 C. The Brownian motion is a motion due to collision rapidly moving molecules.  
 D. HCl does not soluble in water.
34. the spectator ion in the following reaction ( $Al_{(s)} + H_2SO_{4(aq)} \rightarrow$  ), is;  
 A.  $SO_4^{2-}$     B.  $Al^{+3}$     C.  $H_3O^+$     D. all of them are correct.
35. A solution made from ethanol,  $C_2H_5OH$ , and water is 1.76m in ethanol. How many moles of ethanol are contained per 250g of water?  
 A. 0.142mol    B. 0.44mol    C. 20.24mol    D. 7.04mol
36. Which of the following represents the formation equation?  
 A.  $N_2 + O_2 \rightarrow 2NO$     B.  $C_{(graphite)} + O_2 \rightarrow CO_2$     C.  $CO + \frac{1}{2} O_2 \rightarrow CO_2$     D.  $CO_2 \rightarrow C_{(graphite)} + O_2$
37. The energy required to raise the reactant to the level of the activated complex is:  
 A. Activation energy    B. Free energy    C. Kinetic energy    D. Energy of reaction
38. The dilute aqueous solution of a weak acid contains:  
 A. hydronium ions.    B. acid molecules.    C. anions.    D. all of them are correct
39. Which of the following is the equilibrium constant for an anion hydrolysis reaction?  
 A.  $\frac{[HB][OH^-]}{[B^-]}$     B.  $\frac{[B^-]}{[HB][OH^-]}$     C.  $\frac{[HB]}{[B^-][OH^-]}$     D.  $\frac{[B^-][OH^-]}{[HB]}$
40. Which of the following ions hydrolyze in aqueous solution?  
 A.  $NO_3^-$     B.  $CO_3^{2-}$     C.  $SO_4^{2-}$     D. none of them is correct
41. The net ionic equation for the precipitation Nickel ( II )sulfide is :  
 A.  $NiS_{(s)} \rightarrow Ni^{+2}_{(aq)} + S^{-2}_{(aq)}$     B.  $2Ni^{+2}_{(aq)} + 2S^{-2}_{(aq)} \rightarrow Ni_2S_{2(s)}$   
 C.  $Ni^{+2}_{(aq)} + S^{-2}_{(aq)} \rightarrow NiS_{(s)}$     D. it does not have precipitate equation because it is soluble in water.
42. Which of the following is homogenous mixture?  
 A. milk    B. 24-karat gold    C. tap water    D. oil and water
43. When barium chloride solution is mixed with sodium nitrate:  
 A. sodium chloride precipitates    B. barium nitrate precipitates  
 C. precipitation does not occur    D. Both ( A + B ) are correct
44. Unknown liquid miscible with toluene and immiscible with water which of the following statements is correct?  
 A. an aqueous solution for the liquid conducts electric current.    B. a liquid is nonpolar molecular compound.  
 C. a liquid is polar molecular compound.    D. none of them
45. A substance that can react as an acid or a base :  
 A.  $SO_4^{2-}$     B.  $HSO_3^-$     C.  $CH_3COO^-$     D.  $NH_4^+$
46. The following reaction :  $(2A + B \rightarrow A_2B)$  is occur by one step mechanism the rate law for the reaction is:  
 A.  $R = k[A][B]$     B.  $R = k[A_2B]$     C.  $R = k[A]^2[B]$     D.  $R = k[A][B]^2$
47. The common-ion causes:  
 A. increasing precipitation.    B. decreasing ionization.  
 C. shifting equilibrium to left.    D. all of them are correct.
48. The methyl orange is used to determine the equivalence point in one of the following titration: If the pH range for transition interval is (3.1- 4.4):  
 A. HCl,  $NH_3$     B.  $CH_3COOH, NaOH$     C.  $HNO_3, NaOH$     D.  $NH_3, CH_3COOH$
49. In the following reaction :  $( 2HCl_{(g)} + 184.6kJ \rightarrow H_{2(g)} + Cl_{2(g)} )$ , the standard formation enthalpy of HCl equals :  
 A. 184.6kJ/mol    B. -184.6kJ/mol    C. -92.3kJ/mol    D. 92.3kJ/mol
50. In the following gaseous reaction:  $(N_2 + 3H_2 \rightleftharpoons 2NH_3)$  it was found the  $[NH_3] = 0.62 M$ ,  $[H_2] = 0.14 M$ ,  $[N_2] = 0.45 M$  the value of the equilibrium constant equals:  
 A.  $3.2 \times 10^{-3}$     B.  $3.11 \times 10^2$     C.  $3.11 \times 10^{-2}$     D. 9.84

Answer the following questions : ( two marks for each right choice )

- A proposed mechanism for the reaction is:- slow :  $2\text{NO} + \text{H}_2 \rightarrow \text{N}_2\text{O} + \text{H}_2\text{O}$   
 fast :  $\text{N}_2\text{O} + \text{H}_2 \rightarrow \text{N}_2 + \text{H}_2\text{O}$  which of the following is correct ?  
 A.  $R = k[\text{NO}][\text{H}_2]$  B. overall balanced equation for the reaction is :  $2\text{NO} + 2\text{H}_2 \rightarrow \text{N}_2 + 2\text{H}_2\text{O}$   
 C. the reaction order is second D. Both (A+C) are correct
- Calculate the moles of NaOH if 100 mL of its solution neutralized with 200 mL of 0.01M HBr ?  
 A. 0.01mol B. 0.002mol C. 0.001mol D. 0.02mol
- In aqueous solution contains,  $\text{Ca}^{+2}$ ,  $\text{SO}_4^{2-}$  ions,  $\text{CaSO}_4$  precipitates if :  
 A.  $[\text{Ca}^{+2}][\text{SO}_4^{2-}] = K_{sp}$  B.  $[\text{Ca}^{+2}][\text{SO}_4^{2-}] > K_{sp}$  C.  $[\text{Ca}^{+2}][\text{SO}_4^{2-}] < K_{sp}$  D. can not be determined
- In the following reaction :  $(\text{BF}_3(\text{aq}) + \text{F}^-(\text{aq}) \rightarrow \text{BF}_4^-(\text{aq}))$  which of the following is Lewis base ?  
 A.  $\text{F}^-$  B.  $\text{BF}_3$  C.  $\text{BF}_4^-$  D. none of them is correct
- All of the following statements are true about the collision theory except:  
 A. all collisions between particles of reactant leads to the occurrence of the chemical reaction  
 B. the reaction rate is directly proportional with the number of effective collision.  
 C. in order for chemical reaction to occur, the reacting particles must collide  
 D. the particles of reactants must have enough energy to initiate the reaction.
- For an exothermic dissolution process, the increasing of the temperature causes:  
 A. increasing dissolution B. decreasing dissolution C. decreasing crystallization D. Both (A+C) are correct
- In the following gaseous reaction:  $(\text{N}_2 + 3\text{H}_2 \rightleftharpoons 2\text{NH}_3)$  it was found the  $[\text{NH}_3] = 0.62 \text{ M}$ ,  $[\text{H}_2] = 0.14 \text{ M}$ ,  $[\text{N}_2] = 0.45 \text{ M}$   
 the value of the equilibrium constant equals:  
 A.  $3.2 \times 10^{-3}$  B.  $3.11 \times 10^2$  C.  $3.11 \times 10^{-2}$  D. 9.84
- In equilibrium gaseous reaction:  $2\text{NO} + \text{Cl}_2 \rightleftharpoons 2\text{NOCl} + \text{energy}$ , which of the following shift the reaction to the right ?  
 A. adding catalyst B. decreasing system volume C. increasing temperature D. decreasing pressure
- Which of the following is a binary acid?  
 A.  $\text{H}_2\text{S}$  B.  $\text{H}_2\text{CO}_3$  C.  $\text{H}_2\text{O}_2$  D. all of them are correct
- The rate law of the following reaction:  $\text{A} + 2\text{B} \rightarrow \text{AB}_2$ , is  $R = k[\text{B}]^2$ , what happens to the reaction rate when the concentration of both reactants is doubled?  
 A. the reaction rate remains the same. B. the reaction rate increases by a factor of two.  
 C. the reaction rate increases by a factor of four. D. the reaction rate increases by a factor eight.
- A solution made from ethanol,  $\text{C}_2\text{H}_5\text{OH}$ , and water is 1.76m in ethanol .How many moles of ethanol are contained per 250g of water?  
 A. 0.142mol B. 0.44mol C. 20.24mol D. 7.04mol
- The following reaction :  $(2\text{A} + \text{B} \rightarrow \text{A}_2\text{B})$  is occur by one step mechanism the rate law for the reaction is:  
 A.  $R = k[\text{A}][\text{B}]$  B.  $R = k[\text{A}_2\text{B}]$  C.  $R = k[\text{A}]^2[\text{B}]$  D.  $R = k[\text{A}][\text{B}]^2$
- Which of the following ions hydrolyze in aqueous solution?  
 A.  $\text{NO}_3^-$  B.  $\text{CO}_3^{2-}$  C.  $\text{SO}_4^{2-}$  D. none of them is correct
- The solution that contains the precisely known concentration of a solute is known as:  
 A. saturated solution B. dilute solution C. standard solution D. buffer solution
- The solubility product of cadmium carbonate,  $\text{CdCO}_3$ , is  $1.0 \times 10^{-12}$ . In a saturated solution of this salt, the concentration of carbonate ions is:  
 A.  $5 \times 10^{-13} \text{ M}$  B.  $3 \times 10^{-6} \text{ M}$  C.  $1 \times 10^{-6} \text{ M}$  D.  $5 \times 10^{-7} \text{ M}$
- The methyl orange is used to determine the equivalence point in one of the following titration: If the pH range for transition interval is (3.1- 4.4):  
 A.  $\text{HCl}$ ,  $\text{NH}_3$  B.  $\text{CH}_3\text{COOH}$ ,  $\text{NaOH}$  C.  $\text{HNO}_3$ ,  $\text{NaOH}$  D.  $\text{NH}_3$ ,  $\text{CH}_3\text{COOH}$
- Adding  $\text{NH}_4\text{Cl}$  to  $\text{NH}_3$  solution leads to:  
 A. decrease  $[\text{NH}_3]$  B. increase  $[\text{OH}^-]$  C. increase ionization of  $\text{NH}_3$  D. increase  $[\text{H}_3\text{O}^+]$
- How many moles of ammonium sulfate must be dissociate to produce 0.4 mol of sulfate ion?  
 A. 0.2 mol B. 0.4 mol C. 0.6 mol D. 0.8 mol
- When polar compound ionizes completely in water the compound is:  
 A. ionic electrolyte. B. weak electrolyte. C. non-electrolyte molecular. D. strong molecular electrolyte.
- The boiling point of a solution is higher than that of a pure solvent because :-  
 A. Vapor-pressure lowering B. Freezing- point heightening  
 C. Vapor-pressure heightening D. none of them
- The strength of an acid does not depend on:  
 A. The polarity of the bond between hydrogen and the element it is bonded. B. the bond energy  
 C. the number of hydrogen atoms in the chemical acid formula. D. both (A+B) are correct
- The rate of the slow reaction increases by :  
 A. the addition of a catalyst. B. increasing activation energy  
 C. increasing concentration. D. Both (A+C) are correct
- Which of the following solutions with the same concentrations has lower  $[\text{H}_3\text{O}^+]$ ?  
 A.  $\text{HCl}$  B.  $\text{H}_2\text{O}$  C.  $\text{NH}_3$  D.  $\text{HF}$
- The energy required to raise the reactant to the level of the activated complex is:  
 A. Activation energy B. Free energy C. Kinetic energy D. Energy of reaction
- The pH of an aqueous solution composed  $2 \times 10^{-4} \text{ mol}$  of  $\text{H}_3\text{O}^+$  ions in 250 mL of its solution is equal to :-  
 A. 3.1 B. 3.7 C. 10.9 D. 10.3
- When barium chloride solution is mixed with sodium nitrate:  
 A. sodium chloride precipitates B. barium nitrate precipitates  
 C. precipitation does not occur D. Both ( A + B ) are correct
- the spectator ion in the following reaction  $(\text{Al}(\text{s}) + \text{H}_2\text{SO}_4(\text{aq}) \rightarrow \text{ } )$ , is;  
 A.  $\text{SO}_4^{2-}$  B.  $\text{Al}^{+3}$  C.  $\text{H}_3\text{O}^+$  D. all of them are correct.
- The value of equilibrium constant for this gaseous reaction :  $(\text{N}_2\text{O}_4 \rightleftharpoons 2\text{NO}_2)$  is 0.1 at a specified temperature, what would be the value of that constant for the reverse reaction at the same condition?  
 A. 0.05 B. 0.1 C. 10 D. 5

29. The net ionic equation for the precipitation Nickel ( II )sulfide is :  
 A.  $\text{NiS}_{(s)} \rightarrow \text{Ni}^{+2}_{(aq)} + \text{S}^{-2}_{(aq)}$       B.  $2\text{Ni}^{+2}_{(aq)} + 2\text{S}^{-2}_{(aq)} \rightarrow \text{Ni}_2\text{S}_{2(s)}$   
 C.  $\text{Ni}^{+2}_{(aq)} + \text{S}^{-2}_{(aq)} \rightarrow \text{NiS}_{(s)}$       D. it does not have precipitate equation because it is soluble in water.
30. The enthalpy change that occurs during the complete combustion of one mole of an element or compound is called:  
 A. Enthalpy of formation.    B. Enthalpy of solution.    C. Enthalpy of combustion.    D. Specific Heat
31. In the following hypothetical reaction :( $\text{A}_2 + \text{B}_2 \rightarrow 2\text{AB} + 30\text{kJ}$ ), the activation energy for the forward reaction equal 50kJ/mol ,the activation energy for reverse reaction is equal to  
 A.20kJ/mol      B. 80kJ/mol      C. -80kJ/mol      D.10kJ/mol
32. In the following an exothermic gaseous reaction :( $2\text{CO} + \text{O}_2 \rightarrow 2\text{CO}_2$ ) , which of the following statements is true about the reaction ?  
 A. The reaction is always spontaneous.      B. The reaction is never spontaneous.  
 C. The reaction is spontaneous at low temperature.      D. The reaction is spontaneous at high temperature.
33. The dilute aqueous solution of a weak acid contains:  
 A. hydronium ions.      B. acid molecules.      C. anions.      D. all of them are correct
34. How much energy would be absorbed as heat by 75g of iron when heated from 295K to 301K if its specific heat is 0.449J/g.K?  
 A. 202kJ      B.27.83J      C.1002J      D. 202J
35. Aqueous solution of  $\text{NH}_3$  is an Arrhenius base because:  
 A. it is proton acceptor.      B. it increases the concentration of hydronium ion.  
 C.it is an electron pair donor.      D.it increases the concentration of hydroxide ion.
36. A substance that can react as an acid or a base :  
 A.  $\text{SO}_4^{2-}$       B.  $\text{HSO}_3^-$       C. $\text{CH}_3\text{COO}^-$       D.  $\text{NH}_4^+$
37. Which of the following is the equilibrium constant for an anion hydrolysis reaction?  
 A.  $\frac{[\text{HB}][\text{OH}^-]}{[\text{B}^-]}$       B.  $\frac{[\text{B}^-]}{[\text{HB}][\text{OH}^-]}$       C.  $\frac{[\text{HB}]}{[\text{B}^-][\text{OH}^-]}$       D.  $\frac{[\text{B}^-][\text{OH}^-]}{[\text{HB}]}$
38. Which one of the following statements is incorrect?  
 A. Many solids dissolve more quickly in a cold solvent than in warm solvent.  
 B. Gases are generally more soluble in water at low temperature.  
 C. Aqueous solution is a mixture containing the solute soluble in water as a solvent.  
 D. The effect of stirring is similar to that of crushing a solid – contact between the solvent and the solute surface is increased.
39. While mixing a small quantity of water with a large quantity of ethanol, water considered as :-  
 A. solvent      B. solute      C. solution      D. none of them
40. All of them are correct except:  
 A. An ionic compound at solid state does not conduct electric current.  
 B. Alloy is a mixture the atoms of two or more metals are uniformly mixed.  
 C. The Brownian motion is a motion due to collision rapidly moving molecules.  
 D. HCl does not soluble in water.
41. In the following reaction :( $2\text{HCl}_{(g)} + 184.6\text{kJ} \rightarrow \text{H}_{2(g)} + \text{Cl}_{2(g)}$ ) , the standard formation enthalpy of HCl equals :  
 A. 184.6kJ/mol      B. -184.6kJ/mol      C. -92.3kJ/mol      D. 92.3kJ/mol
42. The common-ion causes:  
 A. increasing precipitation.      B. decreasing ionization.  
 C. shifting equilibrium to left.      D. all of them are correct.
43. A substance that formed when a strong acid has lost a proton  
 A. strong conjugate base      B. weak conjugate acid      C. weak conjugate base      D. cations
44. The concentration of  $\text{H}_3\text{O}^+$  ions in aqueous solution of  $\text{Ba}(\text{OH})_2$  is  $1 \times 10^{-11} \text{ M}$ , what is the molar concentration of solution?  
 A.  $1 \times 10^{-3} \text{ M}$       B.  $2 \times 10^{-4} \text{ M}$       C.  $2 \times 10^{-3} \text{ M}$       D.  $5 \times 10^{-4} \text{ M}$
45. A reaction has  $\Delta H = -74.8\text{kJ/mol}$  ,  $\Delta S = -0.081\text{kJ/mol.K}$  at  $27^\circ\text{C}$  which of the following is correct?  
 A.  $\Delta G = 50.5 \text{ kJ/mol}$  , nonspontaneous .      B.  $\Delta G = -72.8 \text{ kJ/mol}$  , spontaneous.  
 C.  $\Delta G = 72.8 \text{ kJ/mol}$  , nonspontaneous      D.  $\Delta G = -50.5 \text{ kJ/mol}$  , spontaneous.
46. Which of the following is homogenous mixture?  
 A. milk      B. 24-karat gold      C. tap water      D. oil and water
47. The boiling-point elevation of a solvent is  $2.4^\circ\text{C}$ , when the concentration of the solution containing a nonelectrolyte solute is 3.1m, what is the value of molal boiling-point constant?  
 A.  $1.29^\circ\text{C}/m$       B.  $-0.77^\circ\text{C}/m$       C.  $7.44^\circ\text{C}/m$       D.  $0.77^\circ\text{C}/m$
48. Which of the following represents the formation equation?  
 A.  $\text{N}_2 + \text{O}_2 \rightarrow 2\text{NO}$       B.  $\text{C}_{(\text{graphite})} + \text{O}_2 \rightarrow \text{CO}_2$       C.  $\text{CO} + 1/2 \text{O}_2 \rightarrow \text{CO}_2$       D.  $\text{CO}_2 \rightarrow \text{C}_{(\text{graphite})} + \text{O}_2$
49. The entropy increases at:  
 A. evaporating of liquid      B. temperature raising.      C. increase pressure      D. both(A+B) are correct
50. Unknown liquid miscible with toluene and immiscible with water which of the following statements is correct?  
 A. an aqueous solution for the liquid conducts electric current.      B. a liquid is nonpolar molecular compound.  
 C. a liquid is polar molecular compound.      D. none of them



Answer the following questions : ( two marks for each right choice )

- For an exothermic dissolution process, the increasing of the temperature causes:  
 A. increasing dissolution B. decreasing dissolution C. decreasing crystallization D. Both (A+C) are correct
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- How many moles of ammonium sulfate must be dissociate to produce 0.4 mol of sulfate ion?  
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- The entropy increases at:  
 A. evaporating of liquid B. temperature raising. C. increase pressure D. both(A+B) are correct
- Which of the following is homogenous mixture?  
 A. milk B. 24-karat gold C. tap water D. oil and water
- A proposed mechanism for the reaction is:- slow :  $2NO + H_2 \rightarrow N_2O + H_2O$   
 fast :  $N_2O + H_2 \rightarrow N_2 + H_2O$  which of the following is correct ?  
 A.  $R = k[NO][H_2]$  B. overall balanced equation for the reaction is :  $2NO + 2H_2 \rightarrow N_2 + 2H_2O$   
 C. the reaction order is second D. Both (A+C) are correct
- When polar compound ionizes completely in water the compound is:  
 A. ionic electrolyte. B. weak electrolyte. C. non-electrolyte molecular. D. strong molecular electrolyte.
- The energy required to raise the reactant to the level of the activated complex is:  
 A. Activation energy B. Free energy C. Kinetic energy D. Energy of reaction
- In the following hypothetical reaction :  $(A_2 + B_2 \rightarrow 2AB + 30kJ)$ , the activation energy for the forward reaction equal 50kJ/mol ,the activation energy for reverse reaction is equal to  
 A. 20kJ/mol B. 80kJ/mol C. -80kJ/mol D. 10kJ/mol
- A reaction has  $\Delta H = -74.8 kJ/mol$  ,  $\Delta S = -0.081 kJ/mol.K$  at  $27^\circ C$  which of the following is correct?  
 A.  $\Delta G = 50.5 kJ/mol$  , nonspontaneous . B.  $\Delta G = -72.8 kJ/mol$  , spontaneous.  
 C.  $\Delta G = 72.8 kJ/mol$  , nonspontaneous D.  $\Delta G = -50.5 kJ/mol$  , spontaneous.

13. Which of the following is the equilibrium constant for an anion hydrolysis reaction?

- A.  $\frac{[HB][OH^-]}{[B^-]}$  B.  $\frac{[B^-]}{[HB][OH^-]}$  C.  $\frac{[HB]}{[B^-][OH^-]}$  D.  $\frac{[B^-][OH^-]}{[HB]}$

14. In the following gaseous reaction:  $(N_2 + 3H_2 \rightleftharpoons 2NH_3)$  it was found the  $[NH_3] = 0.62 M$  ,  $[H_2] = 0.14 M$  ,  $[N_2] = 0.45 M$  the value of the equilibrium constant equals:

- A.  $3.2 \times 10^{-3}$  B.  $3.11 \times 10^2$  C.  $3.11 \times 10^{-2}$  D. 9.84

15. The net ionic equation for the precipitation Nickel ( II ) sulfide is :

- A.  $NiS_{(s)} \rightarrow Ni^{2+}_{(aq)} + S^{2-}_{(aq)}$  B.  $2Ni^{2+}_{(aq)} + 2S^{2-}_{(aq)} \rightarrow Ni_2S_{2(s)}$   
 C.  $Ni^{2+}_{(aq)} + S^{2-}_{(aq)} \rightarrow NiS_{(s)}$  D. it does not have precipitate equation because it is soluble in water.

16. Which of the following solutions with the same concentrations has lower  $[H_3O^+]$ ?

- A. HCl B.  $H_2O$  C.  $NH_3$  D. HF

17. Which of the following represents the formation equation?

- A.  $N_2 + O_2 \rightarrow 2NO$  B.  $C_{(graphite)} + O_2 \rightarrow CO_2$  C.  $CO + \frac{1}{2} O_2 \rightarrow CO_2$  D.  $CO_2 \rightarrow C_{(graphite)} + O_2$

18. The methyl orange is used to determine the equivalence point in one of the following titration: If the pH range for transition interval is (3.1- 4.4):

- A. HCl,  $NH_3$  B.  $CH_3COOH$ , NaOH C.  $HNO_3$ , NaOH D.  $NH_3$ ,  $CH_3COOH$

19. The solubility product of cadmium carbonate,  $CdCO_3$  , is  $1.0 \times 10^{-12}$  .In a saturated solution of this salt, the concentration of carbonate ions is:

- A.  $5 \times 10^{-13} M$  B.  $3 \times 10^{-6} M$  C.  $1 \times 10^{-6} M$  D.  $5 \times 10^{-7} M$

20. The strength of an acid does not depend on:

- A. The polarity of the bond between hydrogen and the element it is bonded. B. the bond energy  
 C. the number of hydrogen atoms in the chemical acid formula. D. both (A+B) are correct

21. the spectator ion in the following reaction  $(Al_{(s)} + H_2SO_{4(aq)} \rightarrow \quad)$  , is;

- A.  $SO_4^{2-}$  B.  $Al^{+3}$  C.  $H_3O^+$  D. all of them are correct.

22. The rate law of the following reaction:  $A + 2B \rightarrow AB_2$  ,is  $R = k[B]^2$  , what happens to the reaction rate when the concentration of both reactants is doubled?

- A. the reaction rate remains the same. B. the reaction rate increases by a factor of two.  
 C. the reaction rate increases by a factor of four. D. the reaction rate increases by a factor eight.

23. The dilute aqueous solution of a weak acid contains:

- A. hydronium ions. B. acid molecules. C. anions. D. all of them are correct

24. In the following reaction :  $(BF_{3(aq)} + F^-_{(aq)} \rightarrow BF_4^-_{(aq)})$  which of the following is Lewis base?

- A.  $F^-$  B.  $BF_3$  C.  $BF_4^-$  D. none of them is correct

25. How much energy would be absorbed as heat by 75g of iron when heated from 295K to 301K if its specific heat is  $0.449 J/g.K$ ?

- A. 202kJ B. 27.83J C. 1002J D. 202J

26. The solution that contains the precisely known concentration of a solute is known as:

- A. saturated solution B. dilute solution C. standard solution D. buffer solution

27. A solution made from ethanol,  $C_2H_5OH$ , and water is 1.76m in ethanol. How many moles of ethanol are contained per 250g of water?  
 A. 0.142mol      B. 0.44mol      C. 20.24mol      D. 7.04mol
28. A substance that can react as an acid or a base :  
 A.  $SO_4^{2-}$       B.  $HSO_3^-$       C.  $CH_3COO^-$       D.  $NH_4^+$
29. Which of the following ions hydrolyze in aqueous solution?  
 A.  $NO_3^-$       B.  $CO_3^{2-}$       C.  $SO_4^{2-}$       D. none of them is correct
30. Adding  $NH_4Cl$  to  $NH_3$  solution leads to:  
 A. decrease  $[NH_3]$       B. increase  $[OH^-]$       C. increase ionization of  $NH_3$       D. increase  $[H_3O^+]$
31. In aqueous solution contains,  $Ca^{+2}$ ,  $SO_4^{2-}$  ions,  $CaSO_4$  precipitates if :  
 A.  $[Ca^{+2}][SO_4^{2-}] = K_{sp}$       B.  $[Ca^{+2}][SO_4^{2-}] > K_{sp}$       C.  $[Ca^{+2}][SO_4^{2-}] < K_{sp}$       D. can not be determined
32. All of the following statements are true about the collision theory except:  
 A. all collisions between particles of reactant leads to the occurrence of the chemical reaction  
 B. the reaction rate is directly proportional with the number of effective collision.  
 C. in order for chemical reaction to occur, the reacting particles must collide  
 D. the particles of reactants must have enough energy to initiate the reaction.
33. All of them are correct except:  
 A. An ionic compound at solid state does not conduct electric current.  
 B. Alloy is a mixture the atoms of two or more metals are uniformly mixed.  
 C. The Brownian motion is a motion due to collision rapidly moving molecules.  
 D. HCl does not soluble in water.
34. Aqueous solution of  $NH_3$  is an Arrhenius base because:  
 A. it is proton acceptor.      B. it increases the concentration of hydronium ion.  
 C. it is an electron pair donor.      D. it increases the concentration of hydroxide ion.
35. The boiling point of a solution is higher than that of a pure solvent because :-  
 A. Vapor-pressure lowering      B. Freezing- point heightening  
 C. Vapor-pressure heightening      D. none of them
36. The rate of the slow reaction increases by :  
 A. the addition of a catalyst.      B. increasing activation energy  
 C. increasing concentration.      D. Both (A+C) are correct
37. The following reaction :  $(2A+B \rightarrow A_2B)$  is occur by one step mechanism the rate law for the reaction is:  
 A.  $R=k[A][B]$       B.  $R=k[A_2B]$       C.  $R=k[A]^2[B]$       D.  $R=k[A][B]^2$
38. Which of the following is a binary acid?  
 A.  $H_2S$       B.  $H_2CO_3$       C.  $H_2O_2$       D. all of them are correct
39. The boiling-point elevation of a solvent is  $2.4^\circ C$ , when the concentration of the solution containing a nonelectrolyte solute is 3.1m, what is the value of molal boiling-point constant?  
 A.  $1.29^\circ C/m$       B.  $-0.77^\circ C/m$       C.  $7.44^\circ C/m$       D.  $0.77^\circ C/m$
40. While mixing a small quantity of water with a large quantity of ethanol, water considered as :-  
 A. solvent      B. solute      C. solution      D. none of them

41. In the following an exothermic gaseous reaction :  $(2CO+O_2 \rightarrow 2CO_2)$ , which of the following statements is true about the reaction ?  
 A. The reaction is always spontaneous.      B. The reaction is never spontaneous.  
 C. The reaction is spontaneous at low temperature.      D. The reaction is spontaneous at high temperature.
42. When barium chloride solution is mixed with sodium nitrate:  
 A. sodium chloride precipitates      B. barium nitrate precipitates  
 C. precipitation does not occur      D. Both ( A + B ) are correct
43. The enthalpy change that occurs during the complete combustion of one mole of an element or compound is called:  
 A. Enthalpy of formation.      B. Enthalpy of solution.      C. Enthalpy of combustion.      D. Specific Heat
44. In the following reaction :  $(2HCl_{(g)} + 184.6kJ \rightarrow H_{2(g)} + Cl_{2(g)})$ , the standard formation enthalpy of HCl equals :  
 A. 184.6kJ/mol      B. -184.6kJ/mol      C. -92.3kJ/mol      D. 92.3kJ/mol
45. The value of equilibrium constant for this gaseous reaction :  $(N_2O_4 \rightleftharpoons 2NO_2)$  is 0.1 at a specified temperature, what would be the value of that constant for the reverse reaction at the same condition?  
 A. 0.05      B. 0.1      C. 10      D. 5
46. The common-ion causes:  
 A. increasing precipitation.      B. decreasing ionization.  
 C. shifting equilibrium to left.      D. all of them are correct.
47. A substance that formed when a strong acid has lost a proton  
 A. strong conjugate base      B. weak conjugate acid      C. weak conjugate base      D. cations
48. The concentration of  $H_3O^+$  ions in aqueous solution of  $Ba(OH)_2$  is  $1 \times 10^{-11} M$ , what is the molar concentration of solution?  
 A.  $1 \times 10^{-3} M$       B.  $2 \times 10^{-4} M$       C.  $2 \times 10^{-3} M$       D.  $5 \times 10^{-4} M$
49. Calculate the moles of NaOH if 100 mL of its solution neutralized with 200 mL of 0.01M HBr ?  
 A. 0.01mol      B. 0.002mol      C. 0.001mol      D. 0.02mol
50. In equilibrium gaseous reaction:  $2NO+Cl_2 \rightleftharpoons 2NOCl + \text{energy}$ , which of the following shift the reaction to the right ?  
 A. adding catalyst      B. decreasing system volume      C. increasing temperature      D. decreasing pressure

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Answer the following questions : ( two marks for each right choice )

- In the following reaction :  $(2\text{HCl}_{(g)} + 184.6\text{kJ} \rightarrow \text{H}_{2(g)} + \text{Cl}_{2(g)})$ , the standard formation enthalpy of HCl equals :  
 A. 184.6kJ/mol B. -184.6kJ/mol C. -92.3kJ/mol D. 92.3kJ/mol
- The rate law of the following reaction:  $\text{A} + 2\text{B} \rightarrow \text{AB}_2$ , is  $R = k[\text{B}]^2$ , what happens to the reaction rate when the concentration of both reactants is doubled?  
 A. the reaction rate remains the same. B. the reaction rate increases by a factor of two.  
 C. the reaction rate increases by a factor of four. D. the reaction rate increases by a factor eight.
- The boiling point of a solution is higher than that of a pure solvent because :-  
 A. Vapor-pressure lowering B. Freezing- point heightening  
 C. Vapor-pressure heightening D. none of them
- In equilibrium gaseous reaction:  $2\text{NO} + \text{Cl}_2 \rightleftharpoons 2\text{NOCl} + \text{energy}$ , which of the following shift the reaction to the right ?  
 A. adding catalyst B. decreasing system volume C. increasing temperature D. decreasing pressure
- Calculate the moles of NaOH if 100 mL of its solution neutralized with 200 mL of 0.01M HBr ?  
 A. 0.01mol B. 0.002mol C. 0.001mol D. 0.02mol
- The dilute aqueous solution of a weak acid contains:  
 A. hydronium ions. B. acid molecules. C. anions. D. all of them are correct
- The concentration of  $\text{H}_3\text{O}^+$  ions in aqueous solution of  $\text{Ba}(\text{OH})_2$  is  $1 \times 10^{-11} \text{ M}$ , what is the molar concentration of solution?  
 A.  $1 \times 10^{-3} \text{ M}$  B.  $2 \times 10^{-4} \text{ M}$  C.  $2 \times 10^{-3} \text{ M}$  D.  $5 \times 10^{-4} \text{ M}$
- All of them are correct except:  
 A. An ionic compound at solid state does not conduct electric current.  
 B. Alloy is a mixture the atoms of two or more metals are uniformly mixed.  
 C. The Brownian motion is a motion due to collision rapidly moving molecules.  
 D. HCl does not soluble in water.
- A substance that can react as an acid or a base :  
 A.  $\text{SO}_4^{2-}$  B.  $\text{HSO}_3^-$  C.  $\text{CH}_3\text{COO}^-$  D.  $\text{NH}_4^+$
- The common-ion causes:  
 A. increasing precipitation. B. decreasing ionization.  
 C. shifting equilibrium to left. D. all of them are correct.
- The enthalpy change that occurs during the complete combustion of one mole of an element or compound is called:  
 A. Enthalpy of formation. B. Enthalpy of solution. C. Enthalpy of combustion. D. Specific Heat
- Which of the following represents the formation equation?  
 A.  $\text{N}_2 + \text{O}_2 \rightarrow 2\text{NO}$  B.  $\text{C}_{(\text{graphite})} + \text{O}_2 \rightarrow \text{CO}_2$  C.  $\text{CO} + \frac{1}{2} \text{O}_2 \rightarrow \text{CO}_2$  D.  $\text{CO}_2 \rightarrow \text{C}_{(\text{graphite})} + \text{O}_2$
- A reaction has  $\Delta H = -74.8 \text{ kJ/mol}$ ,  $\Delta S = -0.081 \text{ kJ/mol.K}$  at  $27^\circ\text{C}$  which of the following is correct?  
 A.  $\Delta G = 50.5 \text{ kJ/mol}$ , nonspontaneous. B.  $\Delta G = -72.8 \text{ kJ/mol}$ , spontaneous.  
 C.  $\Delta G = 72.8 \text{ kJ/mol}$ , nonspontaneous D.  $\Delta G = -50.5 \text{ kJ/mol}$ , spontaneous.
- When polar compound ionizes completely in water the compound is:  
 A. ionic electrolyte. B. weak electrolyte. C. non-electrolyte molecular. D. strong molecular electrolyte.
- For an exothermic dissolution process, the increasing of the temperature causes:  
 A. increasing dissolution B. decreasing dissolution C. decreasing crystallization D. Both (A+C) are correct
- In the following gaseous reaction:  $(\text{N}_2 + 3\text{H}_2 \rightleftharpoons 2\text{NH}_3)$  it was found the  $[\text{NH}_3] = 0.62 \text{ M}$ ,  $[\text{H}_2] = 0.14 \text{ M}$ ,  $[\text{N}_2] = 0.45 \text{ M}$  the value of the equilibrium constant equals:  
 A.  $3.2 \times 10^{-3}$  B.  $3.11 \times 10^2$  C.  $3.11 \times 10^{-2}$  D. 9.84
- Aqueous solution of  $\text{NH}_3$  is an Arrhenius base because:  
 A. it is proton acceptor. B. it increases the concentration of hydronium ion.  
 C. it is an electron pair donor. D. it increases the concentration of hydroxide ion.
- The value of equilibrium constant for this gaseous reaction :  $(\text{N}_2\text{O}_4 \rightleftharpoons 2\text{NO}_2)$  is 0.1 at a specified temperature, what would be the value of that constant for the reverse reaction at the same condition?  
 A. 0.05 B. 0.1 C. 10 D. 5
- In aqueous solution contains,  $\text{Ca}^{+2}$ ,  $\text{SO}_4^{2-}$  ions,  $\text{CaSO}_4$  precipitates if :  
 A.  $[\text{Ca}^{+2}][\text{SO}_4^{2-}] = K_{sp}$  B.  $[\text{Ca}^{+2}][\text{SO}_4^{2-}] > K_{sp}$  C.  $[\text{Ca}^{+2}][\text{SO}_4^{2-}] < K_{sp}$  D. can not be determined
- The boiling-point elevation of a solvent is  $2.4^\circ\text{C}$ , when the concentration of the solution containing a nonelectrolyte solute is  $3.1 \text{ m}$ , what is the value of molal boiling-point constant?  
 A.  $1.29^\circ\text{C/m}$  B.  $-0.77^\circ\text{C/m}$  C.  $7.44^\circ\text{C/m}$  D.  $0.77^\circ\text{C/m}$
- Which of the following ions hydrolyze in aqueous solution?  
 A.  $\text{NO}_3^-$  B.  $\text{CO}_3^{2-}$  C.  $\text{SO}_4^{2-}$  D. none of them is correct
- In the following hypothetical reaction :  $(\text{A}_2 + \text{B}_2 \rightarrow 2\text{AB} + 30\text{kJ})$ , the activation energy for the forward reaction equal  $50 \text{ kJ/mol}$ , the activation energy for reverse reaction is equal to  
 A.  $20 \text{ kJ/mol}$  B.  $80 \text{ kJ/mol}$  C.  $-80 \text{ kJ/mol}$  D.  $10 \text{ kJ/mol}$
- How many moles of ammonium sulfate must be dissociate to produce  $0.4 \text{ mol}$  of sulfate ion?  
 A. 0.2 mol B. 0.4 mol C. 0.6 mol D. 0.8 mol
- Adding  $\text{NH}_4\text{Cl}$  to  $\text{NH}_3$  solution leads to:  
 A. decrease  $[\text{NH}_3]$  B. increase  $[\text{OH}^-]$  C. increase ionization of  $\text{NH}_3$  D. increase  $[\text{H}_3\text{O}^+]$
- Which of the following is the equilibrium constant for an anion hydrolysis reaction?  
 A.  $\frac{[\text{HB}][\text{OH}^-]}{[\text{B}^-]}$  B.  $\frac{[\text{B}^-]}{[\text{HB}][\text{OH}^-]}$  C.  $\frac{[\text{HB}]}{[\text{B}^-][\text{OH}^-]}$  D.  $\frac{[\text{B}^-][\text{OH}^-]}{[\text{HB}]}$
- The entropy increases at:  
 A. evaporating of liquid B. temperature raising. C. increase pressure D. both (A+B) are correct
- Which of the following is homogenous mixture?  
 A. milk B. 24-karat gold C. tap water D. oil and water

28. The methyl orange is used to determine the equivalence point in one of the following titration: If the pH range for transition interval is (3.1- 4.4):

- A. HCl, NH<sub>3</sub>      B. CH<sub>3</sub>COOH, NaOH      C. HNO<sub>3</sub>, NaOH      D. NH<sub>3</sub>, CH<sub>3</sub>COOH

29. A proposed mechanism for the reaction is:- slow :  $2\text{NO} + \text{H}_2 \rightarrow \text{N}_2\text{O} + \text{H}_2\text{O}$

fast :  $\text{N}_2\text{O} + \text{H}_2 \rightarrow \text{N}_2 + \text{H}_2\text{O}$  which of the following is correct ?

- A.  $R = k[\text{NO}][\text{H}_2]$       B. overall balanced equation for the reaction is :  $2\text{NO} + 2\text{H}_2 \rightarrow \text{N}_2 + 2\text{H}_2\text{O}$   
C. the reaction order is second      D. Both (A+C) are correct

30. Which of the following is a binary acid?

- A. H<sub>2</sub>S      B. H<sub>2</sub>CO<sub>3</sub>      C. H<sub>2</sub>O<sub>2</sub>      D. all of them are correct

31. How much energy would be absorbed as heat by 75g of iron when heated from 295K to 301K if its specific heat is 0.449J/g.K?

- A. 202kJ      B. 27.83J      C. 1002J      D. 202J

32. Which of the following solutions with the same concentrations has lower  $[\text{H}_3\text{O}^+]$ ?

- A. HCl      B. H<sub>2</sub>O      C. NH<sub>3</sub>      D. HF

33. The solubility product of cadmium carbonate,  $\text{CdCO}_3$ , is  $1.0 \times 10^{-12}$ . In a saturated solution of this salt, the concentration of carbonate ions is:

- A.  $5 \times 10^{-13}$  M      B.  $3 \times 10^{-6}$  M      C.  $1 \times 10^{-6}$  M      D.  $5 \times 10^{-7}$  M

34. Unknown liquid miscible with toluene and immiscible with water which of the following statements is correct?

- A. an aqueous solution for the liquid conducts electric current.      B. a liquid is nonpolar molecular compound.  
C. a liquid is polar molecular compound.      D. none of them

35. All of the following statements are true about the collision theory except:

- A. all collisions between particles of reactant leads to the occurrence of the chemical reaction  
B. the reaction rate is directly proportional with the number of effective collision.  
C. in order for chemical reaction to occur, the reacting particles must collide  
D. the particles of reactants must have enough energy to initiate the reaction.

36. The pH of an aqueous solution composed  $2 \times 10^{-4}$  mol of  $\text{H}_3\text{O}^+$  ions in 250 mL of its solution is equal to :-

- A. 3.1      B. 3.7      C. 10.9      D. 10.3

37. A solution made from ethanol,  $\text{C}_2\text{H}_5\text{OH}$ , and water is 1.76m in ethanol. How many moles of ethanol are contained per 250g of water?

- A. 0.142mol      B. 0.44mol      C. 20.24mol      D. 7.04mol

38. In the following reaction :  $(\text{BF}_{3(\text{aq})} + \text{F}^-_{(\text{aq})} \rightarrow \text{BF}_4^-_{(\text{aq})})$  which of the following is Lewis base?

- A.  $\text{F}^-$       B.  $\text{BF}_3$       C.  $\text{BF}_4^-$       D. none of them is correct

39. The strength of an acid does not depend on:

- A. The polarity of the bond between hydrogen and the element it is bonded.      B. the bond energy  
C. the number of hydrogen atoms in the chemical acid formula.      D. both (A+B) are correct

40. When barium chloride solution is mixed with sodium nitrate:

- A. sodium chloride precipitates      B. barium nitrate precipitates  
C. precipitation does not occur      D. Both (A + B) are correct

41. The rate of the slow reaction increases by :

- A. the addition of a catalyst.      B. increasing activation energy  
C. increasing concentration.      D. Both (A+C) are correct

42. The following reaction :  $(2\text{A} + \text{B} \rightarrow \text{A}_2\text{B})$  is occur by one step mechanism the rate law for the reaction is:

- A.  $R = k[\text{A}][\text{B}]$       B.  $R = k[\text{A}_2\text{B}]$       C.  $R = k[\text{A}]^2[\text{B}]$       D.  $R = k[\text{A}][\text{B}]^2$

43. the spectator ion in the following reaction  $(\text{Al}_{(\text{s})} + \text{H}_2\text{SO}_{4(\text{aq})} \rightarrow \quad)$ , is;

- A.  $\text{SO}_4^{2-}$       B.  $\text{Al}^{+3}$       C.  $\text{H}_3\text{O}^+$       D. all of them are correct.

44. The net ionic equation for the precipitation Nickel ( II )sulfide is :

- A.  $\text{NiS}_{(\text{s})} \rightarrow \text{Ni}^{+2}_{(\text{aq})} + \text{S}^{-2}_{(\text{aq})}$       B.  $2\text{Ni}^{+2}_{(\text{aq})} + 2\text{S}^{-2}_{(\text{aq})} \rightarrow \text{Ni}_2\text{S}_{2(\text{s})}$   
C.  $\text{Ni}^{+2}_{(\text{aq})} + \text{S}^{-2}_{(\text{aq})} \rightarrow \text{NiS}_{(\text{s})}$       D. it does not have precipitate equation because it is soluble in water.

45. The energy required to raise the reactant to the level of the activated complex is:

- A. Activation energy      B. Free energy      C. Kinetic energy      D. Energy of reaction

46. In the following an exothermic gaseous reaction :  $(2\text{CO} + \text{O}_2 \rightarrow 2\text{CO}_2)$ , which of the following statements is true about the reaction ?

- A. The reaction is always spontaneous.      B. The reaction is never spontaneous.  
C. The reaction is spontaneous at low temperature.      D. The reaction is spontaneous at high temperature.

47. A substance that formed when a strong acid has lost a proton

- A. strong conjugate base      B. weak conjugate acid      C. weak conjugate base      D. cations

48. The solution that contains the precisely known concentration of a solute is known as:

- A. saturated solution      B. dilute solution      C. standard solution      D. buffer solution

49. While mixing a small quantity of water with a large quantity of ethanol, water considered as :-

- A. solvent      B. solute      C. solution      D. none of them

50. Which one of the following statements is incorrect?

- A. Many solids dissolve more quickly in a cold solvent than in warm solvent.  
B. Gases are generally more soluble in water at low temperature.  
C. Aqueous solution is a mixture containing the solute soluble in water as a solvent.  
D. The effect of stirring is similar to that of crushing a solid – contact between the solvent and the solute surface is increased.

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Answer the following questions : ( two marks for each right choice )

- When polar compound ionizes completely in water the compound is:  
A. ionic electrolyte. B. weak electrolyte. C. non-electrolyte molecular. D. strong molecular electrolyte.
- While mixing a small quantity of water with a large quantity of ethanol, water considered as :-  
A. solvent B. solute C. solution D. none of them
- Which one of the following statements is incorrect?  
A. Many solids dissolve more quickly in a cold solvent than in warm solvent.  
B. Gases are generally more soluble in water at low temperature.  
C. Aqueous solution is a mixture containing the solute soluble in water as a solvent.  
D. The effect of stirring is similar to that of crushing a solid – contact between the solvent and the solute surface is increased.
- A solution made from ethanol,  $C_2H_5OH$ , and water is 1.76m in ethanol. How many moles of ethanol are contained per 250g of water?  
A. 0.142mol B. 0.44mol C. 20.24mol D. 7.04mol
- The rate law of the following reaction:  $A+2B \rightarrow AB_2$ , is  $R=k[B]^2$ , what happens to the reaction rate when the concentration of both reactants is doubled?  
A. the reaction rate remains the same. B. the reaction rate increases by a factor of two.  
C. the reaction rate increases by a factor of four. D. the reaction rate increases by a factor eight.
- For an exothermic dissolution process, the increasing of the temperature causes:  
A. increasing dissolution B. decreasing dissolution C. decreasing crystallization D. Both (A+C) are correct
- The methyl orange is used to determine the equivalence point in one of the following titration: If the pH range for transition interval is (3.1- 4.4):  
A. HCl,  $NH_3$  B.  $CH_3COOH$ , NaOH C.  $HNO_3$ , NaOH D.  $NH_3$ ,  $CH_3COOH$
- The dilute aqueous solution of a weak acid contains:  
A. hydronium ions. B. acid molecules. C. anions. D. all of them are correct
- All of the following statements are true about the collision theory except:  
A. all collisions between particles of reactant leads to the occurrence of the chemical reaction  
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D. the particles of reactants must have enough energy to initiate the reaction.
- The strength of an acid does not depend on:  
A. The polarity of the bond between hydrogen and the element it is bonded. B. the bond energy  
C. the number of hydrogen atoms in the chemical acid formula. D. both (A+B) are correct
- The following reaction :  $(2A+B \rightarrow A_2B)$  is occur by one step mechanism the rate law for the reaction is:  
A.  $R=k[A][B]$  B.  $R=k[A_2B]$  C.  $R=k[A]^2[B]$  D.  $R=k[A][B]^2$
- How many moles of ammonium sulfate must be dissociate to produce 0.4 mol of sulfate ion?  
A. 0.2 mol B. 0.4 mol C. 0.6 mol D. 0.8 mol

13. When barium chloride solution is mixed with sodium nitrate:

- A. sodium chloride precipitates B. barium nitrate precipitates  
C. precipitation does not occur D. Both ( A + B ) are correct

14. A substance that formed when a strong acid has lost a proton

- A. strong conjugate base B. weak conjugate acid C. weak conjugate base D. cations

15. The net ionic equation for the precipitation Nickel ( II ) sulfide is :

- A.  $NiS_{(s)} \rightarrow Ni^{+2}_{(aq)} + S^{-2}_{(aq)}$  B.  $2Ni^{+2}_{(aq)} + 2S^{-2}_{(aq)} \rightarrow Ni_2S_{2(s)}$   
C.  $Ni^{+2}_{(aq)} + S^{-2}_{(aq)} \rightarrow NiS_{(s)}$  D. it does not have precipitate equation because it is soluble in water.

16. The pH of an aqueous solution composed  $2 \times 10^{-4}$  mol of  $H_3O^+$  ions in 250 mL of its solution is equal to :-

- A. 3.1 B. 3.7 C. 10.9 D. 10.3

17. The boiling-point elevation of a solvent is  $2.4^\circ C$ , when the concentration of the solution containing a nonelectrolyte solute is 3.1m, what is the value of molal boiling-point constant?

- A.  $1.29^\circ C/m$  B.  $-0.77^\circ C/m$  C.  $7.44^\circ C/m$  D.  $0.77^\circ C/m$

18. How much energy would be absorbed as heat by 75g of iron when heated from 295K to 301K if its specific heat is  $0.449 J/g.K$ ?

- A. 202kJ B. 27.83J C. 1002J D. 202J

19. In the following an exothermic gaseous reaction :  $(2CO + O_2 \rightarrow 2CO_2)$ , which of the following statements is true about the reaction ?

- A. The reaction is always spontaneous. B. The reaction is never spontaneous.  
C. The reaction is spontaneous at low temperature. D. The reaction is spontaneous at high temperature.

20. All of them are correct except:

- A. An ionic compound at solid state does not conduct electric current.  
B. Alloy is a mixture the atoms of two or more metals are uniformly mixed.  
C. The Brownian motion is a motion due to collision rapidly moving molecules.  
D. HCl does not soluble in water.

21. A proposed mechanism for the reaction is:- slow :  $2NO + H_2 \rightarrow N_2O + H_2O$

fast :  $N_2O + H_2 \rightarrow N_2 + H_2O$  which of the following is correct ?

- A.  $R=k[NO][H_2]$  B. overall balanced equation for the reaction is :  $2NO + 2H_2 \rightarrow N_2 + 2H_2O$   
C. the reaction order is second D. Both (A+C) are correct

22. The boiling point of a solution is higher than that of a pure solvent because :-

- A. Vapor-pressure lowering B. Freezing- point heightening  
C. Vapor-pressure heightening D. none of them

23. Calculate the moles of NaOH if 100 mL of its solution neutralized with 200 mL of 0.01M HBr ?

- A. 0.01mol B. 0.002mol C. 0.001mol D. 0.02mol

24. Adding  $NH_4Cl$  to  $NH_3$  solution leads to:

- A. decrease  $[NH_3]$  B. increase  $[OH^-]$  C. increase ionization of  $NH_3$  D. increase  $[H_3O^+]$

25. Aqueous solution of  $NH_3$  is an Arrhenius base because:

- A. it is proton acceptor. B. it increases the concentration of hydronium ion.  
C. it is an electron pair donor. D. it increases the concentration of hydroxide ion.

26. The common-ion causes:  
 A. increasing precipitation. B. decreasing ionization.  
 C. shifting equilibrium to left. D. all of them are correct.
27. Which of the following is homogenous mixture?  
 A. milk B. 24-karat gold C. tap water D. oil and water
28. Which of the following ions hydrolyze in aqueous solution?  
 A.  $\text{NO}_3^-$  B.  $\text{CO}_3^{2-}$  C.  $\text{SO}_4^{2-}$  D. none of them is correct
29. The concentration of  $\text{H}_3\text{O}^+$  ions in aqueous solution of  $\text{Ba}(\text{OH})_2$  is  $1 \times 10^{-11} \text{ M}$ , what is the molar concentration of solution?  
 A.  $1 \times 10^{-3} \text{ M}$  B.  $2 \times 10^{-4} \text{ M}$  C.  $2 \times 10^{-3} \text{ M}$  D.  $5 \times 10^{-4} \text{ M}$
30. Unknown liquid miscible with toluene and immiscible with water which of the following statements is correct?  
 A. an aqueous solution for the liquid conducts electric current. B. a liquid is nonpolar molecular compound.  
 C. a liquid is polar molecular compound. D. none of them
31. The solubility product of cadmium carbonate,  $\text{CdCO}_3$ , is  $1.0 \times 10^{-12}$ . In a saturated solution of this salt, the concentration of carbonate ions is:  
 A.  $5 \times 10^{-13} \text{ M}$  B.  $3 \times 10^{-6} \text{ M}$  C.  $1 \times 10^{-6} \text{ M}$  D.  $5 \times 10^{-7} \text{ M}$
32. Which of the following solutions with the same concentrations has lower  $[\text{H}_3\text{O}^+]$ ?  
 A.  $\text{HCl}$  B.  $\text{H}_2\text{O}$  C.  $\text{NH}_3$  D.  $\text{HF}$
33. In the following hypothetical reaction :  $(\text{A}_2 + \text{B}_2 \rightarrow 2\text{AB} + 30\text{kJ})$ , the activation energy for the forward reaction equal  $50\text{kJ/mol}$ , the activation energy for reverse reaction is equal to  
 A.  $20\text{kJ/mol}$  B.  $80\text{kJ/mol}$  C.  $-80\text{kJ/mol}$  D.  $10\text{kJ/mol}$
34. In the following gaseous reaction:  $(\text{N}_2 + 3\text{H}_2 \rightleftharpoons 2\text{NH}_3)$  it was found the  $[\text{NH}_3] = 0.62 \text{ M}$ ,  $[\text{H}_2] = 0.14 \text{ M}$ ,  $[\text{N}_2] = 0.45 \text{ M}$  the value of the equilibrium constant equals:  
 A.  $3.2 \times 10^{-3}$  B.  $3.11 \times 10^2$  C.  $3.11 \times 10^{-2}$  D. 9.84
35. The solution that contains the precisely known concentration of a solute is known as:  
 A. saturated solution B. dilute solution C. standard solution D. buffer solution
36. In the following reaction :  $(2\text{HCl}_{(g)} + 184.6\text{kJ} \rightarrow \text{H}_{2(g)} + \text{Cl}_{2(g)})$ , the standard formation enthalpy of  $\text{HCl}$  equals :  
 A.  $184.6\text{kJ/mol}$  B.  $-184.6\text{kJ/mol}$  C.  $-92.3\text{kJ/mol}$  D.  $92.3\text{kJ/mol}$
37. The enthalpy change that occurs during the complete combustion of one mole of an element or compound is called:  
 A. Enthalpy of formation. B. Enthalpy of solution. C. Enthalpy of combustion. D. Specific Heat
38. Which of the following is the equilibrium constant for an anion hydrolysis reaction?  
 A.  $\frac{[\text{HB}][\text{OH}^-]}{[\text{B}^-]}$  B.  $\frac{[\text{B}^-]}{[\text{HB}][\text{OH}^-]}$  C.  $\frac{[\text{HB}]}{[\text{B}^-][\text{OH}^-]}$  D.  $\frac{[\text{B}^-][\text{OH}^-]}{[\text{HB}]}$
39. A substance that can react as an acid or a base :  
 A.  $\text{SO}_4^{2-}$  B.  $\text{HSO}_3^-$  C.  $\text{CH}_3\text{COO}^-$  D.  $\text{NH}_4^+$
40. Which of the following represents the formation equation?  
 A.  $\text{N}_2 + \text{O}_2 \rightarrow 2\text{NO}$  B.  $\text{C}_{(\text{graphite})} + \text{O}_2 \rightarrow \text{CO}_2$  C.  $\text{CO} + 1/2 \text{O}_2 \rightarrow \text{CO}_2$  D.  $\text{CO}_2 \rightarrow \text{C}_{(\text{graphite})} + \text{O}_2$
41. The energy required to raise the reactant to the level of the activated complex is:  
 A. Activation energy B. Free energy C. Kinetic energy D. Energy of reaction
42. In aqueous solution contains,  $\text{Ca}^{+2}$ ,  $\text{SO}_4^{2-}$  ions,  $\text{CaSO}_4$  precipitates if :  
 A.  $[\text{Ca}^{+2}][\text{SO}_4^{2-}] = K_{sp}$  B.  $[\text{Ca}^{+2}][\text{SO}_4^{2-}] > K_{sp}$  C.  $[\text{Ca}^{+2}][\text{SO}_4^{2-}] < K_{sp}$  D. can not be determined
43. In the following reaction :  $(\text{BF}_{3(aq)} + \text{F}^-_{(aq)} \rightarrow \text{BF}_4^-_{(aq)})$  which of the following is Lewis base?  
 A.  $\text{F}^-$  B.  $\text{BF}_3$  C.  $\text{BF}_4^-$  D. none of them is correct
44. A reaction has  $\Delta H = -74.8\text{kJ/mol}$ ,  $\Delta S = -0.081\text{kJ/mol.K}$  at  $27^\circ\text{C}$  which of the following is correct?  
 A.  $\Delta G = 50.5\text{kJ/mol}$ , nonspontaneous. B.  $\Delta G = -72.8\text{kJ/mol}$ , spontaneous.  
 C.  $\Delta G = 72.8\text{kJ/mol}$ , nonspontaneous D.  $\Delta G = -50.5\text{kJ/mol}$ , spontaneous.
45. Which of the following is a binary acid?  
 A.  $\text{H}_2\text{S}$  B.  $\text{H}_2\text{CO}_3$  C.  $\text{H}_2\text{O}_2$  D. all of them are correct
46. the spectator ion in the following reaction  $(\text{Al}_{(s)} + \text{H}_2\text{SO}_{4(aq)} \rightarrow \quad)$ , is;  
 A.  $\text{SO}_4^{2-}$  B.  $\text{Al}^{+3}$  C.  $\text{H}_3\text{O}^+$  D. all of them are correct.
47. The entropy increases at:  
 A. evaporating of liquid B. temperature raising. C. increase pressure D. both(A+B) are correct
48. In equilibrium gaseous reaction:  $2\text{NO} + \text{Cl}_2 \rightleftharpoons 2\text{NOCl} + \text{energy}$ , which of the following shift the reaction to the right ?  
 A. adding catalyst B. decreasing system volume C. increasing temperature D. decreasing pressure
49. The value of equilibrium constant for this gaseous reaction :  $(\text{N}_2\text{O}_4 \rightleftharpoons 2\text{NO}_2)$  is 0.1 at a specified temperature, what would be the value of that constant for the reverse reaction at the same condition?  
 A. 0.05 B. 0.1 C. 10 D. 5
50. The rate of the slow reaction increases by :  
 A. the addition of a catalyst. B. increasing activation energy  
 C. increasing concentration. D. Both (A+C) are correct

**M**

Answer the following questions : ( two marks for each right choice )

- Which of the following is a binary acid?  
 A.  $H_2S$  B.  $H_2CO_3$  C.  $H_2O_2$  D. all of them are correct
- When polar compound ionizes completely in water the compound is:  
 A. ionic electrolyte. B. weak electrolyte. C. non-electrolyte molecular. D. strong molecular electrolyte.
- In the following reaction :  $(BF_3(aq) + F^-(aq) \rightarrow BF_4^-(aq))$  which of the following is Lewis base?  
 A.  $F^-$  B.  $BF_3$  C.  $BF_4^-$  D. none of them is correct
- In the following gaseous reaction:  $(N_2 + 3H_2 \rightleftharpoons 2NH_3)$  it was found the  $[NH_3]=0.62\text{ M}$ ,  $[H_2]=0.14\text{ M}$ ,  $[N_2]=0.45\text{ M}$  the value of the equilibrium constant equals:  
 A.  $3.2 \times 10^{-3}$  B.  $3.11 \times 10^2$  C.  $3.11 \times 10^{-2}$  D. 9.84
- When barium chloride solution is mixed with sodium nitrate:  
 A. sodium chloride precipitates B. barium nitrate precipitates  
 C. precipitation does not occur D. Both ( A + B ) are correct
- The boiling point of a solution is higher than that of a pure solvent because :-  
 A. Vapor-pressure lowering B. Freezing- point heightening  
 C. Vapor-pressure heightening D. none of them
- Which one of the following statements is incorrect?  
 A. Many solids dissolve more quickly in a cold solvent than in warm solvent.  
 B. Gases are generally more soluble in water at low temperature.  
 C. Aqueous solution is a mixture containing the solute soluble in water as a solvent.  
 D. The effect of stirring is similar to that of crushing a solid – contact between the solvent and the solute surface is increased.
- All of the following statements are true about the collision theory except:  
 A. all collisions between particles of reactant leads to the occurrence of the chemical reaction  
 B. the reaction rate is directly proportional with the number of effective collision.  
 C. in order for chemical reaction to occur, the reacting particles must collide  
 D. the particles of reactants must have enough energy to initiate the reaction.
- The solubility product of cadmium carbonate,  $CdCO_3$ , is  $1.0 \times 10^{-12}$ . In a saturated solution of this salt, the concentration of carbonate ions is:  
 A.  $5 \times 10^{-13}\text{ M}$  B.  $3 \times 10^{-6}\text{ M}$  C.  $1 \times 10^{-6}\text{ M}$  D.  $5 \times 10^{-7}\text{ M}$
- The common-ion causes:  
 A. increasing precipitation. B. decreasing ionization.  
 C. shifting equilibrium to left. D. all of them are correct.
- In equilibrium gaseous reaction:  $2NO + Cl_2 \rightleftharpoons 2NOCl + \text{energy}$ , which of the following shift the reaction to the right ?  
 A. adding catalyst B. decreasing system volume C. increasing temperature D. decreasing pressure

- Aqueous solution of  $NH_3$  is an Arrhenius base because:  
 A. it is proton acceptor. B. it increases the concentration of hydronium ion.  
 C. it is an electron pair donor. D. it increases the concentration of hydroxide ion.
- The solution that contains the precisely known concentration of a solute is known as:  
 A. saturated solution B. dilute solution C. standard solution D. buffer solution
- Which of the following is homogenous mixture?  
 A. milk B. 24-karat gold C. tap water D. oil and water
- A substance that can react as an acid or a base :  
 A.  $SO_4^{2-}$  B.  $HSO_3^-$  C.  $CH_3COO^-$  D.  $NH_4^+$
- In the following an exothermic gaseous reaction :  $(2CO + O_2 \rightarrow 2CO_2)$ , which of the following statements is true about the reaction ?  
 A. The reaction is always spontaneous. B. The reaction is never spontaneous.  
 C. The reaction is spontaneous at low temperature. D. The reaction is spontaneous at high temperature.
- The rate law of the following reaction:  $A + 2B \rightarrow AB_2$ , is  $R = k[B]^2$ , what happens to the reaction rate when the concentration of both reactants is doubled?  
 A. the reaction rate remains the same. B. the reaction rate increases by a factor of two.  
 C. the reaction rate increases by a factor of four. D. the reaction rate increases by a factor eight.
- A reaction has  $\Delta H = -74.8\text{ kJ/mol}$ ,  $\Delta S = -0.081\text{ kJ/mol.K}$  at  $27^\circ\text{C}$  which of the following is correct?  
 A.  $\Delta G = 50.5\text{ kJ/mol}$ , nonspontaneous. B.  $\Delta G = -72.8\text{ kJ/mol}$ , spontaneous.  
 C.  $\Delta G = 72.8\text{ kJ/mol}$ , nonspontaneous D.  $\Delta G = -50.5\text{ kJ/mol}$ , spontaneous.
- In the following hypothetical reaction :  $(A_2 + B_2 \rightarrow 2AB + 30\text{ kJ})$ , the activation energy for the forward reaction equal  $50\text{ kJ/mol}$ , the activation energy for reverse reaction is equal to  
 A.  $20\text{ kJ/mol}$  B.  $80\text{ kJ/mol}$  C.  $-80\text{ kJ/mol}$  D.  $10\text{ kJ/mol}$
- Which of the following solutions with the same concentrations has lower  $[H_3O^+]$ ?  
 A. HCl B.  $H_2O$  C.  $NH_3$  D. HF
- In aqueous solution contains,  $Ca^{+2}$ ,  $SO_4^{2-}$  ions,  $CaSO_4$  precipitates if :  
 A.  $[Ca^{+2}][SO_4^{2-}] = K_{sp}$  B.  $[Ca^{+2}][SO_4^{2-}] > K_{sp}$  C.  $[Ca^{+2}][SO_4^{2-}] < K_{sp}$  D. can not be determined
- The strength of an acid does not depend on:  
 A. The polarity of the bond between hydrogen and the element it is bonded. B. the bond energy  
 C. the number of hydrogen atoms in the chemical acid formula. D. both (A+B) are correct
- A substance that formed when a strong acid has lost a proton  
 A. strong conjugate base B. weak conjugate acid C. weak conjugate base D. cations
- The dilute aqueous solution of a weak acid contains:  
 A. hydronium ions. B. acid molecules. C. anions. D. all of them are correct
- A proposed mechanism for the reaction is:- slow :  $2NO + H_2 \rightarrow N_2O + H_2O$   
 fast :  $N_2O + H_2 \rightarrow N_2 + H_2O$  which of the following is correct ?  
 A.  $R = k[NO][H_2]$  B. overall balanced equation for the reaction is :  $2NO + 2H_2 \rightarrow N_2 + 2H_2O$   
 C. the reaction order is second D. Both (A+C) are correct

26. In the following reaction :  $(2\text{HCl}_{(g)} + 184.6\text{kJ} \rightarrow \text{H}_{2(g)} + \text{Cl}_{2(g)})$ , the standard formation enthalpy of HCl equals :

- A. 184.6kJ/mol      B. -184.6kJ/mol      C. -92.3kJ/mol      D. 92.3kJ/mol

27. The net ionic equation for the precipitation Nickel ( II )sulfide is :

- A.  $\text{NiS}_{(s)} \rightarrow \text{Ni}^{+2}_{(aq)} + \text{S}^{-2}_{(aq)}$       B.  $2\text{Ni}^{+2}_{(aq)} + 2\text{S}^{-2}_{(aq)} \rightarrow \text{Ni}_2\text{S}_{2(s)}$   
C.  $\text{Ni}^{+2}_{(aq)} + \text{S}^{-2}_{(aq)} \rightarrow \text{NiS}_{(s)}$       D. it does not have precipitate equation because it is soluble in water.

28. The entropy increases at:

- A. evaporating of liquid      B. temperature raising.      C. increase pressure      D. both(A+B) are correct

29. The value of equilibrium constant for this gaseous reaction :  $(\text{N}_2\text{O}_4 \rightleftharpoons 2\text{NO}_2)$  is 0.1 at a specified temperature, what would be the value of that constant for the reverse reaction at the same condition?

- A. 0.05      B. 0.1      C. 10      D. 5

30. The pH of an aqueous solution composed  $2 \times 10^{-4}$  mol of  $\text{H}_3\text{O}^+$  ions in 250 mL of its solution is equal to :-

- A. 3.1      B. 3.7      C. 10.9      D. 10.3

31. A solution made from ethanol ,  $\text{C}_2\text{H}_5\text{OH}$ , and water is 1.76m in ethanol .How many moles of ethanol are contained per 250g of water?

- A. 0.142mol      B. 0.44mol      C. 20.24mol      D. 7.04mol

32. The boiling-point elevation of a solvent is  $2.4^\circ\text{C}$ , when the concentration of the solution containing a nonelectrolyte solute is 3.1m, what is the value of molal boiling-point constant?

- A.  $1.29^\circ\text{C}/m$       B.  $-0.77^\circ\text{C}/m$       C.  $7.44^\circ\text{C}/m$       D.  $0.77^\circ\text{C}/m$

33. The enthalpy change that occurs during the complete combustion of one mole of an element or compound is called:

- A. Enthalpy of formation.      B. Enthalpy of solution.      C. Enthalpy of combustion.      D. Specific Heat

34. Which of the following ions hydrolyze in aqueous solution?

- A.  $\text{NO}_3^-$       B.  $\text{CO}_3^{2-}$       C.  $\text{SO}_4^{2-}$       D. none of them is correct

35. How many moles of ammonium sulfate must be dissociate to produce 0.4 mol of sulfate ion?

- A. 0.2 mol      B. 0.4 mol      C. 0.6 mol      D. 0.8 mol

36. Which of the following is the equilibrium constant for an anion hydrolysis reaction?

- A.  $\frac{[\text{HB}][\text{OH}^-]}{[\text{B}^-]}$       B.  $\frac{[\text{B}^-]}{[\text{HB}][\text{OH}^-]}$       C.  $\frac{[\text{HB}]}{[\text{B}^-][\text{OH}^-]}$       D.  $\frac{[\text{B}^-][\text{OH}^-]}{[\text{HB}]}$

37. For an exothermic dissolution process, the increasing of the temperature causes:

- A. increasing dissolution      B. decreasing dissolution      C. decreasing crystallization      D. Both (A+C) are correct

38. The rate of the slow reaction increases by :

- A. the addition of a catalyst.      B. increasing activation energy  
C. increasing concentration.      D. Both (A+C) are correct

39. The energy required to raise the reactant to the level of the activated complex is:

- A. Activation energy      B. Free energy      C. Kinetic energy      D. Energy of reaction

40. The methyl orange is used to determine the equivalence point in one of the following titration: If the pH range for transition interval is (3.1- 4.4):

- A. HCl,  $\text{NH}_3$       B.  $\text{CH}_3\text{COOH}$ , NaOH      C.  $\text{HNO}_3$ , NaOH      D.  $\text{NH}_3$ ,  $\text{CH}_3\text{COOH}$

41. The following reaction :  $(2\text{A} + \text{B} \rightarrow \text{A}_2\text{B})$  is occur by one step mechanism the rate law for the reaction is:

- A.  $R = k[\text{A}][\text{B}]$       B.  $R = k[\text{A}_2\text{B}]$       C.  $R = k[\text{A}]^2[\text{B}]$       D.  $R = k[\text{A}][\text{B}]^2$

42. While mixing a small quantity of water with a large quantity of ethanol, water considered as :-

- A. solvent      B. solute      C. solution      D. none of them

43. Adding  $\text{NH}_4\text{Cl}$  to  $\text{NH}_3$  solution leads to:

- A. decrease  $[\text{NH}_3]$       B. increase  $[\text{OH}^-]$       C. increase ionization of  $\text{NH}_3$       D. increase  $[\text{H}_3\text{O}^+]$

44. Calculate the moles of NaOH if 100 mL of its solution neutralized with 200 mL of 0.01M HBr ?

- A. 0.01mol      B. 0.002mol      C. 0.001mol      D. 0.02mol

45. All of them are correct except:

- A. An ionic compound at solid state does not conduct electric current.  
B. Alloy is a mixture the atoms of two or more metals are uniformly mixed.  
C. The Brownian motion is a motion due to collision rapidly moving molecules.  
D. HCl does not soluble in water.

46. the spectator ion in the following reaction  $(\text{Al}_{(s)} + \text{H}_2\text{SO}_{4(aq)} \rightarrow \quad)$ , is;

- A.  $\text{SO}_4^{2-}$       B.  $\text{Al}^{+3}$       C.  $\text{H}_3\text{O}^+$       D. all of them are correct.

47. How much energy would be absorbed as heat by 75g of iron when heated from 295K to 301K if its specific heat is  $0.449\text{J/g.K}$ ?

- A. 202kJ      B. 27.83J      C. 1002J      D. 202J

48. Unknown liquid miscible with toluene and immiscible with water which of the following statements is correct?

- A. an aqueous solution for the liquid conducts electric current.      B. a liquid is nonpolar molecular compound.  
C. a liquid is polar molecular compound.      D. none of them

49. The concentration of  $\text{H}_3\text{O}^+$  ions in aqueous solution of  $\text{Ba}(\text{OH})_2$  is  $1 \times 10^{-11}\text{M}$ , what is the molar concentration of solution?

- A.  $1 \times 10^{-3}\text{M}$       B.  $2 \times 10^{-4}\text{M}$       C.  $2 \times 10^{-3}\text{M}$       D.  $5 \times 10^{-4}\text{M}$

50. Which of the following represents the formation equation?

- A.  $\text{N}_2 + \text{O}_2 \rightarrow 2\text{NO}$       B.  $\text{C}_{(\text{graphite})} + \text{O}_2 \rightarrow \text{CO}_2$       C.  $\text{CO} + 1/2 \text{O}_2 \rightarrow \text{CO}_2$       D.  $\text{CO}_2 \rightarrow \text{C}_{(\text{graphite})} + \text{O}_2$

N



Answer the following questions : ( two marks for each right choice )

- The dilute aqueous solution of a weak acid contains:  
 A. hydronium ions. B. acid molecules. C. anions. D. all of them are correct
- All of them are correct except:  
 A. An ionic compound at solid state does not conduct electric current.  
 B. Alloy is a mixture the atoms of two or more metals are uniformly mixed.  
 C. The Brownian motion is a motion due to collision rapidly moving molecules.  
 D. HCl does not soluble in water.
- Calculate the moles of NaOH if 100 mL of its solution neutralized with 200 mL of 0.01M HBr ?  
 A. 0.01mol B. 0.002mol C. 0.001mol D. 0.02mol
- The solubility product of cadmium carbonate,  $\text{CdCO}_3$ , is  $1.0 \times 10^{-12}$ . In a saturated solution of this salt, the concentration of carbonate ions is:  
 A.  $5 \times 10^{-13}$  M B.  $3 \times 10^{-6}$  M C.  $1 \times 10^{-6}$  M D.  $5 \times 10^{-7}$  M
- In the following reaction :  $(2\text{HCl}_{(g)} + 184.6\text{kJ} \rightarrow \text{H}_{2(g)} + \text{Cl}_{2(g)})$ , the standard formation enthalpy of HCl equals :  
 A. 184.6kJ/mol B. -184.6kJ/mol C. -92.3kJ/mol D. 92.3kJ/mol
- A substance that can react as an acid or a base :  
 A.  $\text{SO}_4^{2-}$  B.  $\text{HSO}_3^-$  C.  $\text{CH}_3\text{COO}^-$  D.  $\text{NH}_4^+$
- Which of the following is a binary acid?  
 A.  $\text{H}_2\text{S}$  B.  $\text{H}_2\text{CO}_3$  C.  $\text{H}_2\text{O}_2$  D. all of them are correct
- The solution that contains the precisely known concentration of a solute is known as:  
 A. saturated solution B. dilute solution C. standard solution D. buffer solution
- The boiling point of a solution is higher than that of a pure solvent because :-  
 A. Vapor-pressure lowering B. Freezing- point heightening  
 C. Vapor-pressure heightening D. none of them
- For an exothermic dissolution process, the increasing of the temperature causes:  
 A. increasing dissolution B. decreasing dissolution C. decreasing crystallization D. Both (A+C) are correct
- The concentration of  $\text{H}_3\text{O}^+$  ions in aqueous solution of  $\text{Ba}(\text{OH})_2$  is  $1 \times 10^{-11}$  M, what is the molar concentration of solution?  
 A.  $1 \times 10^{-3}$  M B.  $2 \times 10^{-4}$  M C.  $2 \times 10^{-3}$  M D.  $5 \times 10^{-4}$  M
- the spectator ion in the following reaction  $(\text{Al}_{(s)} + \text{H}_2\text{SO}_{4(aq)} \rightarrow \quad)$ , is;  
 A.  $\text{SO}_4^{2-}$  B.  $\text{Al}^{+3}$  C.  $\text{H}_3\text{O}^+$  D. all of them are correct.
- In equilibrium gaseous reaction:  $2\text{NO} + \text{Cl}_2 \rightleftharpoons 2\text{NOCl} + \text{energy}$ , which of the following shift the reaction to the right ?  
 A. adding catalyst B. decreasing system volume C. increasing temperature D. decreasing pressure
- While mixing a small quantity of water with a large quantity of ethanol, water considered as :-  
 A. solvent B. solute C. solution D. none of them
- Which of the following solutions with the same concentrations has lower  $[\text{H}_3\text{O}^+]$ ?  
 A. HCl B.  $\text{H}_2\text{O}$  C.  $\text{NH}_3$  D. HF
- How many moles of ammonium sulfate must be dissociate to produce 0.4 mol of sulfate ion?  
 A. 0.2 mol B. 0.4 mol C. 0.6 mol D. 0.8 mol
- The following reaction :  $(2\text{A} + \text{B} \rightarrow \text{A}_2\text{B})$  is occur by one step mechanism the rate law for the reaction is:  
 A.  $\text{R} = k[\text{A}][\text{B}]$  B.  $\text{R} = k[\text{A}_2\text{B}]$  C.  $\text{R} = k[\text{A}]^2[\text{B}]$  D.  $\text{R} = k[\text{A}][\text{B}]^2$
- When polar compound ionizes completely in water the compound is:  
 A. ionic electrolyte. B. weak electrolyte. C. non-electrolyte molecular. D. strong molecular electrolyte.
- The entropy increases at:  
 A. evaporating of liquid B. temperature raising. C. increase pressure D. both(A+B) are correct
- Which of the following is homogenous mixture?  
 A. milk B. 24-karat gold C. tap water D. oil and water
- The energy required to raise the reactant to the level of the activated complex is:  
 A. Activation energy B. Free energy C. Kinetic energy D. Energy of reaction
- Unknown liquid miscible with toluene and immiscible with water which of the following statements is correct?  
 A. an aqueous solution for the liquid conducts electric current. B. a liquid is nonpolar molecular compound.  
 C. a liquid is polar molecular compound. D. none of them
- The methyl orange is used to determine the equivalence point in one of the following titration: If the pH range for transition interval is (3.1- 4.4):  
 A. HCl,  $\text{NH}_3$  B.  $\text{CH}_3\text{COOH}$ , NaOH C.  $\text{HNO}_3$ , NaOH D.  $\text{NH}_3$ ,  $\text{CH}_3\text{COOH}$
- The common-ion causes:  
 A. increasing precipitation. B. decreasing ionization.  
 C. shifting equilibrium to left. D. all of them are correct.
- Aqueous solution of  $\text{NH}_3$  is an Arrhenius base because:  
 A. it is proton acceptor. B. it increases the concentration of hydronium ion.  
 C. it is an electron pair donor. D. it increases the concentration of hydroxide ion.
- Which of the following ions hydrolyze in aqueous solution?  
 A.  $\text{NO}_3^-$  B.  $\text{CO}_3^{2-}$  C.  $\text{SO}_4^{2-}$  D. none of them is correct
- The boiling-point elevation of a solvent is  $2.4^\circ\text{C}$ , when the concentration of the solution containing a nonelectrolyte solute is 3.1m, what is the value of molal boiling-point constant?  
 A.  $1.29^\circ\text{C}/m$  B.  $-0.77^\circ\text{C}/m$  C.  $7.44^\circ\text{C}/m$  D.  $0.77^\circ\text{C}/m$
- Which of the following is the equilibrium constant for an anion hydrolysis reaction?  
 A.  $\frac{[\text{HB}][\text{OH}^-]}{[\text{B}^-]}$  B.  $\frac{[\text{B}^-]}{[\text{HB}][\text{OH}^-]}$  C.  $\frac{[\text{HB}]}{[\text{B}^-][\text{OH}^-]}$  D.  $\frac{[\text{B}^-][\text{OH}^-]}{[\text{HB}]}$
- The rate of the slow reaction increases by :  
 A. the addition of a catalyst. B. increasing activation energy  
 C. increasing concentration. D. Both (A+C) are correct

30. How much energy would be absorbed as heat by 75g of iron when heated from 295K to 301K if its specific heat is 0.449J/g.K?  
 A. 202kJ B. 27.83J C. 1002J D. 202J
31. The enthalpy change that occurs during the complete combustion of one mole of an element or compound is called:  
 A. Enthalpy of formation. B. Enthalpy of solution. C. Enthalpy of combustion. D. Specific Heat
32. The strength of an acid does not depend on:  
 A. The polarity of the bond between hydrogen and the element it is bonded. B. the bond energy  
 C. the number of hydrogen atoms in the chemical acid formula. D. both (A+B) are correct
33. Which of the following represents the formation equation?  
 A.  $N_2 + O_2 \rightarrow 2NO$  B.  $C_{(graphite)} + O_2 \rightarrow CO_2$  C.  $CO + \frac{1}{2} O_2 \rightarrow CO_2$  D.  $CO_2 \rightarrow C_{(graphite)} + O_2$
34. Which one of the following statements is incorrect?  
 A. Many solids dissolve more quickly in a cold solvent than in warm solvent.  
 B. Gases are generally more soluble in water at low temperature.  
 C. Aqueous solution is a mixture containing the solute soluble in water as a solvent.  
 D. The effect of stirring is similar to that of crushing a solid – contact between the solvent and the solute surface is increased.
35. All of the following statements are true about the collision theory except:  
 A. all collisions between particles of reactant leads to the occurrence of the chemical reaction  
 B. the reaction rate is directly proportional with the number of effective collision.  
 C. in order for chemical reaction to occur, the reacting particles must collide  
 D. the particles of reactants must have enough energy to initiate the reaction.
36. In the following reaction : ( $BF_{3(aq)} + F^-_{(aq)} \rightarrow BF_4^-_{(aq)}$ ) which of the following is Lewis base?  
 A.  $F^-$  B.  $BF_3$  C.  $BF_4^-$  D. none of them is correct
37. Adding  $NH_4Cl$  to  $NH_3$  solution leads to:  
 A. decrease  $[NH_3]$  B. increase  $[OH^-]$  C. increase ionization of  $NH_3$  D. increase  $[H_3O^+]$
38. In the following gaseous reaction: ( $N_2 + 3H_2 \rightleftharpoons 2NH_3$ ) it was found the  $[NH_3]=0.62\text{ M}$ ,  $[H_2]=0.14\text{ M}$ ,  $[N_2]=0.45\text{ M}$  the value of the equilibrium constant equals:  
 A.  $3.2 \times 10^{-3}$  B.  $3.11 \times 10^2$  C.  $3.11 \times 10^{-2}$  D. 9.84
39. A substance that formed when a strong acid has lost a proton  
 A. strong conjugate base B. weak conjugate acid C. weak conjugate base D. cations
40. The value of equilibrium constant for this gaseous reaction : ( $N_2O_4 \rightleftharpoons 2NO_2$ ) is 0.1 at a specified temperature, what would be the value of that constant for the reverse reaction at the same condition?  
 A. 0.05 B. 0.1 C. 10 D. 5
41. A proposed mechanism for the reaction is:- slow :  $2NO + H_2 \rightarrow N_2O + H_2O$   
 fast :  $N_2O + H_2 \rightarrow N_2 + H_2O$  which of the following is correct ?  
 A.  $R = k[NO][H_2]$  B. overall balanced equation for the reaction is :  $2NO + 2H_2 \rightarrow N_2 + 2H_2O$   
 C. the reaction order is second D. Both (A+C) are correct
42. In the following an exothermic gaseous reaction : ( $2CO + O_2 \rightarrow 2CO_2$ ) , which of the following statements is true about the reaction ?  
 A. The reaction is always spontaneous. B. The reaction is never spontaneous.  
 C. The reaction is spontaneous at low temperature. D. The reaction is spontaneous at high temperature.
43. In aqueous solution contains,  $Ca^{+2}$ ,  $SO_4^{2-}$  ions,  $CaSO_4$  precipitates if :  
 A.  $[Ca^{+2}][SO_4^{2-}] = K_{sp}$  B.  $[Ca^{+2}][SO_4^{2-}] > K_{sp}$  C.  $[Ca^{+2}][SO_4^{2-}] < K_{sp}$  D. can not be determined
44. When barium chloride solution is mixed with sodium nitrate:  
 A. sodium chloride precipitates B. barium nitrate precipitates  
 C. precipitation does not occur D. Both ( A + B ) are correct
45. A solution made from ethanol ,  $C_2H_5OH$ , and water is 1.76m in ethanol .How many moles of ethanol are contained per 250g of water?  
 A. 0.142mol B. 0.44mol C. 20.24mol D. 7.04mol
46. A reaction has  $\Delta H = -74.8\text{ kJ/mol}$  ,  $\Delta S = -0.081\text{ kJ/mol.K}$  at  $27^\circ\text{C}$  which of the following is correct?  
 A.  $\Delta G = 50.5\text{ kJ/mol}$  , nonspontaneous . B.  $\Delta G = -72.8\text{ kJ/mol}$  , spontaneous.  
 C.  $\Delta G = 72.8\text{ kJ/mol}$  , nonspontaneous D.  $\Delta G = -50.5\text{ kJ/mol}$  , spontaneous.
47. The pH of an aqueous solution composed  $2 \times 10^{-4}\text{ mol}$  of  $H_3O^+$  ions in 250 mL of its solution is equal to :-  
 A. 3.1 B. 3.7 C. 10.9 D. 10.3
48. The net ionic equation for the precipitation Nickel ( II ) sulfide is :  
 A.  $NiS_{(s)} \rightarrow Ni^{+2}_{(aq)} + S^{-2}_{(aq)}$  B.  $2Ni^{+2}_{(aq)} + 2S^{-2}_{(aq)} \rightarrow Ni_2S_{2(s)}$   
 C.  $Ni^{+2}_{(aq)} + S^{-2}_{(aq)} \rightarrow NiS_{(s)}$  D. it does not have precipitate equation because it is soluble in water.
49. In the following hypothetical reaction : ( $A_2 + B_2 \rightarrow 2AB + 30\text{ kJ}$ ), the activation energy for the forward reaction equal 50kJ/mol ,the activation energy for reverse reaction is equal to  
 A. 20kJ/mol B. 80kJ/mol C. -80kJ/mol D. 10kJ/mol
50. The rate law of the following reaction:  $A + 2B \rightarrow AB_2$ , is  $R = k[B]^2$ , what happens to the reaction rate when the concentration of both reactants is doubled?  
 A. the reaction rate remains the same. B. the reaction rate increases by a factor of two.  
 C. the reaction rate increases by a factor of four. D. the reaction rate increases by a factor eight.



Answer the following questions : ( two marks for each right choice )

- The value of equilibrium constant for this gaseous reaction :  $(N_2O_4 \rightleftharpoons 2NO_2)$  is 0.1 at a specified temperature, what would be the value of that constant for the reverse reaction at the same condition?  
 A. 0.05 B. 0.1 C. 10 D. 5
- How many moles of ammonium sulfate must be dissociate to produce 0.4 mol of sulfate ion?  
 A. 0.2 mol B. 0.4 mol C. 0.6 mol D. 0.8 mol
- Which of the following is a binary acid?  
 A.  $H_2S$  B.  $H_2CO_3$  C.  $H_2O_2$  D. all of them are correct
- In the following reaction :  $(BF_3(aq) + F^-(aq) \rightarrow BF_4^-(aq))$  which of the following is Lewis base?  
 A.  $F^-$  B.  $BF_3$  C.  $BF_4^-$  D. none of them is correct
- The following reaction :  $(2A+B \rightarrow A_2B)$  is occur by one step mechanism the rate law for the reaction is:  
 A.  $R=k[A][B]$  B.  $R=k[A_2B]$  C.  $R=k[A]^2[B]$  D.  $R=k[A][B]^2$
- In aqueous solution contains,  $Ca^{+2}$ ,  $SO_4^{2-}$  ions,  $CaSO_4$  precipitates if :  
 A.  $[Ca^{+2}][SO_4^{2-}] = K_{sp}$  B.  $[Ca^{+2}][SO_4^{2-}] > K_{sp}$  C.  $[Ca^{+2}][SO_4^{2-}] < K_{sp}$  D. can not be determined
- A solution made from ethanol,  $C_2H_5OH$ , and water is 1.76m in ethanol .How many moles of ethanol are contained per 250g of water?  
 A. 0.142mol B. 0.44mol C. 20.24mol D. 7.04mol
- When polar compound ionizes completely in water the compound is:  
 A. ionic electrolyte. B. weak electrolyte. C. non-electrolyte molecular. D. strong molecular electrolyte.
- The boiling-point elevation of a solvent is  $2.4^\circ C$ , when the concentration of the solution containing a nonelectrolyte solute is 3.1m, what is the value of molal boiling-point constant?  
 A.  $1.29^\circ C/m$  B.  $-0.77^\circ C/m$  C.  $7.44^\circ C/m$  D.  $0.77^\circ C/m$
- A reaction has  $\Delta H = -74.8 kJ/mol$ ,  $\Delta S = -0.081 kJ/mol.K$  at  $27^\circ C$  which of the following is correct?  
 A.  $\Delta G = 50.5 kJ/mol$ , nonspontaneous. B.  $\Delta G = -72.8 kJ/mol$ , spontaneous.  
 C.  $\Delta G = 72.8 kJ/mol$ , nonspontaneous D.  $\Delta G = -50.5 kJ/mol$ , spontaneous.
- Which of the following is homogenous mixture?  
 A. milk B. 24-karat gold C. tap water D. oil and water
- Unknown liquid miscible with toluene and immiscible with water which of the following statements is correct?  
 A. an aqueous solution for the liquid conducts electric current. B. a liquid is nonpolar molecular compound.  
 C. a liquid is polar molecular compound. D. none of them
- The concentration of  $H_3O^+$  ions in aqueous solution of  $Ba(OH)_2$  is  $1 \times 10^{-11} M$ , what is the molar concentration of solution?  
 A.  $1 \times 10^{-3} M$  B.  $2 \times 10^{-4} M$  C.  $2 \times 10^{-3} M$  D.  $5 \times 10^{-4} M$
- All of them are correct except:  
 A. An ionic compound at solid state does not conduct electric current.  
 B. Alloy is a mixture the atoms of two or more metals are uniformly mixed.  
 C. The Brownian motion is a motion due to collision rapidly moving molecules.  
 D. HCl does not soluble in water.
- The energy required to raise the reactant to the level of the activated complex is:  
 A. Activation energy B. Free energy C. Kinetic energy D. Energy of reaction
- Which of the following is the equilibrium constant for an anion hydrolysis reaction?  
 A.  $\frac{[HB][OH^-]}{[B^-]}$  B.  $\frac{[B^-]}{[HB][OH^-]}$  C.  $\frac{[HB]}{[B^-][OH^-]}$  D.  $\frac{[B^-][OH^-]}{[HB]}$
- When barium chloride solution is mixed with sodium nitrate:  
 A. sodium chloride precipitates B. barium nitrate precipitates  
 C. precipitation does not occur D. Both ( A + B ) are correct
- While mixing a small quantity of water with a large quantity of ethanol, water considered as :-  
 A. solvent B. solute C. solution D. none of them
- For an exothermic dissolution process, the increasing of the temperature causes:  
 A. increasing dissolution B. decreasing dissolution C. decreasing crystallization D. Both (A+C) are correct
- Aqueous solution of  $NH_3$  is an Arrhenius base because:  
 A. it is proton acceptor. B. it increases the concentration of hydronium ion.  
 C. it is an electron pair donor. D. it increases the concentration of hydroxide ion.
- Adding  $NH_4Cl$  to  $NH_3$  solution leads to:  
 A. decrease  $[NH_3]$  B. increase  $[OH^-]$  C. increase ionization of  $NH_3$  D. increase  $[H_3O^+]$
- Calculate the moles of NaOH if 100 mL of its solution neutralized with 200 mL of 0.01M HBr ?  
 A. 0.01mol B. 0.002mol C. 0.001mol D. 0.02mol
- A substance that formed when a strong acid has lost a proton  
 A. strong conjugate base B. weak conjugate acid C. weak conjugate base D. cations
- The net ionic equation for the precipitation Nickel ( II ) sulfide is :  
 A.  $NiS_{(s)} \rightarrow Ni^{+2}_{(aq)} + S^{-2}_{(aq)}$  B.  $2Ni^{+2}_{(aq)} + 2S^{-2}_{(aq)} \rightarrow Ni_2S_{2(s)}$   
 C.  $Ni^{+2}_{(aq)} + S^{-2}_{(aq)} \rightarrow NiS_{(s)}$  D. it does not have precipitate equation because it is soluble in water.
- Which of the following solutions with the same concentrations has lower  $[H_3O^+]$ ?  
 A. HCl B.  $H_2O$  C.  $NH_3$  D. HF
- In the following gaseous reaction:  $(N_2 + 3H_2 \rightleftharpoons 2NH_3)$  it was found the  $[NH_3] = 0.62 M$ ,  $[H_2] = 0.14 M$ ,  $[N_2] = 0.45 M$  the value of the equilibrium constant equals:  
 A.  $3.2 \times 10^{-3}$  B.  $3.11 \times 10^2$  C.  $3.11 \times 10^{-2}$  D. 9.84
- The boiling point of a solution is higher than that of a pure solvent because :-  
 A. Vapor-pressure lowering B. Freezing- point heightening  
 C. Vapor-pressure heightening D. none of them

28. Which one of the following statements is incorrect?
- Many solids dissolve more quickly in a cold solvent than in warm solvent.
  - Gases are generally more soluble in water at low temperature.
  - Aqueous solution is a mixture containing the solute soluble in water as a solvent.
  - The effect of stirring is similar to that of crushing a solid – contact between the solvent and the solute surface is increased.
29. The methyl orange is used to determine the equivalence point in one of the following titration: If the pH range for transition interval is (3.1- 4.4):
- HCl, NH<sub>3</sub>
  - CH<sub>3</sub>COOH, NaOH
  - HNO<sub>3</sub>, NaOH
  - NH<sub>3</sub>, CH<sub>3</sub>COOH
30. The dilute aqueous solution of a weak acid contains:
- hydronium ions.
  - acid molecules.
  - anions.
  - all of them are correct
31. A proposed mechanism for the reaction is:- slow :  $2\text{NO} + \text{H}_2 \rightarrow \text{N}_2\text{O} + \text{H}_2\text{O}$   
fast :  $\text{N}_2\text{O} + \text{H}_2 \rightarrow \text{N}_2 + \text{H}_2\text{O}$  which of the following is correct ?
- $R = k[\text{NO}][\text{H}_2]$
  - overall balanced equation for the reaction is :  $2\text{NO} + 2\text{H}_2 \rightarrow \text{N}_2 + 2\text{H}_2\text{O}$
  - the reaction order is second
  - Both (A+C) are correct
32. All of the following statements are true about the collision theory except:
- all collisions between particles of reactant leads to the occurrence of the chemical reaction
  - the reaction rate is directly proportional with the number of effective collision.
  - in order for chemical reaction to occur, the reacting particles must collide
  - the particles of reactants must have enough energy to initiate the reaction.
33. Which of the following represents the formation equation?
- $\text{N}_2 + \text{O}_2 \rightarrow 2\text{NO}$
  - $\text{C}_{(\text{graphite})} + \text{O}_2 \rightarrow \text{CO}_2$
  - $\text{CO} + \frac{1}{2} \text{O}_2 \rightarrow \text{CO}_2$
  - $\text{CO}_2 \rightarrow \text{C}_{(\text{graphite})} + \text{O}_2$
34. In the following reaction :  $(2\text{HCl}_{(\text{g})} + 184.6\text{kJ} \rightarrow \text{H}_{2(\text{g})} + \text{Cl}_{2(\text{g})})$ , the standard formation enthalpy of HCl equals :
- 184.6kJ/mol
  - 184.6kJ/mol
  - 92.3kJ/mol
  - 92.3kJ/mol
35. the spectator ion in the following reaction  $(\text{Al}_{(\text{s})} + \text{H}_2\text{SO}_{4(\text{aq})} \rightarrow \quad),$  is;
- $\text{SO}_4^{2-}$
  - $\text{Al}^{+3}$
  - $\text{H}_3\text{O}^{+}$
  - all of them are correct.
36. In the following an exothermic gaseous reaction :  $(2\text{CO} + \text{O}_2 \rightarrow 2\text{CO}_2)$  , which of the following statements is true about the reaction ?
- The reaction is always spontaneous.
  - The reaction is never spontaneous.
  - The reaction is spontaneous at low temperature.
  - The reaction is spontaneous at high temperature.
37. The rate of the slow reaction increases by :
- the addition of a catalyst.
  - increasing activation energy
  - increasing concentration.
  - Both (A+C) are correct
38. In equilibrium gaseous reaction:  $2\text{NO} + \text{Cl}_2 \rightleftharpoons 2\text{NOCl} + \text{energy}$ , which of the following shift the reaction to the right ?
- adding catalyst
  - decreasing system volume
  - increasing temperature
  - decreasing pressure
39. The entropy increases at:
- evaporating of liquid
  - temperature raising.
  - increase pressure
  - both(A+B) are correct
40. Which of the following ions hydrolyze in aqueous solution?
- $\text{NO}_3^-$
  - $\text{CO}_3^{2-}$
  - $\text{SO}_4^{2-}$
  - none of them is correct
41. The solution that contains the precisely known concentration of a solute is known as:
- saturated solution
  - dilute solution
  - standard solution
  - buffer solution
42. In the following hypothetical reaction :  $(\text{A}_2 + \text{B}_2 \rightarrow 2\text{AB} + 30\text{kJ})$ , the activation energy for the forward reaction equal 50kJ/mol ,the activation energy for reverse reaction is equal to
- 20kJ/mol
  - 80kJ/mol
  - 80kJ/mol
  - 10kJ/mol
43. A substance that can react as an acid or a base :
- $\text{SO}_4^{2-}$
  - $\text{HSO}_3^-$
  - $\text{CH}_3\text{COO}^-$
  - $\text{NH}_4^+$
44. How much energy would be absorbed as heat by 75g of iron when heated from 295K to 301K if its specific heat is 0.449J/g.K?
- 202kJ
  - 27.83J
  - 1002J
  - 202J
45. The pH of an aqueous solution composed  $2 \times 10^{-4}$  mol of  $\text{H}_3\text{O}^+$  ions in 250 mL of its solution is equal to :-
- 3.1
  - 3.7
  - 10.9
  - 10.3
46. The solubility product of cadmium carbonate,  $\text{CdCO}_3$  , is  $1.0 \times 10^{-12}$  .In a saturated solution of this salt, the concentration of carbonate ions is:
- $5 \times 10^{-13}$  M
  - $3 \times 10^{-6}$  M
  - $1 \times 10^{-6}$  M
  - $5 \times 10^{-7}$  M
47. The common-ion causes:
- increasing precipitation.
  - decreasing ionization.
  - shifting equilibrium to left.
  - all of them are correct.
48. The enthalpy change that occurs during the complete combustion of one mole of an element or compound is called:
- Enthalpy of formation.
  - Enthalpy of solution.
  - Enthalpy of combustion.
  - Specific Heat
49. The rate law of the following reaction:  $\text{A} + 2\text{B} \rightarrow \text{AB}_2$ , is  $R = k[\text{B}]^2$  , what happens to the reaction rate when the concentration of both reactants is doubled?
- the reaction rate remains the same.
  - the reaction rate increases by a factor of two.
  - the reaction rate increases by a factor of four.
  - the reaction rate increases by a factor eight.
50. The strength of an acid does not depend on:
- The polarity of the bond between hydrogen and the element it is bonded.
  - the bond energy
  - the number of hydrogen atoms in the chemical acid formula.
  - both (A+B) are correct



Answer the following questions : ( two marks for each right choice )

- Which of the following is a binary acid?  
 A.  $\text{H}_2\text{S}$  B.  $\text{H}_2\text{CO}_3$  C.  $\text{H}_2\text{O}_2$  D. all of them are correct
- Adding  $\text{NH}_4\text{Cl}$  to  $\text{NH}_3$  solution leads to:  
 A. decrease  $[\text{NH}_3]$  B. increase  $[\text{OH}^-]$  C. increase ionization of  $\text{NH}_3$  D. increase  $[\text{H}_3\text{O}^+]$
- A solution made from ethanol,  $\text{C}_2\text{H}_5\text{OH}$ , and water is 1.76m in ethanol. How many moles of ethanol are contained per 250g of water?  
 A. 0.142mol B. 0.44mol C. 20.24mol D. 7.04mol
- Which of the following solutions with the same concentrations has lower  $[\text{H}_3\text{O}^+]$ ?  
 A.  $\text{HCl}$  B.  $\text{H}_2\text{O}$  C.  $\text{NH}_3$  D.  $\text{HF}$
- All of them are correct except:  
 A. An ionic compound at solid state does not conduct electric current.  
 B. Alloy is a mixture the atoms of two or more metals are uniformly mixed.  
 C. The Brownian motion is a motion due to collision rapidly moving molecules.  
 D.  $\text{HCl}$  does not soluble in water.
- Which of the following represents the formation equation?  
 A.  $\text{N}_2 + \text{O}_2 \rightarrow 2\text{NO}$  B.  $\text{C}(\text{graphite}) + \text{O}_2 \rightarrow \text{CO}_2$  C.  $\text{CO} + \frac{1}{2} \text{O}_2 \rightarrow \text{CO}_2$  D.  $\text{CO}_2 \rightarrow \text{C}(\text{graphite}) + \text{O}_2$
- Which of the following is homogenous mixture?  
 A. milk B. 24-karat gold C. tap water D. oil and water
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- Which one of the following statements is incorrect?  
 A. Many solids dissolve more quickly in a cold solvent than in warm solvent.  
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 C. Aqueous solution is a mixture containing the solute soluble in water as a solvent.  
 D. The effect of stirring is similar to that of crushing a solid – contact between the solvent and the solute surface is increased.
- In the following reaction :  $(\text{BF}_3(\text{aq}) + \text{F}^-(\text{aq}) \rightarrow \text{BF}_4^-(\text{aq}))$  which of the following is Lewis base?  
 A.  $\text{F}^-$  B.  $\text{BF}_3$  C.  $\text{BF}_4^-$  D. none of them is correct
- The rate law of the following reaction:  $\text{A} + 2\text{B} \rightarrow \text{AB}_2$ , is  $R = k[\text{B}]^2$ , what happens to the reaction rate when the concentration of both reactants is doubled?  
 A. the reaction rate remains the same. B. the reaction rate increases by a factor of two.  
 C. the reaction rate increases by a factor of four. D. the reaction rate increases by a factor eight.
- In the following hypothetical reaction :  $(\text{A}_2 + \text{B}_2 \rightarrow 2\text{AB} + 30\text{kJ})$ , the activation energy for the forward reaction equal 50kJ/mol, the activation energy for reverse reaction is equal to  
 A. 20kJ/mol B. 80kJ/mol C. -80kJ/mol D. 10kJ/mol
- Calculate the moles of  $\text{NaOH}$  if 100 mL of its solution neutralized with 200 mL of 0.01M  $\text{HBr}$  ?  
 A. 0.01mol B. 0.002mol C. 0.001mol D. 0.02mol
- The strength of an acid does not depend on:  
 A. The polarity of the bond between hydrogen and the element it is bonded. B. the bond energy  
 C. the number of hydrogen atoms in the chemical acid formula. D. both (A+B) are correct
- In aqueous solution contains,  $\text{Ca}^{2+}, \text{SO}_4^{2-}$  ions,  $\text{CaSO}_4$  precipitates if :  
 A.  $[\text{Ca}^{2+}][\text{SO}_4^{2-}] = K_{sp}$  B.  $[\text{Ca}^{2+}][\text{SO}_4^{2-}] > K_{sp}$  C.  $[\text{Ca}^{2+}][\text{SO}_4^{2-}] < K_{sp}$  D. can not be determined
- In the following an exothermic gaseous reaction :  $(2\text{CO} + \text{O}_2 \rightarrow 2\text{CO}_2)$ , which of the following statements is true about the reaction ?  
 A. The reaction is always spontaneous. B. The reaction is never spontaneous.  
 C. The reaction is spontaneous at low temperature. D. The reaction is spontaneous at high temperature.
- The concentration of  $\text{H}_3\text{O}^+$  ions in aqueous solution of  $\text{Ba}(\text{OH})_2$  is  $1 \times 10^{-11} \text{ M}$ , what is the molar concentration of solution?  
 A.  $1 \times 10^{-3} \text{ M}$  B.  $2 \times 10^{-4} \text{ M}$  C.  $2 \times 10^{-3} \text{ M}$  D.  $5 \times 10^{-4} \text{ M}$
- Unknown liquid miscible with toluene and immiscible with water which of the following statements is correct?  
 A. an aqueous solution for the liquid conducts electric current. B. a liquid is nonpolar molecular compound.  
 C. a liquid is polar molecular compound. D. none of them
- The pH of an aqueous solution composed  $2 \times 10^{-4} \text{ mol}$  of  $\text{H}_3\text{O}^+$  ions in 250 mL of its solution is equal to :-  
 A. 3.1 B. 3.7 C. 10.9 D. 10.3
- A reaction has  $\Delta H = -74.8 \text{ kJ/mol}$ ,  $\Delta S = -0.081 \text{ kJ/mol.K}$  at  $27^\circ\text{C}$  which of the following is correct?  
 A.  $\Delta G = 50.5 \text{ kJ/mol}$ , nonspontaneous. B.  $\Delta G = -72.8 \text{ kJ/mol}$ , spontaneous.  
 C.  $\Delta G = 72.8 \text{ kJ/mol}$ , nonspontaneous D.  $\Delta G = -50.5 \text{ kJ/mol}$ , spontaneous.
- The energy required to raise the reactant to the level of the activated complex is:  
 A. Activation energy B. Free energy C. Kinetic energy D. Energy of reaction

26. In equilibrium gaseous reaction:  $2\text{NO} + \text{Cl}_2 \rightleftharpoons 2\text{NOCl} + \text{energy}$ , which of the following shift the reaction to the right ?  
 A. adding catalyst    B. decreasing system volume    C. increasing temperature    D. decreasing pressure
27. the spectator ion in the following reaction ( $\text{Al}_{(\text{s})} + \text{H}_2\text{SO}_{4(\text{aq})} \rightarrow$  ), is:  
 A.  $\text{SO}_4^{2-}$     B.  $\text{Al}^{+3}$     C.  $\text{H}_3\text{O}^+$     D. all of them are correct.
28. The entropy increases at:  
 A. evaporating of liquid    B. temperature raising.    C. increase pressure    D. both(A+B) are correct
29. The net ionic equation for the precipitation Nickel ( II )sulfide is :  
 A.  $\text{NiS}_{(\text{s})} \rightarrow \text{Ni}^{+2}_{(\text{aq})} + \text{S}^{-2}_{(\text{aq})}$     B.  $2\text{Ni}^{+2}_{(\text{aq})} + 2\text{S}^{-2}_{(\text{aq})} \rightarrow \text{Ni}_2\text{S}_{2(\text{s})}$   
 C.  $\text{Ni}^{+2}_{(\text{aq})} + \text{S}^{-2}_{(\text{aq})} \rightarrow \text{NiS}_{(\text{s})}$     D. it does not have precipitate equation because it is soluble in water.
30. The rate of the slow reaction increases by :  
 A. the addition of a catalyst.    B. increasing activation energy  
 C. increasing concentration.    D. Both (A+C) are correct
31. All of the following statements are true about the collision theory except:  
 A. all collisions between particles of reactant leads to the occurrence of the chemical reaction  
 B. the reaction rate is directly proportional with the number of effective collision.  
 C. in order for chemical reaction to occur, the reacting particles must collide  
 D. the particles of reactants must have enough energy to initiate the reaction.
32. Which of the following is the equilibrium constant for an anion hydrolysis reaction?  
 A.  $\frac{[\text{HB}][\text{OH}^-]}{[\text{B}^-]}$     B.  $\frac{[\text{B}^-]}{[\text{HB}][\text{OH}^-]}$     C.  $\frac{[\text{HB}]}{[\text{B}^-][\text{OH}^-]}$     D.  $\frac{[\text{B}^-][\text{OH}^-]}{[\text{HB}]}$
33. Which of the following ions hydrolyze in aqueous solution?  
 A.  $\text{NO}_3^-$     B.  $\text{CO}_3^{2-}$     C.  $\text{SO}_4^{2-}$     D. none of them is correct
34. When barium chloride solution is mixed with sodium nitrate:  
 A. sodium chloride precipitates    B. barium nitrate precipitates  
 C. precipitation does not occur    D. Both ( A + B ) are correct
35. How many moles of ammonium sulfate must be dissociate to produce 0.4 mol of sulfate ion?  
 A. 0.2 mol    B. 0.4 mol    C. 0.6 mol    D. 0.8 mol
36. The value of equilibrium constant for this gaseous reaction :( $\text{N}_2\text{O}_4 \rightleftharpoons 2\text{NO}_2$ ) is 0.1 at a specified temperature, what would be the value of that constant for the reverse reaction at the same condition?  
 A. 0.05    B. 0.1    C. 10    D. 5
37. The solution that contains the precisely known concentration of a solute is known as:  
 A. saturated solution    B. dilute solution    C. standard solution    D. buffer solution
38. The dilute aqueous solution of a weak acid contains:  
 A. hydronium ions.    B. acid molecules.    C. anions.    D. all of them are correct
39. How much energy would be absorbed as heat by 75g of iron when heated from 295K to 301K if its specific heat is 0.449J/g.K?  
 A. 202kJ    B. 27.83J    C. 1002J    D. 202J
40. The solubility product of cadmium carbonate,  $\text{CdCO}_3$ , is  $1.0 \times 10^{-12}$ . In a saturated solution of this salt, the concentration of carbonate ions is:  
 A.  $5 \times 10^{-13} \text{ M}$     B.  $3 \times 10^{-6} \text{ M}$     C.  $1 \times 10^{-6} \text{ M}$     D.  $5 \times 10^{-7} \text{ M}$
41. Aqueous solution of  $\text{NH}_3$  is an Arrhenius base because:  
 A. it is proton acceptor.    B. it increases the concentration of hydronium ion.  
 C. it is an electron pair donor.    D. it increases the concentration of hydroxide ion.
42. The following reaction :( $2\text{A} + \text{B} \rightarrow \text{A}_2\text{B}$ ) is occur by one step mechanism the rate law for the reaction is:  
 A.  $\text{R} = k[\text{A}][\text{B}]$     B.  $\text{R} = k[\text{A}_2\text{B}]$     C.  $\text{R} = k[\text{A}]^2[\text{B}]$     D.  $\text{R} = k[\text{A}][\text{B}]^2$
43. The common-ion causes:  
 A. increasing precipitation.    B. decreasing ionization.  
 C. shifting equilibrium to left.    D. all of them are correct.
44. In the following reaction :( $2\text{HCl}_{(\text{g})} + 184.6\text{kJ} \rightarrow \text{H}_{2(\text{g})} + \text{Cl}_{2(\text{g})}$ ), the standard formation enthalpy of HCl equals :  
 A. 184.6kJ/mol    B. -184.6kJ/mol    C. -92.3kJ/mol    D. 92.3kJ/mol
45. The methyl orange is used to determine the equivalence point in one of the following titration: If the pH range for transition interval is (3.1- 4.4):  
 A. HCl,  $\text{NH}_3$     B.  $\text{CH}_3\text{COOH}$ , NaOH    C.  $\text{HNO}_3$ , NaOH    D.  $\text{NH}_3$ ,  $\text{CH}_3\text{COOH}$
46. When polar compound ionizes completely in water the compound is:  
 A. ionic electrolyte.    B. weak electrolyte.    C. non-electrolyte molecular.    D. strong molecular electrolyte.
47. A proposed mechanism for the reaction is:- slow : $2\text{NO} + \text{H}_2 \rightarrow \text{N}_2\text{O} + \text{H}_2\text{O}$   
 fast : $\text{N}_2\text{O} + \text{H}_2 \rightarrow \text{N}_2 + \text{H}_2\text{O}$  which of the following is correct ?  
 A.  $\text{R} = k[\text{NO}][\text{H}_2]$     B. overall balanced equation for the reaction is : $2\text{NO} + 2\text{H}_2 \rightarrow \text{N}_2 + 2\text{H}_2\text{O}$   
 C. the reaction order is second    D. Both (A+C) are correct
48. A substance that can react as an acid or a base :  
 A.  $\text{SO}_4^{2-}$     B.  $\text{HSO}_3^-$     C.  $\text{CH}_3\text{COO}^-$     D.  $\text{NH}_4^+$
49. A substance that formed when a strong acid has lost a proton  
 A. strong conjugate base    B. weak conjugate acid    C. weak conjugate base    D. cations
50. The boiling-point elevation of a solvent is  $2.4^\circ\text{C}$ , when the concentration of the solution containing a nonelectrolyte solute is 3.1m, what is the value of molal boiling-point constant?  
 A.  $1.29^\circ\text{C}/m$     B.  $-0.77^\circ\text{C}/m$     C.  $7.44^\circ\text{C}/m$     D.  $0.77^\circ\text{C}/m$

Answer the following questions : ( two marks for each right choice )

- When barium chloride solution is mixed with sodium nitrate:
  - sodium chloride precipitates
  - barium nitrate precipitates
  - precipitation does not occur
  - Both ( A + B ) are correct
- Aqueous solution of  $\text{NH}_3$  is an Arrhenius base because:
  - it is proton acceptor.
  - it increases the concentration of hydronium ion.
  - it is an electron pair donor.
  - it increases the concentration of hydroxide ion.
- In the following hypothetical reaction :  $(\text{A}_2 + \text{B}_2 \rightarrow 2\text{AB} + 30\text{kJ})$ , the activation energy for the forward reaction equal 50kJ/mol ,the activation energy for reverse reaction is equal to
  - 20kJ/mol
  - 80kJ/mol
  - 80kJ/mol
  - 10kJ/mol
- A solution made from ethanol , $\text{C}_2\text{H}_5\text{OH}$ ,and water is 1.76m in ethanol .How many moles of ethanol are contained per 250g of water?
  - 0.142mol
  - 0.44mol
  - 20.24mol
  - 7.04mol
- How much energy would be absorbed as heat by 75g of iron when heated from 295K to 301K if its specific heat is 0.449J/g.K?
  - 202kJ
  - 27.83J
  - 1002J
  - 202J
- The dilute aqueous solution of a weak acid contains:
  - hydronium ions.
  - acid molecules.
  - anions.
  - all of them are correct
- In equilibrium gaseous reaction:  $2\text{NO} + \text{Cl}_2 \rightleftharpoons 2\text{NOCl} + \text{energy}$ , which of the following shift the reaction to the right ?
  - adding catalyst
  - decreasing system volume
  - increasing temperature
  - decreasing pressure
- The common-ion causes:
  - increasing precipitation.
  - decreasing ionization.
  - shifting equilibrium to left.
  - all of them are correct.
- The rate of the slow reaction increases by :
  - the addition of a catalyst.
  - increasing activation energy
  - increasing concentration.
  - Both (A+C) are correct
- the spectator ion in the following reaction  $(\text{Al}_{(\text{s})} + \text{H}_2\text{SO}_{4(\text{aq})} \rightarrow \quad),$  is;
  - $\text{SO}_4^{2-}$
  - $\text{Al}^{+3}$
  - $\text{H}_3\text{O}^+$
  - all of them are correct.
- For an exothermic dissolution process, the increasing of the temperature causes:
  - increasing dissolution
  - decreasing dissolution
  - decreasing crystallization
  - Both (A+C) are correct
- When polar compound ionizes completely in water the compound is:
  - ionic electrolyte.
  - weak electrolyte.
  - non-electrolyte molecular.
  - strong molecular electrolyte.
- All of them are correct except:
  - An ionic compound at solid state does not conduct electric current.
  - Alloy is a mixture the atoms of two or more metals are uniformly mixed.
  - The Brownian motion is a motion due to collision rapidly moving molecules.
  - HCl does not soluble in water.
- Which of the following represents the formation equation?
  - $\text{N}_2 + \text{O}_2 \rightarrow 2\text{NO}$
  - $\text{C}_{(\text{graphite})} + \text{O}_2 \rightarrow \text{CO}_2$
  - $\text{CO} + 1/2 \text{O}_2 \rightarrow \text{CO}_2$
  - $\text{CO}_2 \rightarrow \text{C}_{(\text{graphite})} + \text{O}_2$
- In aqueous solution contains,  $\text{Ca}^{+2}, \text{SO}_4^{2-}$  ions,  $\text{CaSO}_4$  precipitates if :
  - $[\text{Ca}^{+2}][\text{SO}_4^{2-}] = K_{\text{sp}}$
  - $[\text{Ca}^{+2}][\text{SO}_4^{2-}] > K_{\text{sp}}$
  - $[\text{Ca}^{+2}][\text{SO}_4^{2-}] < K_{\text{sp}}$
  - can not be determined
- The entropy increases at:
  - evaporating of liquid
  - temperature raising.
  - increase pressure
  - both(A+B) are correct
- A reaction has  $\Delta H = -74.8\text{kJ/mol}$  ,  $\Delta S = -0.081\text{kJ/mol.K}$  at  $27^\circ\text{C}$  which of the following is correct?
  - $\Delta G = 50.5\text{kJ/mol}$  , nonspontaneous .
  - $\Delta G = -72.8\text{kJ/mol}$  , spontaneous.
  - $\Delta G = 72.8\text{kJ/mol}$  , nonspontaneous
  - $\Delta G = -50.5\text{kJ/mol}$  , spontaneous.
- The boiling-point elevation of a solvent is  $2.4^\circ\text{C}$ , when the concentration of the solution containing a nonelectrolyte solute is 3.1m, what is the value of molal boiling-point constant?
  - $1.29^\circ\text{C/m}$
  - $-0.77^\circ\text{C/m}$
  - $7.44^\circ\text{C/m}$
  - $0.77^\circ\text{C/m}$
- The enthalpy change that occurs during the complete combustion of one mole of an element or compound is called:
  - Enthalpy of formation.
  - Enthalpy of solution.
  - Enthalpy of combustion.
  - Specific Heat
- Which of the following solutions with the same concentrations has lower  $[\text{H}_3\text{O}^+]$ ?
  - HCl
  - $\text{H}_2\text{O}$
  - $\text{NH}_3$
  - HF
- While mixing a small quantity of water with a large quantity of ethanol, water considered as :-
  - solvent
  - solute
  - solution
  - none of them
- A substance that formed when a strong acid has lost a proton
  - strong conjugate base
  - weak conjugate acid
  - weak conjugate base
  - cations
- In the following gaseous reaction:  $(\text{N}_2 + 3\text{H}_2 \rightleftharpoons 2\text{NH}_3)$  it was found the  $[\text{NH}_3] = 0.62\text{M}$  ,  $[\text{H}_2] = 0.14\text{M}$  ,  $[\text{N}_2] = 0.45\text{M}$  the value of the equilibrium constant equals:
  - $3.2 \times 10^{-3}$
  - $3.11 \times 10^2$
  - $3.11 \times 10^{-2}$
  - 9.84
- Which of the following is the equilibrium constant for an anion hydrolysis reaction?
  - $\frac{[\text{HB}][\text{OH}^-]}{[\text{B}^-]}$
  - $\frac{[\text{B}^-]}{[\text{HB}][\text{OH}^-]}$
  - $\frac{[\text{HB}]}{[\text{B}^-][\text{OH}^-]}$
  - $\frac{[\text{B}^-][\text{OH}^-]}{[\text{HB}]}$
- The following reaction :  $(2\text{A} + \text{B} \rightarrow \text{A}_2\text{B})$  is occur by one step mechanism the rate law for the reaction is:
  - $\text{R} = k[\text{A}][\text{B}]$
  - $\text{R} = k[\text{A}_2\text{B}]$
  - $\text{R} = k[\text{A}]^2[\text{B}]$
  - $\text{R} = k[\text{A}][\text{B}]^2$
- All of the following statements are true about the collision theory except:
  - all collisions between particles of reactant leads to the occurrence of the chemical reaction
  - the reaction rate is directly proportional with the number of effective collision.
  - in order for chemical reaction to occur, the reacting particles must collide
  - the particles of reactants must have enough energy to initiate the reaction.

27. A substance that can react as an acid or a base :

- A.  $\text{SO}_4^{2-}$                       B.  $\text{HSO}_3^-$                       C.  $\text{CH}_3\text{COO}^-$                       D.  $\text{NH}_4^+$

28. In the following an exothermic gaseous reaction :  $(2\text{CO} + \text{O}_2 \rightarrow 2\text{CO}_2)$  , which of the following statements is true about the reaction ?

- A. The reaction is always spontaneous.                      B. The reaction is never spontaneous.  
C. The reaction is spontaneous at low temperature.                      D. The reaction is spontaneous at high temperature.

29. Which of the following is a binary acid?

- A.  $\text{H}_2\text{S}$                       B.  $\text{H}_2\text{CO}_3$                       C.  $\text{H}_2\text{O}_2$                       D. all of them are correct

30. Unknown liquid miscible with toluene and immiscible with water which of the following statements is correct?

- A. an aqueous solution for the liquid conducts electric current.                      B. a liquid is nonpolar molecular compound.  
C. a liquid is polar molecular compound.                      D. none of them

31. The energy required to raise the reactant to the level of the activated complex is:

- A. Activation energy                      B. Free energy                      C. Kinetic energy                      D. Energy of reaction

32. The solution that contains the precisely known concentration of a solute is known as:

- A. saturated solution                      B. dilute solution                      C. standard solution                      D. buffer solution

33. How many moles of ammonium sulfate must be dissociate to produce 0.4 mol of sulfate ion?

- A. 0.2 mol                      B. 0.4 mol                      C. 0.6 mol                      D. 0.8 mol

34. The strength of an acid does not depend on:

- A. The polarity of the bond between hydrogen and the element it is bonded.                      B. the bond energy  
C. the number of hydrogen atoms in the chemical acid formula.                      D. both (A+B) are correct

35. Which one of the following statements is incorrect?

- A. Many solids dissolve more quickly in a cold solvent than in warm solvent.  
B. Gases are generally more soluble in water at low temperature.  
C. Aqueous solution is a mixture containing the solute soluble in water as a solvent.  
D. The effect of stirring is similar to that of crushing a solid – contact between the solvent and the solute surface is increased.

36. Which of the following ions hydrolyze in aqueous solution?

- A.  $\text{NO}_3^-$                       B.  $\text{CO}_3^{2-}$                       C.  $\text{SO}_4^{2-}$                       D. none of them is correct

37. The pH of an aqueous solution composed  $2 \times 10^{-4}$  mol of  $\text{H}_3\text{O}^+$  ions in 250 mL of its solution is equal to :-

- A. 3.1                      B. 3.7                      C. 10.9                      D. 10.3

38. The rate law of the following reaction:  $\text{A} + 2\text{B} \rightarrow \text{AB}_2$ , is  $R = k[\text{B}]^2$ , what happens to the reaction rate when the concentration of both reactants is doubled?

- A. the reaction rate remains the same.                      B. the reaction rate increases by a factor of two.  
C. the reaction rate increases by a factor of four.                      D. the reaction rate increases by a factor eight.

39. The concentration of  $\text{H}_3\text{O}^+$  ions in aqueous solution of  $\text{Ba}(\text{OH})_2$  is  $1 \times 10^{-11}$  M, what is the molar concentration of solution?

- A.  $1 \times 10^{-3}$  M                      B.  $2 \times 10^{-4}$  M                      C.  $2 \times 10^{-3}$  M                      D.  $5 \times 10^{-4}$  M

40. In the following reaction :  $(\text{BF}_{3(\text{aq})} + \text{F}^-_{(\text{aq})} \rightarrow \text{BF}_4^-_{(\text{aq})})$  which of the following is Lewis base?

- A.  $\text{F}^-$                       B.  $\text{BF}_3$                       C.  $\text{BF}_4^-$                       D. none of them is correct

41. A proposed mechanism for the reaction is:- slow :  $2\text{NO} + \text{H}_2 \rightarrow \text{N}_2\text{O} + \text{H}_2\text{O}$

fast :  $\text{N}_2\text{O} + \text{H}_2 \rightarrow \text{N}_2 + \text{H}_2\text{O}$  which of the following is correct ?

- A.  $R = k[\text{NO}][\text{H}_2]$                       B. overall balanced equation for the reaction is :  $2\text{NO} + 2\text{H}_2 \rightarrow \text{N}_2 + 2\text{H}_2\text{O}$   
C. the reaction order is second                      D. Both (A+C) are correct

42. Which of the following is homogenous mixture?

- A. milk                      B. 24-karat gold                      C. tap water                      D. oil and water

43. The boiling point of a solution is higher than that of a pure solvent because :-

- A. Vapor-pressure lowering                      B. Freezing- point heightening  
C. Vapor-pressure heightening                      D. none of them

44. Adding  $\text{NH}_4\text{Cl}$  to  $\text{NH}_3$  solution leads to:

- A. decrease  $[\text{NH}_3]$                       B. increase  $[\text{OH}^-]$                       C. increase ionization of  $\text{NH}_3$                       D. increase  $[\text{H}_3\text{O}^+]$

45. The value of equilibrium constant for this gaseous reaction :  $(\text{N}_2\text{O}_4 \rightleftharpoons 2\text{NO}_2)$  is 0.1 at a specified temperature, what would be the value of that constant for the reverse reaction at the same condition?

- A. 0.05                      B. 0.1                      C. 10                      D. 5

46. The net ionic equation for the precipitation Nickel ( II )sulfide is :

- A.  $\text{NiS}_{(\text{s})} \rightarrow \text{Ni}^{+2}_{(\text{aq})} + \text{S}^{-2}_{(\text{aq})}$                       B.  $2\text{Ni}^{+2}_{(\text{aq})} + 2\text{S}^{-2}_{(\text{aq})} \rightarrow \text{Ni}_2\text{S}_{2(\text{s})}$   
C.  $\text{Ni}^{+2}_{(\text{aq})} + \text{S}^{-2}_{(\text{aq})} \rightarrow \text{NiS}_{(\text{s})}$                       D. it does not have precipitate equation because it is soluble in water.

47. Calculate the moles of NaOH if 100 mL of its solution neutralized with 200 mL of 0.01M HBr ?

- A. 0.01mol                      B. 0.002mol                      C. 0.001mol                      D. 0.02mol

48. In the following reaction :  $(2\text{HCl}_{(\text{g})} + 184.6\text{kJ} \rightarrow \text{H}_{2(\text{g})} + \text{Cl}_{2(\text{g})})$ , the standard formation enthalpy of HCl equals :

- A. 184.6kJ/mol                      B. -184.6kJ/mol                      C. -92.3kJ/mol                      D. 92.3kJ/mol

49. The methyl orange is used to determine the equivalence point in one of the following titration: If the pH range for transition interval is (3.1- 4.4):

- A.  $\text{HCl}$ ,  $\text{NH}_3$                       B.  $\text{CH}_3\text{COOH}$ ,  $\text{NaOH}$                       C.  $\text{HNO}_3$ ,  $\text{NaOH}$                       D.  $\text{NH}_3$ ,  $\text{CH}_3\text{COOH}$

50. The solubility product of cadmium carbonate,  $\text{CdCO}_3$ , is  $1.0 \times 10^{-12}$ . In a saturated solution of this salt, the concentration of carbonate ions is:

- A.  $5 \times 10^{-13}$  M                      B.  $3 \times 10^{-6}$  M                      C.  $1 \times 10^{-6}$  M                      D.  $5 \times 10^{-7}$  M

R



Answer the following questions : ( two marks for each right choice )

- Unknown liquid miscible with toluene and immiscible with water which of the following statements is correct?  
 A. an aqueous solution for the liquid conducts electric current. B. a liquid is nonpolar molecular compound.  
 C. a liquid is polar molecular compound. D. none of them
- The solubility product of cadmium carbonate,  $\text{CdCO}_3$ , is  $1.0 \times 10^{-12}$ . In a saturated solution of this salt, the concentration of carbonate ions is:  
 A.  $5 \times 10^{-13} \text{ M}$  B.  $3 \times 10^{-6} \text{ M}$  C.  $1 \times 10^{-6} \text{ M}$  D.  $5 \times 10^{-7} \text{ M}$
- When polar compound ionizes completely in water the compound is:  
 A. ionic electrolyte. B. weak electrolyte. C. non-electrolyte molecular. D. strong molecular electrolyte.
- The pH of an aqueous solution composed  $2 \times 10^{-4} \text{ mol}$  of  $\text{H}_3\text{O}^+$  ions in 250 mL of its solution is equal to :-  
 A. 3.1 B. 3.7 C. 10.9 D. 10.3
- The value of equilibrium constant for this gaseous reaction :  $(\text{N}_2\text{O}_4 \rightleftharpoons 2\text{NO}_2)$  is 0.1 at a specified temperature, what would be the value of that constant for the reverse reaction at the same condition?  
 A. 0.05 B. 0.1 C. 10 D. 5
- In the following reaction :  $(2\text{HCl}_{(g)} + 184.6 \text{ kJ} \rightarrow \text{H}_{2(g)} + \text{Cl}_{2(g)})$ , the standard formation enthalpy of HCl equals :  
 A. 184.6 kJ/mol B. -184.6 kJ/mol C. -92.3 kJ/mol D. 92.3 kJ/mol
- In aqueous solution contains,  $\text{Ca}^{+2}, \text{SO}_4^{2-}$  ions,  $\text{CaSO}_4$  precipitates if :  
 A.  $[\text{Ca}^{+2}][\text{SO}_4^{2-}] = K_{sp}$  B.  $[\text{Ca}^{+2}][\text{SO}_4^{2-}] > K_{sp}$  C.  $[\text{Ca}^{+2}][\text{SO}_4^{2-}] < K_{sp}$  D. can not be determined
- Which of the following is homogenous mixture?  
 A. milk B. 24-karat gold C. tap water D. oil and water
- The dilute aqueous solution of a weak acid contains:  
 A. hydronium ions. B. acid molecules. C. anions. D. all of them are correct
- The rate law of the following reaction:  $\text{A} + 2\text{B} \rightarrow \text{AB}_2$ , is  $R = k[\text{B}]^2$ , what happens to the reaction rate when the concentration of both reactants is doubled?  
 A. the reaction rate remains the same. B. the reaction rate increases by a factor of two.  
 C. the reaction rate increases by a factor of four. D. the reaction rate increases by a factor eight.
- The following reaction :  $(2\text{A} + \text{B} \rightarrow \text{A}_2\text{B})$  is occur by one step mechanism the rate law for the reaction is:  
 A.  $R = k[\text{A}][\text{B}]$  B.  $R = k[\text{A}_2\text{B}]$  C.  $R = k[\text{A}]^2[\text{B}]$  D.  $R = k[\text{A}][\text{B}]^2$
- The rate of the slow reaction increases by :  
 A. the addition of a catalyst. B. increasing activation energy  
 C. increasing concentration. D. Both (A+C) are correct
- A solution made from ethanol,  $\text{C}_2\text{H}_5\text{OH}$ , and water is 1.76m in ethanol .How many moles of ethanol are contained per 250g of water?  
 A. 0.142mol B. 0.44mol C. 20.24mol D. 7.04mol

- In equilibrium gaseous reaction:  $2\text{NO} + \text{Cl}_2 \rightleftharpoons 2\text{NOCl} + \text{energy}$ , which of the following shift the reaction to the right ?  
 A. adding catalyst B. decreasing system volume C. increasing temperature D. decreasing pressure
- In the following an exothermic gaseous reaction :  $(2\text{CO} + \text{O}_2 \rightarrow 2\text{CO}_2)$ , which of the following statements is true about the reaction ?  
 A. The reaction is always spontaneous. B. The reaction is never spontaneous.  
 C. The reaction is spontaneous at low temperature. D. The reaction is spontaneous at high temperature.
- The enthalpy change that occurs during the complete combustion of one mole of an element or compound is called:  
 A. Enthalpy of formation. B. Enthalpy of solution. C. Enthalpy of combustion. D. Specific Heat
- Which of the following is a binary acid?  
 A.  $\text{H}_2\text{S}$  B.  $\text{H}_2\text{CO}_3$  C.  $\text{H}_2\text{O}_2$  D. all of them are correct
- The concentration of  $\text{H}_3\text{O}^+$  ions in aqueous solution of  $\text{Ba}(\text{OH})_2$  is  $1 \times 10^{-11} \text{ M}$ , what is the molar concentration of solution?  
 A.  $1 \times 10^{-3} \text{ M}$  B.  $2 \times 10^{-4} \text{ M}$  C.  $2 \times 10^{-3} \text{ M}$  D.  $5 \times 10^{-4} \text{ M}$
- Calculate the moles of NaOH if 100 mL of its solution neutralized with 200 mL of 0.01M HBr ?  
 A. 0.01mol B. 0.002mol C. 0.001mol D. 0.02mol
- Which of the following solutions with the same concentrations has lower  $[\text{H}_3\text{O}^+]$ ?  
 A. HCl B.  $\text{H}_2\text{O}$  C.  $\text{NH}_3$  D. HF
- All of the following statements are true about the collision theory except:  
 A. all collisions between particles of reactant leads to the occurrence of the chemical reaction  
 B. the reaction rate is directly proportional with the number of effective collision.  
 C. in order for chemical reaction to occur, the reacting particles must collide  
 D. the particles of reactants must have enough energy to initiate the reaction.
- Which of the following represents the formation equation?  
 A.  $\text{N}_2 + \text{O}_2 \rightarrow 2\text{NO}$  B.  $\text{C}_{(\text{graphite})} + \text{O}_2 \rightarrow \text{CO}_2$  C.  $\text{CO} + 1/2 \text{O}_2 \rightarrow \text{CO}_2$  D.  $\text{CO}_2 \rightarrow \text{C}_{(\text{graphite})} + \text{O}_2$
- The net ionic equation for the precipitation Nickel ( II )sulfide is :  
 A.  $\text{NiS}_{(s)} \rightarrow \text{Ni}^{+2}_{(aq)} + \text{S}^{-2}_{(aq)}$  B.  $2\text{Ni}^{+2}_{(aq)} + 2\text{S}^{-2}_{(aq)} \rightarrow \text{Ni}_2\text{S}_{2(s)}$   
 C.  $\text{Ni}^{+2}_{(aq)} + \text{S}^{-2}_{(aq)} \rightarrow \text{NiS}_{(s)}$  D. it does not have precipitate equation because it is soluble in water.
- All of them are correct except:  
 A. An ionic compound at solid state does not conduct electric current.  
 B. Alloy is a mixture the atoms of two or more metals are uniformly mixed.  
 C. The Brownian motion is a motion due to collision rapidly moving molecules.  
 D. HCl does not soluble in water.
- the spectator ion in the following reaction  $(\text{Al}_{(s)} + \text{H}_2\text{SO}_{4(aq)} \rightarrow \quad)$ , is;  
 A.  $\text{SO}_4^{2-}$  B.  $\text{Al}^{+3}$  C.  $\text{H}_3\text{O}^+$  D. all of them are correct.
- While mixing a small quantity of water with a large quantity of ethanol, water considered as :-  
 A. solvent B. solute C. solution D. none of them
- For an exothermic dissolution process, the increasing of the temperature causes:  
 A. increasing dissolution B. decreasing dissolution C. decreasing crystallization D. Both (A+C) are correct

28. In the following gaseous reaction:  $(N_2 + 3H_2 \rightleftharpoons 2NH_3)$  it was found the  $[NH_3]=0.62\text{ M}$ ,  $[H_2]=0.14\text{ M}$ ,  $[N_2]=0.45\text{ M}$  the value of the equilibrium constant equals:

- A.  $3.2 \times 10^{-3}$       B.  $3.11 \times 10^2$       C.  $3.11 \times 10^{-2}$       D. 9.84

29. Which of the following is the equilibrium constant for an anion hydrolysis reaction?

- A.  $\frac{[HB][OH^-]}{[B^-]}$       B.  $\frac{[B^-]}{[HB][OH^-]}$       C.  $\frac{[HB]}{[B^-][OH^-]}$       D.  $\frac{[B^-][OH^-]}{[HB]}$

30. The boiling point of a solution is higher than that of a pure solvent because :-

- A. Vapor-pressure lowering      B. Freezing- point heightening  
C. Vapor-pressure heightening      D. none of them

31. The common-ion causes:

- A. increasing precipitation.      B. decreasing ionization.  
C. shifting equilibrium to left.      D. all of them are correct.

32. The boiling-point elevation of a solvent is  $2.4^\circ\text{C}$ , when the concentration of the solution containing a nonelectrolyte solute is  $3.1\text{ m}$ , what is the value of molal boiling-point constant?

- A.  $1.29^\circ\text{C/m}$       B.  $-0.77^\circ\text{C/m}$       C.  $7.44^\circ\text{C/m}$       D.  $0.77^\circ\text{C/m}$

33. A proposed mechanism for the reaction is:- slow :  $2NO + H_2 \rightarrow N_2O + H_2O$

fast :  $N_2O + H_2 \rightarrow N_2 + H_2O$  which of the following is correct ?

- A.  $R = k[NO][H_2]$       B. overall balanced equation for the reaction is :  $2NO + 2H_2 \rightarrow N_2 + 2H_2O$   
C. the reaction order is second      D. Both (A+C) are correct

34. The strength of an acid does not depend on:

- A. The polarity of the bond between hydrogen and the element it is bonded.      B. the bond energy  
C. the number of hydrogen atoms in the chemical acid formula.      D. both (A+B) are correct

35. Adding  $NH_4Cl$  to  $NH_3$  solution leads to:

- A. decrease  $[NH_3]$       B. increase  $[OH^-]$       C. increase ionization of  $NH_3$       D. increase  $[H_3O^+]$

36. The entropy increases at:

- A. evaporating of liquid      B. temperature raising.      C. increase pressure      D. both(A+B) are correct

37. In the following hypothetical reaction :  $(A_2 + B_2 \rightarrow 2AB + 30\text{ kJ})$ , the activation energy for the forward reaction equal  $50\text{ kJ/mol}$ , the activation energy for reverse reaction is equal to

- A.  $20\text{ kJ/mol}$       B.  $80\text{ kJ/mol}$       C.  $-80\text{ kJ/mol}$       D.  $10\text{ kJ/mol}$

38. Aqueous solution of  $NH_3$  is an Arrhenius base because:

- A. it is proton acceptor.      B. it increases the concentration of hydronium ion.  
C. it is an electron pair donor.      D. it increases the concentration of hydroxide ion.

39. A reaction has  $\Delta H = -74.8\text{ kJ/mol}$ ,  $\Delta S = -0.081\text{ kJ/mol.K}$  at  $27^\circ\text{C}$  which of the following is correct?

- A.  $\Delta G = 50.5\text{ kJ/mol}$ , nonspontaneous.      B.  $\Delta G = -72.8\text{ kJ/mol}$ , spontaneous.  
C.  $\Delta G = 72.8\text{ kJ/mol}$ , nonspontaneous      D.  $\Delta G = -50.5\text{ kJ/mol}$ , spontaneous.

40. The methyl orange is used to determine the equivalence point in one of the following titration: If the pH range for transition interval is (3.1- 4.4):

- A.  $HCl$ ,  $NH_3$       B.  $CH_3COOH$ ,  $NaOH$       C.  $HNO_3$ ,  $NaOH$       D.  $NH_3$ ,  $CH_3COOH$

41. In the following reaction :  $(BF_{3(aq)} + F^-_{(aq)} \rightarrow BF_{4(aq)}^-)$  which of the following is Lewis base?

- A.  $F^-$       B.  $BF_3$       C.  $BF_4^-$       D. none of them is correct

42. Which one of the following statements is incorrect?

- A. Many solids dissolve more quickly in a cold solvent than in warm solvent.  
B. Gases are generally more soluble in water at low temperature.  
C. Aqueous solution is a mixture containing the solute soluble in water as a solvent.  
D. The effect of stirring is similar to that of crushing a solid – contact between the solvent and the solute surface is increased.

43. Which of the following ions hydrolyze in aqueous solution?

- A.  $NO_3^-$       B.  $CO_3^{2-}$       C.  $SO_4^{2-}$       D. none of them is correct

44. A substance that can react as an acid or a base :

- A.  $SO_4^{2-}$       B.  $HSO_3^-$       C.  $CH_3COO^-$       D.  $NH_4^+$

45. How many moles of ammonium sulfate must be dissociate to produce  $0.4\text{ mol}$  of sulfate ion?

- A.  $0.2\text{ mol}$       B.  $0.4\text{ mol}$       C.  $0.6\text{ mol}$       D.  $0.8\text{ mol}$

46. The solution that contains the precisely known concentration of a solute is known as:

- A. saturated solution      B. dilute solution      C. standard solution      D. buffer solution

47. How much energy would be absorbed as heat by  $75\text{ g}$  of iron when heated from  $295\text{ K}$  to  $301\text{ K}$  if its specific heat is  $0.449\text{ J/g.K}$ ?

- A.  $202\text{ kJ}$       B.  $27.83\text{ J}$       C.  $1002\text{ J}$       D.  $202\text{ J}$

48. The energy required to raise the reactant to the level of the activated complex is:

- A. Activation energy      B. Free energy      C. Kinetic energy      D. Energy of reaction

49. When barium chloride solution is mixed with sodium nitrate:

- A. sodium chloride precipitates      B. barium nitrate precipitates  
C. precipitation does not occur      D. Both ( A + B ) are correct

50. A substance that formed when a strong acid has lost a proton

- A. strong conjugate base      B. weak conjugate acid      C. weak conjugate base      D. cations

**S**

Answer the following questions : ( two marks for each right choice )

- All of them are correct except:
  - An ionic compound at solid state does not conduct electric current.
  - Alloy is a mixture the atoms of two or more metals are uniformly mixed.
  - The Brownian motion is a motion due to collision rapidly moving molecules.
  - HCl does not soluble in water.
- The common-ion causes:
  - increasing precipitation.
  - decreasing ionization.
  - shifting equilibrium to left.
  - all of them are correct.
- The following reaction :  $(2A+B \rightarrow A_2B)$  is occur by one step mechanism the rate law for the reaction is:
  - $R=k[A][B]$
  - $R=k[A_2B]$
  - $R=k[A]^2[B]$
  - $R=k[A][B]^2$
- Which one of the following statements is incorrect?
  - Many solids dissolve more quickly in a cold solvent than in warm solvent.
  - Gases are generally more soluble in water at low temperature.
  - Aqueous solution is a mixture containing the solute soluble in water as a solvent.
  - The effect of stirring is similar to that of crushing a solid – contact between the solvent and the solute surface is increased.
- The dilute aqueous solution of a weak acid contains:
  - hydronium ions.
  - acid molecules.
  - anions.
  - all of them are correct
- When polar compound ionizes completely in water the compound is:
  - ionic electrolyte.
  - weak electrolyte.
  - non-electrolyte molecular.
  - strong molecular electrolyte.
- A substance that formed when a strong acid has lost a proton
  - strong conjugate base
  - weak conjugate acid
  - weak conjugate base
  - cations
- the spectator ion in the following reaction  $(Al_{(s)} + H_2SO_{4(aq)} \rightarrow \quad)$ , is;
  - $SO_4^{2-}$
  - $Al^{+3}$
  - $H_3O^+$
  - all of them are correct.
- The methyl orange is used to determine the equivalence point in one of the following titration: If the pH range for transition interval is (3.1- 4.4):
  - HCl,  $NH_3$
  - $CH_3COOH, NaOH$
  - $HNO_3, NaOH$
  - $NH_3, CH_3COOH$
- The entropy increases at:
  - evaporating of liquid
  - temperature raising.
  - increase pressure
  - both(A+B) are correct
- All of the following statements are true about the collision theory except:
  - all collisions between particles of reactant leads to the occurrence of the chemical reaction
  - the reaction rate is directly proportional with the number of effective collision.
  - in order for chemical reaction to occur, the reacting particles must collide
  - the particles of reactants must have enough energy to initiate the reaction.
- The boiling-point elevation of a solvent is  $2.4^\circ C$ , when the concentration of the solution containing a nonelectrolyte solute is  $3.1m$ , what is the value of molal boiling-point constant?
  - $1.29^\circ C/m$
  - $-0.77^\circ C/m$
  - $7.44^\circ C/m$
  - $0.77^\circ C/m$
- A substance that can react as an acid or a base :
  - $SO_4^{2-}$
  - $HSO_3^-$
  - $CH_3COO^-$
  - $NH_4^+$
- In the following an exothermic gaseous reaction :  $(2CO+O_2 \rightarrow 2CO_2)$  , which of the following statements is true about the reaction ?
  - The reaction is always spontaneous.
  - The reaction is never spontaneous.
  - The reaction is spontaneous at low temperature.
  - The reaction is spontaneous at high temperature.
- The concentration of  $H_3O^+$  ions in aqueous solution of  $Ba(OH)_2$  is  $1 \times 10^{-11} M$ , what is the molar concentration of solution?
  - $1 \times 10^{-3} M$
  - $2 \times 10^{-4} M$
  - $2 \times 10^{-3} M$
  - $5 \times 10^{-4} M$
- The boiling point of a solution is higher than that of a pure solvent because :-
  - Vapor-pressure lowering
  - Freezing- point heightening
  - Vapor-pressure heightening
  - none of them
- While mixing a small quantity of water with a large quantity of ethanol, water considered as :-
  - solvent
  - solute
  - solution
  - none of them
- Which of the following ions hydrolyze in aqueous solution?
  - $NO_3^-$
  - $CO_3^{2-}$
  - $SO_4^{2-}$
  - none of them is correct
- The solution that contains the precisely known concentration of a solute is known as:
  - saturated solution
  - dilute solution
  - standard solution
  - buffer solution
- Which of the following represents the formation equation?
  - $N_2+O_2 \rightarrow 2NO$
  - $C_{(graphite)} + O_2 \rightarrow CO_2$
  - $CO + 1/2 O_2 \rightarrow CO_2$
  - $CO_2 \rightarrow C_{(graphite)} + O_2$
- Which of the following is a binary acid?
  - $H_2S$
  - $H_2CO_3$
  - $H_2O_2$
  - all of them are correct
- In the following reaction :  $(BF_{3(aq)} + F^-_{(aq)} \rightarrow BF_4^-_{(aq)})$  which of the following is Lewis base?
  - $F^-$
  - $BF_3$
  - $BF_4^-$
  - none of them is correct
- A reaction has  $\Delta H = -74.8 kJ/mol$  ,  $\Delta S = -0.081 kJ/mol.K$  at  $27^\circ C$  which of the following is correct?
  - $\Delta G = 50.5 kJ/mol$  , nonspontaneous .
  - $\Delta G = -72.8 kJ/mol$  , spontaneous.
  - $\Delta G = 72.8 kJ/mol$  , nonspontaneous
  - $\Delta G = -50.5 kJ/mol$  , spontaneous.
- A solution made from ethanol ,  $C_2H_5OH$ , and water is  $1.76m$  in ethanol .How many moles of ethanol are contained per 250g of water?
  - $0.142 mol$
  - $0.44 mol$
  - $20.24 mol$
  - $7.04 mol$
- How much energy would be absorbed as heat by 75g of iron when heated from  $295K$  to  $301K$  if its specific heat is  $0.449 J/g.K$ ?
  - $202 kJ$
  - $27.83 J$
  - $1002 J$
  - $202 J$

26. When barium chloride solution is mixed with sodium nitrate:  
 A. sodium chloride precipitates      B. barium nitrate precipitates  
 C. precipitation does not occur      D. Both ( A + B ) are correct
27. The rate law of the following reaction:  $A + 2B \rightarrow AB_2$ , is  $R = k[B]^2$ , what happens to the reaction rate when the concentration of both reactants is doubled?  
 A. the reaction rate remains the same.      B. the reaction rate increases by a factor of two.  
 C. the reaction rate increases by a factor of four.      D. the reaction rate increases by a factor eight.
28. Unknown liquid miscible with toluene and immiscible with water which of the following statements is correct?  
 A. an aqueous solution for the liquid conducts electric current.      B. a liquid is nonpolar molecular compound.  
 C. a liquid is polar molecular compound.      D. none of them
29. Aqueous solution of  $NH_3$  is an Arrhenius base because:  
 A. it is proton acceptor.      B. it increases the concentration of hydronium ion.  
 C. it is an electron pair donor.      D. it increases the concentration of hydroxide ion.
30. In the following hypothetical reaction :  $(A_2 + B_2 \rightarrow 2AB + 30kJ)$ , the activation energy for the forward reaction equal 50kJ/mol ,the activation energy for reverse reaction is equal to  
 A. 20kJ/mol      B. 80kJ/mol      C. -80kJ/mol      D. 10kJ/mol
31. Which of the following is the equilibrium constant for an anion hydrolysis reaction?  
 A.  $\frac{[HB][OH^-]}{[B^-]}$       B.  $\frac{[B^-]}{[HB][OH^-]}$       C.  $\frac{[HB]}{[B^-][OH^-]}$       D.  $\frac{[B^-][OH^-]}{[HB]}$
32. The strength of an acid does not depend on:  
 A. The polarity of the bond between hydrogen and the element it is bonded.      B. the bond energy  
 C. the number of hydrogen atoms in the chemical acid formula.      D. both (A+B) are correct
33. Which of the following solutions with the same concentrations has lower  $[H_3O^+]$ ?  
 A. HCl      B.  $H_2O$       C.  $NH_3$       D. HF
34. The solubility product of cadmium carbonate,  $CdCO_3$ , is  $1.0 \times 10^{-12}$ . In a saturated solution of this salt, the concentration of carbonate ions is:  
 A.  $5 \times 10^{-13} M$       B.  $3 \times 10^{-6} M$       C.  $1 \times 10^{-6} M$       D.  $5 \times 10^{-7} M$
35. The enthalpy change that occurs during the complete combustion of one mole of an element or compound is called:  
 A. Enthalpy of formation.      B. Enthalpy of solution.      C. Enthalpy of combustion.      D. Specific Heat
36. In the following reaction :  $(2HCl_{(g)} + 184.6kJ \rightarrow H_{2(g)} + Cl_{2(g)})$ , the standard formation enthalpy of HCl equals :  
 A. 184.6kJ/mol      B. -184.6kJ/mol      C. -92.3kJ/mol      D. 92.3kJ/mol
37. A proposed mechanism for the reaction is:- slow :  $2NO + H_2 \rightarrow N_2O + H_2O$   
 fast :  $N_2O + H_2 \rightarrow N_2 + H_2O$       which of the following is correct ?  
 A.  $R = k[NO][H_2]$       B. overall balanced equation for the reaction is :  $2NO + 2H_2 \rightarrow N_2 + 2H_2O$   
 C. the reaction order is second      D. Both (A+C) are correct
38. In equilibrium gaseous reaction:  $2NO + Cl_2 \rightleftharpoons 2NOCl + \text{energy}$ , which of the following shift the reaction to the right ?  
 A. adding catalyst      B. decreasing system volume      C. increasing temperature      D. decreasing pressure
39. How many moles of ammonium sulfate must be dissociate to produce 0.4 mol of sulfate ion?  
 A. 0.2 mol      B. 0.4 mol      C. 0.6 mol      D. 0.8 mol
40. The value of equilibrium constant for this gaseous reaction :  $(N_2O_4 \rightleftharpoons 2NO_2)$  is 0.1 at a specified temperature, what would be the value of that constant for the reverse reaction at the same condition?  
 A. 0.05      B. 0.1      C. 10      D. 5
41. The net ionic equation for the precipitation Nickel ( II ) sulfide is :  
 A.  $NiS_{(s)} \rightarrow Ni^{+2}_{(aq)} + S^{-2}_{(aq)}$       B.  $2Ni^{+2}_{(aq)} + 2S^{-2}_{(aq)} \rightarrow Ni_2S_{2(s)}$   
 C.  $Ni^{+2}_{(aq)} + S^{-2}_{(aq)} \rightarrow NiS_{(s)}$       D. it does not have precipitate equation because it is soluble in water.
42. In aqueous solution contains,  $Ca^{+2}, SO_4^{2-}$  ions,  $CaSO_4$  precipitates if :  
 A.  $[Ca^{+2}][SO_4^{2-}] = K_{sp}$       B.  $[Ca^{+2}][SO_4^{2-}] > K_{sp}$       C.  $[Ca^{+2}][SO_4^{2-}] < K_{sp}$       D. can not be determined
43. Which of the following is homogenous mixture?  
 A. milk      B. 24-karat gold      C. tap water      D. oil and water
44. Calculate the moles of NaOH if 100 mL of its solution neutralized with 200 mL of 0.01M HBr ?  
 A. 0.01mol      B. 0.002mol      C. 0.001mol      D. 0.02mol
45. Adding  $NH_4Cl$  to  $NH_3$  solution leads to:  
 A. decrease  $[NH_3]$       B. increase  $[OH^-]$       C. increase ionization of  $NH_3$       D. increase  $[H_3O^+]$
46. For an exothermic dissolution process, the increasing of the temperature causes:  
 A. increasing dissolution      B. decreasing dissolution      C. decreasing crystallization      D. Both (A+C) are correct
47. The rate of the slow reaction increases by :  
 A. the addition of a catalyst.      B. increasing activation energy  
 C. increasing concentration.      D. Both (A+C) are correct
48. In the following gaseous reaction:  $(N_2 + 3H_2 \rightleftharpoons 2NH_3)$  it was found the  $[NH_3] = 0.62 M$ ,  $[H_2] = 0.14 M$ ,  $[N_2] = 0.45 M$  the value of the equilibrium constant equals:  
 A.  $3.2 \times 10^{-3}$       B.  $3.11 \times 10^2$       C.  $3.11 \times 10^{-2}$       D. 9.84
49. The pH of an aqueous solution composed  $2 \times 10^{-4}$  mol of  $H_3O^+$  ions in 250 mL of its solution is equal to :-  
 A. 3.1      B. 3.7      C. 10.9      D. 10.3
50. The energy required to raise the reactant to the level of the activated complex is:  
 A. Activation energy      B. Free energy      C. Kinetic energy      D. Energy of reaction



Answer the following questions : ( two marks for each right choice )

- The rate law of the following reaction:  $A+2B \rightarrow AB_2$ , is  $R=k[B]^2$ , what happens to the reaction rate when the concentration of both reactants is doubled?  
 A. the reaction rate remains the same. B. the reaction rate increases by a factor of two.  
 C. the reaction rate increases by a factor of four. D. the reaction rate increases by a factor eight.
- The strength of an acid does not depend on:  
 A. The polarity of the bond between hydrogen and the element it is bonded. B. the bond energy  
 C. the number of hydrogen atoms in the chemical acid formula. D. both (A+B) are correct
- The net ionic equation for the precipitation Nickel ( II )sulfide is :  
 A.  $NiS_{(s)} \rightarrow Ni^{+2}_{(aq)} + S^{-2}_{(aq)}$  B.  $2Ni^{+2}_{(aq)} + 2S^{-2}_{(aq)} \rightarrow Ni_2S_{2(s)}$   
 C.  $Ni^{+2}_{(aq)} + S^{-2}_{(aq)} \rightarrow NiS_{(s)}$  D. it does not have precipitate equation because it is soluble in water.
- The concentration of  $H_3O^+$  ions in aqueous solution of  $Ba(OH)_2$  is  $1 \times 10^{-11} M$ , what is the molar concentration of solution?  
 A.  $1 \times 10^{-3} M$  B.  $2 \times 10^{-4} M$  C.  $2 \times 10^{-3} M$  D.  $5 \times 10^{-4} M$
- The entropy increases at:  
 A. evaporating of liquid B. temperature raising. C. increase pressure D. both(A+B) are correct
- The pH of an aqueous solution composed  $2 \times 10^{-4} mol$  of  $H_3O^+$  ions in 250 mL of its solution is equal to :-  
 A. 3.1 B. 3.7 C. 10.9 D. 10.3
- The boiling point of a solution is higher than that of a pure solvent because :-  
 A. Vapor-pressure lowering B. Freezing- point heightening  
 C. Vapor-pressure heightening D. none of them
- In the following gaseous reaction:  $(N_2+3H_2 \rightleftharpoons 2NH_3)$  it was found the  $[NH_3]=0.62 M$ ,  $[H_2]=0.14 M$ ,  $[N_2]=0.45 M$  the value of the equilibrium constant equals:  
 A.  $3.2 \times 10^{-3}$  B.  $3.11 \times 10^2$  C.  $3.11 \times 10^{-2}$  D. 9.84
- In equilibrium gaseous reaction:  $2NO+Cl_2 \rightleftharpoons 2NOCl + \text{energy}$ , which of the following shift the reaction to the right ?  
 A. adding catalyst B. decreasing system volume C. increasing temperature D. decreasing pressure
- Calculate the moles of NaOH if 100 mL of its solution neutralized with 200 mL of 0.01M HBr ?  
 A. 0.01mol B. 0.002mol C. 0.001mol D. 0.02mol
- Which of the following is the equilibrium constant for an anion hydrolysis reaction?  
 A.  $\frac{[HB][OH^-]}{[B^-]}$  B.  $\frac{[B^-]}{[HB][OH^-]}$  C.  $\frac{[HB]}{[B^-][OH^-]}$  D.  $\frac{[B^-][OH^-]}{[HB]}$
- A substance that formed when a strong acid has lost a proton  
 A. strong conjugate base B. weak conjugate acid C. weak conjugate base D. cations
- While mixing a small quantity of water with a large quantity of ethanol, water considered as :-  
 A. solvent B. solute C. solution D. none of them

- A proposed mechanism for the reaction is:- slow :  $2NO+H_2 \rightarrow N_2O+H_2O$   
 fast :  $N_2O+H_2 \rightarrow N_2+H_2O$  which of the following is correct ?  
 A.  $R=k[NO][H_2]$  B. overall balanced equation for the reaction is :  $2NO+2H_2 \rightarrow N_2+2H_2O$   
 C. the reaction order is second D. Both (A+C) are correct
- The solubility product of cadmium carbonate,  $CdCO_3$ , is  $1.0 \times 10^{-12}$ . In a saturated solution of this salt, the concentration of carbonate ions is:  
 A.  $5 \times 10^{-13} M$  B.  $3 \times 10^{-6} M$  C.  $1 \times 10^{-6} M$  D.  $5 \times 10^{-7} M$
- All of them are correct except:  
 A. An ionic compound at solid state does not conduct electric current.  
 B. Alloy is a mixture the atoms of two or more metals are uniformly mixed.  
 C. The Brownian motion is a motion due to collision rapidly moving molecules.  
 D. HCl does not soluble in water.
- The solution that contains the precisely known concentration of a solute is known as:  
 A. saturated solution B. dilute solution C. standard solution D. buffer solution
- Unknown liquid miscible with toluene and immiscible with water which of the following statements is correct?  
 A. an aqueous solution for the liquid conducts electric current. B. a liquid is nonpolar molecular compound.  
 C. a liquid is polar molecular compound. D. none of them
- In aqueous solution contains,  $Ca^{+2}, SO_4^{2-}$  ions,  $CaSO_4$  precipitates if :  
 A.  $[Ca^{+2}][SO_4^{2-}] = K_{sp}$  B.  $[Ca^{+2}][SO_4^{2-}] > K_{sp}$  C.  $[Ca^{+2}][SO_4^{2-}] < K_{sp}$  D. can not be determined
- In the following an exothermic gaseous reaction :  $(2CO+O_2 \rightarrow 2CO_2)$ , which of the following statements is true about the reaction ?  
 A. The reaction is always spontaneous. B. The reaction is never spontaneous.  
 C. The reaction is spontaneous at low temperature. D. The reaction is spontaneous at high temperature.
- The rate of the slow reaction increases by :  
 A. the addition of a catalyst. B. increasing activation energy  
 C. increasing concentration. D. Both (A+C) are correct
- Which one of the following statements is incorrect?  
 A. Many solids dissolve more quickly in a cold solvent than in warm solvent.  
 B. Gases are generally more soluble in water at low temperature.  
 C. Aqueous solution is a mixture containing the solute soluble in water as a solvent.  
 D. The effect of stirring is similar to that of crushing a solid – contact between the solvent and the solute surface is increased.
- A substance that can react as an acid or a base :  
 A.  $SO_4^{2-}$  B.  $HSO_3^-$  C.  $CH_3COO^-$  D.  $NH_4^+$
- How many moles of ammonium sulfate must be dissociate to produce 0.4 mol of sulfate ion?  
 A. 0.2 mol B. 0.4 mol C. 0.6 mol D. 0.8 mol
- When polar compound ionizes completely in water the compound is:  
 A. ionic electrolyte. B. weak electrolyte. C. non-electrolyte molecular. D. strong molecular electrolyte.

26. The value of equilibrium constant for this gaseous reaction :( $N_2O_4 \rightleftharpoons 2NO_2$ ) is 0.1 at a specified temperature, what would be the value of that constant for the reverse reaction at the same condition?  
 A. 0.05                      B. 0.1                      C. 10                      D. 5
27. The following reaction :( $2A+B \rightarrow A_2B$ ) is occur by one step mechanism the rate law for the reaction is:  
 A.  $R=k[A][B]$                       B.  $R=k[A_2B]$                       C.  $R=k[A]^2[B]$                       D.  $R=k[A][B]^2$
28. When barium chloride solution is mixed with sodium nitrate:  
 A. sodium chloride precipitates                      B. barium nitrate precipitates  
 C. precipitation does not occur                      D. Both ( A + B ) are correct
29. Which of the following solutions with the same concentrations has lower  $[H_3O^+]$ ?  
 A. HCl                      B.  $H_2O$                       C.  $NH_3$                       D. HF
30. The common-ion causes:  
 A. increasing precipitation.                      B. decreasing ionization.  
 C. shifting equilibrium to left.                      D. all of them are correct.
31. The enthalpy change that occurs during the complete combustion of one mole of an element or compound is called:  
 A. Enthalpy of formation.    B. Enthalpy of solution.    C. Enthalpy of combustion.    D. Specific Heat
32. How much energy would be absorbed as heat by 75g of iron when heated from 295K to 301K if its specific heat is 0.449J/g.K?  
 A. 202kJ                      B. 27.83J                      C. 1002J                      D. 202J
33. In the following reaction :( $BF_{3(aq)} + F^-_{(aq)} \rightarrow BF_4^-_{(aq)}$ ) which of the following is Lewis base?  
 A.  $F^-$                       B.  $BF_3$                       C.  $BF_4^-$                       D. none of them is correct
34. The methyl orange is used to determine the equivalence point in one of the following titration: If the pH range for transition interval is (3.1- 4.4):  
 A. HCl,  $NH_3$                       B.  $CH_3COOH, NaOH$                       C.  $HNO_3, NaOH$                       D.  $NH_3, CH_3COOH$
35. The dilute aqueous solution of a weak acid contains:  
 A. hydronium ions.                      B. acid molecules.                      C. anions.                      D. all of them are correct
36. The boiling-point elevation of a solvent is  $2.4^\circ C$ , when the concentration of the solution containing a nonelectrolyte solute is 3.1m, what is the value of molal boiling-point constant?  
 A.  $1.29^\circ C/m$                       B.  $-0.77^\circ C/m$                       C.  $7.44^\circ C/m$                       D.  $0.77^\circ C/m$
37. Aqueous solution of  $NH_3$  is an Arrhenius base because:  
 A. it is proton acceptor.                      B. it increases the concentration of hydronium ion.  
 C. it is an electron pair donor.                      D. it increases the concentration of hydroxide ion.
38. For an exothermic dissolution process, the increasing of the temperature causes:  
 A. increasing dissolution    B. decreasing dissolution    C. decreasing crystallization    D. Both (A+C) are correct
39. A reaction has  $\Delta H = -74.8 kJ/mol$  ,  $\Delta S = -0.081 kJ/mol.K$  at  $27^\circ C$  which of the following is correct?  
 A.  $\Delta G = 50.5 kJ/mol$  , nonspontaneous .                      B.  $\Delta G = -72.8 kJ/mol$  , spontaneous.  
 C.  $\Delta G = 72.8 kJ/mol$  , nonspontaneous                      D.  $\Delta G = -50.5 kJ/mol$  , spontaneous.
40. Adding  $NH_4Cl$  to  $NH_3$  solution leads to:  
 A. decrease  $[NH_3]$                       B. increase  $[OH^-]$                       C. increase ionization of  $NH_3$                       D. increase  $[H_3O^+]$
41. Which of the following represents the formation equation?  
 A.  $N_2 + O_2 \rightarrow 2NO$                       B.  $C_{(graphite)} + O_2 \rightarrow CO_2$                       C.  $CO + 1/2 O_2 \rightarrow CO_2$                       D.  $CO_2 \rightarrow C_{(graphite)} + O_2$
42. In the following hypothetical reaction :( $A_2 + B_2 \rightarrow 2AB + 30 kJ$ ), the activation energy for the forward reaction equal 50kJ/mol ,the activation energy for reverse reaction is equal to  
 A. 20kJ/mol                      B. 80kJ/mol                      C. -80kJ/mol                      D. 10kJ/mol
43. the spectator ion in the following reaction ( $Al_{(s)} + H_2SO_{4(aq)} \rightarrow$  ), is;  
 A.  $SO_4^{2-}$                       B.  $Al^{+3}$                       C.  $H_3O^+$                       D. all of them are correct.
44. Which of the following is homogenous mixture?  
 A. milk                      B. 24-karat gold                      C. tap water                      D. oil and water
45. The energy required to raise the reactant to the level of the activated complex is:  
 A. Activation energy                      B. Free energy                      C. Kinetic energy                      D. Energy of reaction
46. Which of the following ions hydrolyze in aqueous solution?  
 A.  $NO_3^-$                       B.  $CO_3^{2-}$                       C.  $SO_4^{2-}$                       D. none of them is correct
47. In the following reaction :( $2HCl_{(g)} + 184.6 kJ \rightarrow H_{2(g)} + Cl_{2(g)}$ ), the standard formation enthalpy of HCl equals :  
 A. 184.6kJ/mol                      B. -184.6kJ/mol                      C. -92.3kJ/mol                      D. 92.3kJ/mol
48. A solution made from ethanol ,  $C_2H_5OH$ , and water is 1.76m in ethanol .How many moles of ethanol are contained per 250g of water?  
 A. 0.142mol                      B. 0.44mol                      C. 20.24mol                      D. 7.04mol
49. All of the following statements are true about the collision theory except:  
 A. all collisions between particles of reactant leads to the occurrence of the chemical reaction  
 B. the reaction rate is directly proportional with the number of effective collision.  
 C. in order for chemical reaction to occur, the reacting particles must collide  
 D. the particles of reactants must have enough energy to initiate the reaction.
50. Which of the following is a binary acid?  
 A.  $H_2S$                       B.  $H_2CO_3$                       C.  $H_2O_2$                       D. all of them are correct

Answer the following questions : ( two marks for each right choice )

- In aqueous solution contains,  $\text{Ca}^{+2}, \text{SO}_4^{2-}$  ions,  $\text{CaSO}_4$  precipitates if :  
 A.  $[\text{Ca}^{+2}][\text{SO}_4^{2-}] = K_{sp}$  B.  $[\text{Ca}^{+2}][\text{SO}_4^{2-}] > K_{sp}$  C.  $[\text{Ca}^{+2}][\text{SO}_4^{2-}] < K_{sp}$  D. can not be determined
- A substance that can react as an acid or a base :  
 A.  $\text{SO}_4^{2-}$  B.  $\text{HSO}_3^-$  C.  $\text{CH}_3\text{COO}^-$  D.  $\text{NH}_4^+$
- All of the following statements are true about the collision theory except:  
 A. all collisions between particles of reactant leads to the occurrence of the chemical reaction  
 B. the reaction rate is directly proportional with the number of effective collision.  
 C. in order for chemical reaction to occur, the reacting particles must collide  
 D. the particles of reactants must have enough energy to initiate the reaction.
- Which of the following is a binary acid?  
 A.  $\text{H}_2\text{S}$  B.  $\text{H}_2\text{CO}_3$  C.  $\text{H}_2\text{O}_2$  D. all of them are correct
- The net ionic equation for the precipitation Nickel ( II )sulfide is :  
 A.  $\text{NiS}_{(s)} \rightarrow \text{Ni}^{+2}_{(aq)} + \text{S}^{2-}_{(aq)}$  B.  $2\text{Ni}^{+2}_{(aq)} + 2\text{S}^{2-}_{(aq)} \rightarrow \text{Ni}_2\text{S}_{2(s)}$   
 C.  $\text{Ni}^{+2}_{(aq)} + \text{S}^{2-}_{(aq)} \rightarrow \text{NiS}_{(s)}$  D. it does not have precipitate equation because it is soluble in water.
- The dilute aqueous solution of a weak acid contains:  
 A. hydronium ions. B. acid molecules. C. anions. D. all of them are correct
- In the following reaction :  $(2\text{HCl}_{(g)} + 184.6\text{kJ} \rightarrow \text{H}_{2(g)} + \text{Cl}_{2(g)})$ , the standard formation enthalpy of  $\text{HCl}$  equals :  
 A.  $184.6\text{kJ/mol}$  B.  $-184.6\text{kJ/mol}$  C.  $-92.3\text{kJ/mol}$  D.  $92.3\text{kJ/mol}$
- The common-ion causes:  
 A. increasing precipitation. B. decreasing ionization.  
 C. shifting equilibrium to left. D. all of them are correct.
- The rate of the slow reaction increases by :  
 A. the addition of a catalyst. B. increasing activation energy  
 C. increasing concentration. D. Both (A+C) are correct
- How much energy would be absorbed as heat by 75g of iron when heated from 295K to 301K if its specific heat is  $0.449\text{J/g.K}$ ?  
 A. 202kJ B. 27.83J C. 1002J D. 202J
- All of them are correct except:  
 A. An ionic compound at solid state does not conduct electric current.  
 B. Alloy is a mixture the atoms of two or more metals are uniformly mixed.  
 C. The Brownian motion is a motion due to collision rapidly moving molecules.  
 D.  $\text{HCl}$  does not soluble in water.
- Unknown liquid miscible with toluene and immiscible with water which of the following statements is correct?  
 A. an aqueous solution for the liquid conducts electric current. B. a liquid is nonpolar molecular compound.  
 C. a liquid is polar molecular compound. D. none of them

- The value of equilibrium constant for this gaseous reaction :  $(\text{N}_2\text{O}_4 \rightleftharpoons 2\text{NO}_2)$  is 0.1 at a specified temperature, what would be the value of that constant for the reverse reaction at the same condition?  
 A. 0.05 B. 0.1 C. 10 D. 5
- the spectator ion in the following reaction  $(\text{Al}_{(s)} + \text{H}_2\text{SO}_{4(aq)} \rightarrow \quad)$ , is;  
 A.  $\text{SO}_4^{2-}$  B.  $\text{Al}^{+3}$  C.  $\text{H}_3\text{O}^+$  D. all of them are correct.
- Which of the following solutions with the same concentrations has lower  $[\text{H}_3\text{O}^+]$ ?  
 A.  $\text{HCl}$  B.  $\text{H}_2\text{O}$  C.  $\text{NH}_3$  D.  $\text{HF}$
- Which of the following represents the formation equation?  
 A.  $\text{N}_2 + \text{O}_2 \rightarrow 2\text{NO}$  B.  $\text{C}_{(\text{graphite})} + \text{O}_2 \rightarrow \text{CO}_2$  C.  $\text{CO} + 1/2 \text{O}_2 \rightarrow \text{CO}_2$  D.  $\text{CO}_2 \rightarrow \text{C}_{(\text{graphite})} + \text{O}_2$
- The enthalpy change that occurs during the complete combustion of one mole of an element or compound is called:  
 A. Enthalpy of formation. B. Enthalpy of solution. C. Enthalpy of combustion. D. Specific Heat
- The pH of an aqueous solution composed  $2 \times 10^{-4}$  mol of  $\text{H}_3\text{O}^+$  ions in 250 mL of its solution is equal to :-  
 A. 3.1 B. 3.7 C. 10.9 D. 10.3
- The energy required to raise the reactant to the level of the activated complex is:  
 A. Activation energy B. Free energy C. Kinetic energy D. Energy of reaction
- The entropy increases at:  
 A. evaporating of liquid B. temperature raising. C. increase pressure D. both(A+B) are correct
- When polar compound ionizes completely in water the compound is:  
 A. ionic electrolyte. B. weak electrolyte. C. non-electrolyte molecular. D. strong molecular electrolyte.
- The boiling-point elevation of a solvent is  $2.4^\circ\text{C}$ , when the concentration of the solution containing a nonelectrolyte solute is  $3.1m$ , what is the value of molal boiling-point constant?  
 A.  $1.29^\circ\text{C}/m$  B.  $-0.77^\circ\text{C}/m$  C.  $7.44^\circ\text{C}/m$  D.  $0.77^\circ\text{C}/m$
- Calculate the moles of  $\text{NaOH}$  if 100 mL of its solution neutralized with 200 mL of  $0.01M \text{HBr}$  ?  
 A. 0.01mol B. 0.002mol C. 0.001mol D. 0.02mol
- While mixing a small quantity of water with a large quantity of ethanol, water considered as :-  
 A. solvent B. solute C. solution D. none of them
- Which of the following is homogenous mixture?  
 A. milk B. 24-karat gold C. tap water D. oil and water
- The following reaction :  $(2\text{A} + \text{B} \rightarrow \text{A}_2\text{B})$  is occur by one step mechanism the rate law for the reaction is:  
 A.  $R = k[\text{A}][\text{B}]$  B.  $R = k[\text{A}_2\text{B}]$  C.  $R = k[\text{A}]^2[\text{B}]$  D.  $R = k[\text{A}][\text{B}]^2$
- The rate law of the following reaction:  $\text{A} + 2\text{B} \rightarrow \text{AB}_2$ , is  $R = k[\text{B}]^2$ , what happens to the reaction rate when the concentration of both reactants is doubled?  
 A. the reaction rate remains the same. B. the reaction rate increases by a factor of two.  
 C. the reaction rate increases by a factor of four. D. the reaction rate increases by a factor eight.
- A solution made from ethanol,  $\text{C}_2\text{H}_5\text{OH}$ , and water is  $1.76m$  in ethanol .How many moles of ethanol are contained per 250g of water?  
 A. 0.142mol B. 0.44mol C. 20.24mol D. 7.04mol

29. The methyl orange is used to determine the equivalence point in one of the following titration: If the pH range for transition interval is (3.1- 4.4):

- A. HCl, NH<sub>3</sub>      B. CH<sub>3</sub>COOH, NaOH      C. HNO<sub>3</sub>, NaOH      D. NH<sub>3</sub>, CH<sub>3</sub>COOH

30. Which of the following ions hydrolyze in aqueous solution?

- A. NO<sub>3</sub><sup>-</sup>      B. CO<sub>3</sub><sup>2-</sup>      C. SO<sub>4</sub><sup>2-</sup>      D. none of them is correct

31. Which one of the following statements is incorrect?

- A. Many solids dissolve more quickly in a cold solvent than in warm solvent.  
B. Gases are generally more soluble in water at low temperature.  
C. Aqueous solution is a mixture containing the solute soluble in water as a solvent.  
D. The effect of stirring is similar to that of crushing a solid – contact between the solvent and the solute surface is increased.

32. A proposed mechanism for the reaction is:- slow : 2NO + H<sub>2</sub> → N<sub>2</sub>O + H<sub>2</sub>O

fast : N<sub>2</sub>O + H<sub>2</sub> → N<sub>2</sub> + H<sub>2</sub>O      which of the following is correct ?

- A. R = k[NO][H<sub>2</sub>]      B. overall balanced equation for the reaction is : 2NO + 2H<sub>2</sub> → N<sub>2</sub> + 2H<sub>2</sub>O  
C. the reaction order is second      D. Both (A+C) are correct

33. The solubility product of cadmium carbonate, CdCO<sub>3</sub>, is 1.0 × 10<sup>-12</sup>. In a saturated solution of this salt, the concentration of carbonate ions is:

- A. 5 × 10<sup>-13</sup> M      B. 3 × 10<sup>-6</sup> M      C. 1 × 10<sup>-6</sup> M      D. 5 × 10<sup>-7</sup> M

34. A reaction has ΔH = -74.8 kJ/mol, ΔS = -0.081 kJ/mol.K at 27°C which of the following is correct?

- A. ΔG = 50.5 kJ/mol, nonspontaneous.      B. ΔG = -72.8 kJ/mol, spontaneous.  
C. ΔG = 72.8 kJ/mol, nonspontaneous      D. ΔG = -50.5 kJ/mol, spontaneous.

35. For an exothermic dissolution process, the increasing of the temperature causes:

- A. increasing dissolution      B. decreasing dissolution      C. decreasing crystallization      D. Both (A+C) are correct

36. Aqueous solution of NH<sub>3</sub> is an Arrhenius base because:

- A. it is proton acceptor.      B. it increases the concentration of hydronium ion.  
C. it is an electron pair donor.      D. it increases the concentration of hydroxide ion.

37. When barium chloride solution is mixed with sodium nitrate:

- A. sodium chloride precipitates      B. barium nitrate precipitates  
C. precipitation does not occur      D. Both (A + B) are correct

38. Which of the following is the equilibrium constant for an anion hydrolysis reaction?

- A.  $\frac{[\text{HB}][\text{OH}^-]}{[\text{B}^-]}$       B.  $\frac{[\text{B}^-]}{[\text{HB}][\text{OH}^-]}$       C.  $\frac{[\text{HB}]}{[\text{B}^-][\text{OH}^-]}$       D.  $\frac{[\text{B}^-][\text{OH}^-]}{[\text{HB}]}$

39. The boiling point of a solution is higher than that of a pure solvent because :-

- A. Vapor-pressure lowering      B. Freezing- point heightening  
C. Vapor-pressure heightening      D. none of them

40. In the following an exothermic gaseous reaction : ( 2CO + O<sub>2</sub> → 2CO<sub>2</sub> ), which of the following statements is true about the reaction ?

- A. The reaction is always spontaneous.      B. The reaction is never spontaneous.  
C. The reaction is spontaneous at low temperature.      D. The reaction is spontaneous at high temperature.

41. In the following reaction : ( BF<sub>3(aq)</sub> + F<sup>-</sup><sub>(aq)</sub> → BF<sub>4</sub><sup>-</sup><sub>(aq)</sub> ) which of the following is Lewis base?

- A. F<sup>-</sup>      B. BF<sub>3</sub>      C. BF<sub>4</sub><sup>-</sup>      D. none of them is correct

42. The concentration of H<sub>3</sub>O<sup>+</sup> ions in aqueous solution of Ba(OH)<sub>2</sub> is 1 × 10<sup>-11</sup> M, what is the molar concentration of solution?

- A. 1 × 10<sup>-3</sup> M      B. 2 × 10<sup>-4</sup> M      C. 2 × 10<sup>-3</sup> M      D. 5 × 10<sup>-4</sup> M

43. In the following gaseous reaction: (N<sub>2</sub> + 3H<sub>2</sub> ⇌ 2NH<sub>3</sub>) it was found the [NH<sub>3</sub>] = 0.62 M, [H<sub>2</sub>] = 0.14 M, [N<sub>2</sub>] = 0.45 M the value of the equilibrium constant equals:

- A. 3.2 × 10<sup>-3</sup>      B. 3.11 × 10<sup>2</sup>      C. 3.11 × 10<sup>-2</sup>      D. 9.84

44. The strength of an acid does not depend on:

- A. The polarity of the bond between hydrogen and the element it is bonded.      B. the bond energy  
C. the number of hydrogen atoms in the chemical acid formula.      D. both (A+B) are correct

45. Adding NH<sub>4</sub>Cl to NH<sub>3</sub> solution leads to:

- A. decrease [NH<sub>3</sub>]      B. increase [OH<sup>-</sup>]      C. increase ionization of NH<sub>3</sub>      D. increase [H<sub>3</sub>O<sup>+</sup>]

46. In the following hypothetical reaction : (A<sub>2</sub> + B<sub>2</sub> → 2AB + 30 kJ), the activation energy for the forward reaction equal 50 kJ/mol, the activation energy for reverse reaction is equal to

- A. 20 kJ/mol      B. 80 kJ/mol      C. -80 kJ/mol      D. 10 kJ/mol

47. In equilibrium gaseous reaction: 2NO + Cl<sub>2</sub> ⇌ 2NOCl + energy, which of the following shift the reaction to the right ?

- A. adding catalyst      B. decreasing system volume      C. increasing temperature      D. decreasing pressure

48. How many moles of ammonium sulfate must be dissociate to produce 0.4 mol of sulfate ion?

- A. 0.2 mol      B. 0.4 mol      C. 0.6 mol      D. 0.8 mol

49. A substance that formed when a strong acid has lost a proton

- A. strong conjugate base      B. weak conjugate acid      C. weak conjugate base      D. cations

50. The solution that contains the precisely known concentration of a solute is known as:

- A. saturated solution      B. dilute solution      C. standard solution      D. buffer solution

V



Answer the following questions : ( two marks for each right choice )

- In equilibrium gaseous reaction:  $2\text{NO} + \text{Cl}_2 \rightleftharpoons 2\text{NOCl} + \text{energy}$ , which of the following shift the reaction to the right ?  
 A. adding catalyst B. decreasing system volume C. increasing temperature D. decreasing pressure
- The rate of the slow reaction increases by :  
 A. the addition of a catalyst. B. increasing activation energy  
 C. increasing concentration. D. Both (A+C) are correct
- The common-ion causes:  
 A. increasing precipitation. B. decreasing ionization.  
 C. shifting equilibrium to left. D. all of them are correct.
- Aqueous solution of  $\text{NH}_3$  is an Arrhenius base because:  
 A. it is proton acceptor. B. it increases the concentration of hydronium ion.  
 C. it is an electron pair donor. D. it increases the concentration of hydroxide ion.
- Which one of the following statements is incorrect?  
 A. Many solids dissolve more quickly in a cold solvent than in warm solvent.  
 B. Gases are generally more soluble in water at low temperature.  
 C. Aqueous solution is a mixture containing the solute soluble in water as a solvent.  
 D. The effect of stirring is similar to that of crushing a solid – contact between the solvent and the solute surface is increased.
- The boiling point of a solution is higher than that of a pure solvent because :-  
 A. Vapor-pressure lowering B. Freezing- point heightening  
 C. Vapor-pressure heightening D. none of them
- A substance that can react as an acid or a base :  
 A.  $\text{SO}_4^{2-}$  B.  $\text{HSO}_3^-$  C.  $\text{CH}_3\text{COO}^-$  D.  $\text{NH}_4^+$
- When barium chloride solution is mixed with sodium nitrate:  
 A. sodium chloride precipitates B. barium nitrate precipitates  
 C. precipitation does not occur D. Both ( A + B ) are correct
- In the following reaction :  $(2\text{HCl}_{(g)} + 184.6\text{kJ} \rightarrow \text{H}_{2(g)} + \text{Cl}_{2(g)})$ , the standard formation enthalpy of HCl equals :  
 A. 184.6kJ/mol B. -184.6kJ/mol C. -92.3kJ/mol D. 92.3kJ/mol
- The dilute aqueous solution of a weak acid contains:  
 A. hydronium ions. B. acid molecules. C. anions. D. all of them are correct
- The pH of an aqueous solution composed  $2 \times 10^{-4}$  mol of  $\text{H}_3\text{O}^+$  ions in 250 mL of its solution is equal to :-  
 A. 3.1 B. 3.7 C. 10.9 D. 10.3
- Which of the following solutions with the same concentrations has lower  $[\text{H}_3\text{O}^+]$ ?  
 A. HCl B.  $\text{H}_2\text{O}$  C.  $\text{NH}_3$  D. HF

- The boiling-point elevation of a solvent is  $2.4^\circ\text{C}$ , when the concentration of the solution containing a nonelectrolyte solute is 3.1m, what is the value of molal boiling-point constant?  
 A.  $1.29^\circ\text{C}/m$  B.  $-0.77^\circ\text{C}/m$  C.  $7.44^\circ\text{C}/m$  D.  $0.77^\circ\text{C}/m$
- The solubility product of cadmium carbonate,  $\text{CdCO}_3$ , is  $1.0 \times 10^{-12}$ . In a saturated solution of this salt, the concentration of carbonate ions is:  
 A.  $5 \times 10^{-13} \text{ M}$  B.  $3 \times 10^{-6} \text{ M}$  C.  $1 \times 10^{-6} \text{ M}$  D.  $5 \times 10^{-7} \text{ M}$
- The rate law of the following reaction:  $\text{A} + 2\text{B} \rightarrow \text{AB}_2$ , is  $R = k[\text{B}]^2$ , what happens to the reaction rate when the concentration of both reactants is doubled?  
 A. the reaction rate remains the same. B. the reaction rate increases by a factor of two.  
 C. the reaction rate increases by a factor of four. D. the reaction rate increases by a factor eight.
- In aqueous solution contains,  $\text{Ca}^{+2}$ ,  $\text{SO}_4^{2-}$  ions,  $\text{CaSO}_4$  precipitates if :  
 A.  $[\text{Ca}^{+2}][\text{SO}_4^{2-}] = K_{sp}$  B.  $[\text{Ca}^{+2}][\text{SO}_4^{2-}] > K_{sp}$  C.  $[\text{Ca}^{+2}][\text{SO}_4^{2-}] < K_{sp}$  D. can not be determined
- When polar compound ionizes completely in water the compound is:  
 A. ionic electrolyte. B. weak electrolyte. C. non-electrolyte molecular. D. strong molecular electrolyte.
- The methyl orange is used to determine the equivalence point in one of the following titration: If the pH range for transition interval is (3.1- 4.4):  
 A. HCl,  $\text{NH}_3$  B.  $\text{CH}_3\text{COOH}$ , NaOH C.  $\text{HNO}_3$ , NaOH D.  $\text{NH}_3$ ,  $\text{CH}_3\text{COOH}$
- The following reaction :  $(2\text{A} + \text{B} \rightarrow \text{A}_2\text{B})$  is occur by one step mechanism the rate law for the reaction is:  
 A.  $R = k[\text{A}][\text{B}]$  B.  $R = k[\text{A}_2\text{B}]$  C.  $R = k[\text{A}]^2[\text{B}]$  D.  $R = k[\text{A}][\text{B}]^2$
- Which of the following is the equilibrium constant for an anion hydrolysis reaction?  
 A.  $\frac{[\text{HB}][\text{OH}^-]}{[\text{B}^-]}$  B.  $\frac{[\text{B}^-]}{[\text{HB}][\text{OH}^-]}$  C.  $\frac{[\text{HB}]}{[\text{B}^-][\text{OH}^-]}$  D.  $\frac{[\text{B}^-][\text{OH}^-]}{[\text{HB}]}$
- All of them are correct except:  
 A. An ionic compound at solid state does not conduct electric current.  
 B. Alloy is a mixture the atoms of two or more metals are uniformly mixed.  
 C. The Brownian motion is a motion due to collision rapidly moving molecules.  
 D. HCl does not soluble in water.
- How many moles of ammonium sulfate must be dissociate to produce 0.4 mol of sulfate ion?  
 A. 0.2 mol B. 0.4 mol C. 0.6 mol D. 0.8 mol
- The enthalpy change that occurs during the complete combustion of one mole of an element or compound is called:  
 A. Enthalpy of formation. B. Enthalpy of solution. C. Enthalpy of combustion. D. Specific Heat
- Unknown liquid miscible with toluene and immiscible with water which of the following statements is correct?  
 A. an aqueous solution for the liquid conducts electric current. B. a liquid is nonpolar molecular compound.  
 C. a liquid is polar molecular compound. D. none of them
- The value of equilibrium constant for this gaseous reaction :  $(\text{N}_2\text{O}_4 \rightleftharpoons 2\text{NO}_2)$  is 0.1 at a specified temperature, what would be the value of that constant for the reverse reaction at the same condition?  
 A. 0.05 B. 0.1 C. 10 D. 5
- Which of the following ions hydrolyze in aqueous solution?  
 A.  $\text{NO}_3^-$  B.  $\text{CO}_3^{2-}$  C.  $\text{SO}_4^{2-}$  D. none of them is correct

27. The net ionic equation for the precipitation Nickel ( II )sulfide is :  
 A.  $\text{NiS}_{(s)} \rightarrow \text{Ni}^{+2}_{(aq)} + \text{S}^{-2}_{(aq)}$       B.  $2\text{Ni}^{+2}_{(aq)} + 2\text{S}^{-2}_{(aq)} \rightarrow \text{Ni}_2\text{S}_{2(s)}$   
 C.  $\text{Ni}^{+2}_{(aq)} + \text{S}^{-2}_{(aq)} \rightarrow \text{NiS}_{(s)}$       D. it does not have precipitate equation because it is soluble in water.
28. The concentration of  $\text{H}_3\text{O}^+$  ions in aqueous solution of  $\text{Ba}(\text{OH})_2$  is  $1 \times 10^{-11} \text{ M}$ , what is the molar concentration of solution?  
 A.  $1 \times 10^{-3} \text{ M}$       B.  $2 \times 10^{-4} \text{ M}$       C.  $2 \times 10^{-3} \text{ M}$       D.  $5 \times 10^{-4} \text{ M}$
29. All of the following statements are true about the collision theory except:  
 A. all collisions between particles of reactant leads to the occurrence of the chemical reaction  
 B. the reaction rate is directly proportional with the number of effective collision.  
 C. in order for chemical reaction to occur, the reacting particles must collide  
 D. the particles of reactants must have enough energy to initiate the reaction.
30. A solution made from ethanol ,  $\text{C}_2\text{H}_5\text{OH}$ , and water is 1.76m in ethanol .How many moles of ethanol are contained per 250g of water?  
 A. 0.142mol      B. 0.44mol      C. 20.24mol      D. 7.04mol
31. Which of the following represents the formation equation?  
 A.  $\text{N}_2 + \text{O}_2 \rightarrow 2\text{NO}$       B.  $\text{C}_{(\text{graphite})} + \text{O}_2 \rightarrow \text{CO}_2$       C.  $\text{CO} + 1/2 \text{O}_2 \rightarrow \text{CO}_2$       D.  $\text{CO}_2 \rightarrow \text{C}_{(\text{graphite})} + \text{O}_2$
32. In the following an exothermic gaseous reaction : (  $2\text{CO} + \text{O}_2 \rightarrow 2\text{CO}_2$  ) , which of the following statements is true about the reaction ?  
 A. The reaction is always spontaneous.      B. The reaction is never spontaneous.  
 C. The reaction is spontaneous at low temperature.      D. The reaction is spontaneous at high temperature.
33. In the following hypothetical reaction : (  $\text{A}_2 + \text{B}_2 \rightarrow 2\text{AB} + 30\text{kJ}$  ), the activation energy for the forward reaction equal 50kJ/mol ,the activation energy for reverse reaction is equal to  
 A. 20kJ/mol      B. 80kJ/mol      C. -80kJ/mol      D. 10kJ/mol
34. Which of the following is homogenous mixture?  
 A. milk      B. 24-karat gold      C. tap water      D. oil and water
35. The entropy increases at:  
 A. evaporating of liquid      B. temperature raising.      C. increase pressure      D. both(A+B) are correct
36. While mixing a small quantity of water with a large quantity of ethanol, water considered as :-  
 A. solvent      B. solute      C. solution      D. none of them
37. Which of the following is a binary acid?  
 A.  $\text{H}_2\text{S}$       B.  $\text{H}_2\text{CO}_3$       C.  $\text{H}_2\text{O}_2$       D. all of them are correct
38. In the following reaction : (  $\text{BF}_3(\text{aq}) + \text{F}^{-}(\text{aq}) \rightarrow \text{BF}_4^{-}(\text{aq})$  ) which of the following is Lewis base?  
 A.  $\text{F}^{-}$       B.  $\text{BF}_3$       C.  $\text{BF}_4^{-}$       D. none of them is correct
39. For an exothermic dissolution process, the increasing of the temperature causes:  
 A. increasing dissolution      B. decreasing dissolution      C. decreasing crystallization      D. Both (A+C) are correct
40. A reaction has  $\Delta H = -74.8 \text{ kJ/mol}$  ,  $\Delta S = -0.081 \text{ kJ/mol.K}$  at  $27^\circ\text{C}$  which of the following is correct?  
 A.  $\Delta G = 50.5 \text{ kJ/mol}$  , nonspontaneous .      B.  $\Delta G = -72.8 \text{ kJ/mol}$  , spontaneous.  
 C.  $\Delta G = 72.8 \text{ kJ/mol}$  , nonspontaneous      D.  $\Delta G = -50.5 \text{ kJ/mol}$  , spontaneous.
41. In the following gaseous reaction: (  $\text{N}_2 + 3\text{H}_2 \rightleftharpoons 2\text{NH}_3$  ) it was found the  $[\text{NH}_3] = 0.62 \text{ M}$  ,  $[\text{H}_2] = 0.14 \text{ M}$  ,  $[\text{N}_2] = 0.45 \text{ M}$  the value of the equilibrium constant equals:  
 A.  $3.2 \times 10^{-3}$       B.  $3.11 \times 10^2$       C.  $3.11 \times 10^{-2}$       D. 9.84
42. The solution that contains the precisely known concentration of a solute is known as:  
 A. saturated solution      B. dilute solution      C. standard solution      D. buffer solution
43. A proposed mechanism for the reaction is:- slow :  $2\text{NO} + \text{H}_2 \rightarrow \text{N}_2\text{O} + \text{H}_2\text{O}$   
 fast :  $\text{N}_2\text{O} + \text{H}_2 \rightarrow \text{N}_2 + \text{H}_2\text{O}$  which of the following is correct ?  
 A.  $R = k[\text{NO}][\text{H}_2]$       B. overall balanced equation for the reaction is :  $2\text{NO} + 2\text{H}_2 \rightarrow \text{N}_2 + 2\text{H}_2\text{O}$   
 C. the reaction order is second      D. Both (A+C) are correct
44. The energy required to raise the reactant to the level of the activated complex is:  
 A. Activation energy      B. Free energy      C. Kinetic energy      D. Energy of reaction
45. Adding  $\text{NH}_4\text{Cl}$  to  $\text{NH}_3$  solution leads to:  
 A. decrease  $[\text{NH}_3]$       B. increase  $[\text{OH}^-]$       C. increase ionization of  $\text{NH}_3$       D. increase  $[\text{H}_3\text{O}^+]$
46. Calculate the moles of  $\text{NaOH}$  if 100 mL of its solution neutralized with 200 mL of 0.01M  $\text{HBr}$  ?  
 A. 0.01mol      B. 0.002mol      C. 0.001mol      D. 0.02mol
47. The strength of an acid does not depend on:  
 A. The polarity of the bond between hydrogen and the element it is bonded.      B. the bond energy  
 C. the number of hydrogen atoms in the chemical acid formula.      D. both (A+B) are correct
48. the spectator ion in the following reaction (  $\text{Al}_{(s)} + \text{H}_2\text{SO}_{4(aq)} \rightarrow \quad \quad \quad$  ), is;  
 A.  $\text{SO}_4^{2-}$       B.  $\text{Al}^{+3}$       C.  $\text{H}_3\text{O}^+$       D. all of them are correct.
49. A substance that formed when a strong acid has lost a proton  
 A. strong conjugate base      B. weak conjugate acid      C. weak conjugate base      D. cations
50. How much energy would be absorbed as heat by 75g of iron when heated from 295K to 301K if its specific heat is  $0.449 \text{ J/g.K}$ ?  
 A. 202kJ      B. 27.83J      C. 1002J      D. 202J

**W**

Answer the following questions : ( two marks for each right choice )

- How much energy would be absorbed as heat by 75g of iron when heated from 295K to 301K if its specific heat is 0.449J/g.K?  
 A. 202kJ B. 27.83J C. 1002J D. 202J
- Adding  $\text{NH}_4\text{Cl}$  to  $\text{NH}_3$  solution leads to:  
 A. decrease  $[\text{NH}_3]$  B. increase  $[\text{OH}^-]$  C. increase ionization of  $\text{NH}_3$  D. increase  $[\text{H}_3\text{O}^+]$
- In the following hypothetical reaction :  $(\text{A}_2 + \text{B}_2 \rightarrow 2\text{AB} + 30\text{kJ})$ , the activation energy for the forward reaction equal 50kJ/mol ,the activation energy for reverse reaction is equal to  
 A. 20kJ/mol B. 80kJ/mol C. -80kJ/mol D. 10kJ/mol
- The pH of an aqueous solution composed  $2 \times 10^{-4}$  mol of  $\text{H}_3\text{O}^+$  ions in 250 mL of its solution is equal to :-  
 A. 3.1 B. 3.7 C. 10.9 D. 10.3
- A solution made from ethanol , $\text{C}_2\text{H}_5\text{OH}$ ,and water is 1.76m in ethanol .How many moles of ethanol are contained per 250g of water?  
 A. 0.142mol B. 0.44mol C. 20.24mol D. 7.04mol
- Aqueous solution of  $\text{NH}_3$  is an Arrhenius base because:  
 A. it is proton acceptor. B. it increases the concentration of hydronium ion.  
 C. it is an electron pair donor. D. it increases the concentration of hydroxide ion.
- In the following an exothermic gaseous reaction :  $(2\text{CO} + \text{O}_2 \rightarrow 2\text{CO}_2)$  , which of the following statements is true about the reaction ?  
 A. The reaction is always spontaneous. B. The reaction is never spontaneous.  
 C. The reaction is spontaneous at low temperature. D. The reaction is spontaneous at high temperature.
- The dilute aqueous solution of a weak acid contains:  
 A. hydronium ions. B. acid molecules. C. anions. D. all of them are correct
- Which of the following is the equilibrium constant for an anion hydrolysis reaction?  
 A.  $\frac{[\text{HB}][\text{OH}^-]}{[\text{B}^-]}$  B.  $\frac{[\text{B}^-]}{[\text{HB}][\text{OH}^-]}$  C.  $\frac{[\text{HB}]}{[\text{B}^-][\text{OH}^-]}$  D.  $\frac{[\text{B}^-][\text{OH}^-]}{[\text{HB}]}$
- The net ionic equation for the precipitation Nickel ( II )sulfide is :  
 A.  $\text{NiS}_{(\text{s})} \rightarrow \text{Ni}^{2+}_{(\text{aq})} + \text{S}^{2-}_{(\text{aq})}$  B.  $2\text{Ni}^{2+}_{(\text{aq})} + 2\text{S}^{2-}_{(\text{aq})} \rightarrow \text{Ni}_2\text{S}_{2(\text{s})}$   
 C.  $\text{Ni}^{2+}_{(\text{aq})} + \text{S}^{2-}_{(\text{aq})} \rightarrow \text{NiS}_{(\text{s})}$  D. it does not have precipitate equation because it is soluble in water.
- The energy required to raise the reactant to the level of the activated complex is:  
 A. Activation energy B. Free energy C. Kinetic energy D. Energy of reaction
- A substance that formed when a strong acid has lost a proton  
 A. strong conjugate base B. weak conjugate acid C. weak conjugate base D. cations
- The strength of an acid does not depend on:  
 A. The polarity of the bond between hydrogen and the element it is bonded. B. the bond energy  
 C. the number of hydrogen atoms in the chemical acid formula. D. both (A+B) are correct

- The concentration of  $\text{H}_3\text{O}^+$  ions in aqueous solution of  $\text{Ba}(\text{OH})_2$  is  $1 \times 10^{-11}$  M, what is the molar concentration of solution?  
 A.  $1 \times 10^{-3}$  M B.  $2 \times 10^{-4}$  M C.  $2 \times 10^{-3}$  M D.  $5 \times 10^{-4}$  M
- The methyl orange is used to determine the equivalence point in one of the following titration: If the pH range for transition interval is (3.1- 4.4):  
 A.  $\text{HCl}, \text{NH}_3$  B.  $\text{CH}_3\text{COOH}, \text{NaOH}$  C.  $\text{HNO}_3, \text{NaOH}$  D.  $\text{NH}_3, \text{CH}_3\text{COOH}$
- Which of the following is a binary acid?  
 A.  $\text{H}_2\text{S}$  B.  $\text{H}_2\text{CO}_3$  C.  $\text{H}_2\text{O}_2$  D. all of them are correct
- The boiling-point elevation of a solvent is  $2.4^\circ\text{C}$ , when the concentration of the solution containing a nonelectrolyte solute is 3.1m, what is the value of molal boiling-point constant?  
 A.  $1.29^\circ\text{C}/m$  B.  $-0.77^\circ\text{C}/m$  C.  $7.44^\circ\text{C}/m$  D.  $0.77^\circ\text{C}/m$
- Which of the following solutions with the same concentrations has lower  $[\text{H}_3\text{O}^+]$ ?  
 A.  $\text{HCl}$  B.  $\text{H}_2\text{O}$  C.  $\text{NH}_3$  D.  $\text{HF}$
- The rate of the slow reaction increases by :  
 A. the addition of a catalyst. B. increasing activation energy  
 C. increasing concentration. D. Both (A+C) are correct
- When polar compound ionizes completely in water the compound is:  
 A. ionic electrolyte. B. weak electrolyte. C. non-electrolyte molecular. D. strong molecular electrolyte.
- Which of the following represents the formation equation?  
 A.  $\text{N}_2 + \text{O}_2 \rightarrow 2\text{NO}$  B.  $\text{C}_{(\text{graphite})} + \text{O}_2 \rightarrow \text{CO}_2$  C.  $\text{CO} + 1/2 \text{O}_2 \rightarrow \text{CO}_2$  D.  $\text{CO}_2 \rightarrow \text{C}_{(\text{graphite})} + \text{O}_2$
- How many moles of ammonium sulfate must be dissociate to produce 0.4 mol of sulfate ion?  
 A. 0.2 mol B. 0.4 mol C. 0.6 mol D. 0.8 mol
- The boiling point of a solution is higher than that of a pure solvent because :-  
 A. Vapor-pressure lowering B. Freezing- point heightening  
 C. Vapor-pressure heightening D. none of them
- The solubility product of cadmium carbonate,  $\text{CdCO}_3$  , is  $1.0 \times 10^{-12}$  .In a saturated solution of this salt, the concentration of carbonate ions is:  
 A.  $5 \times 10^{-13}$  M B.  $3 \times 10^{-6}$  M C.  $1 \times 10^{-6}$  M D.  $5 \times 10^{-7}$  M
- In the following gaseous reaction:  $(\text{N}_2 + 3\text{H}_2 \rightleftharpoons 2\text{NH}_3)$  it was found the  $[\text{NH}_3] = 0.62$  M ,  $[\text{H}_2] = 0.14$  M,  $[\text{N}_2] = 0.45$  M the value of the equilibrium constant equals:  
 A.  $3.2 \times 10^{-3}$  B.  $3.11 \times 10^2$  C.  $3.11 \times 10^{-2}$  D. 9.84
- The rate law of the following reaction:  $\text{A} + 2\text{B} \rightarrow \text{AB}_2$ , is  $R = k[\text{B}]^2$  , what happens to the reaction rate when the concentration of both reactants is doubled?  
 A. the reaction rate remains the same. B. the reaction rate increases by a factor of two.  
 C. the reaction rate increases by a factor of four. D. the reaction rate increases by a factor eight.
- Calculate the moles of  $\text{NaOH}$  if 100 mL of its solution neutralized with 200 mL of 0.01M  $\text{HBr}$  ?  
 A. 0.01mol B. 0.002mol C. 0.001mol D. 0.02mol

28. In equilibrium gaseous reaction:  $2\text{NO} + \text{Cl}_2 \rightleftharpoons 2\text{NOCl} + \text{energy}$ , which of the following shift the reaction to the right ?  
 A. adding catalyst    B. decreasing system volume    C. increasing temperature    D. decreasing pressure
29. The following reaction :  $(2\text{A} + \text{B} \rightarrow \text{A}_2\text{B})$  is occur by one step mechanism the rate law for the reaction is:  
 A.  $R = k[\text{A}][\text{B}]$     B.  $R = k[\text{A}_2\text{B}]$     C.  $R = k[\text{A}]^2[\text{B}]$     D.  $R = k[\text{A}][\text{B}]^2$
30. When barium chloride solution is mixed with sodium nitrate:  
 A. sodium chloride precipitates    B. barium nitrate precipitates  
 C. precipitation does not occur    D. Both ( A + B ) are correct
31. All of the following statements are true about the collision theory except:  
 A. all collisions between particles of reactant leads to the occurrence of the chemical reaction  
 B. the reaction rate is directly proportional with the number of effective collision.  
 C. in order for chemical reaction to occur, the reacting particles must collide  
 D. the particles of reactants must have enough energy to initiate the reaction.
32. Unknown liquid miscible with toluene and immiscible with water which of the following statements is correct?  
 A. an aqueous solution for the liquid conducts electric current.    B. a liquid is nonpolar molecular compound.  
 C. a liquid is polar molecular compound.    D. none of them
33. In aqueous solution contains,  $\text{Ca}^{+2}, \text{SO}_4^{2-}$  ions,  $\text{CaSO}_4$  precipitates if :  
 A.  $[\text{Ca}^{+2}][\text{SO}_4^{2-}] = K_{sp}$     B.  $[\text{Ca}^{+2}][\text{SO}_4^{2-}] > K_{sp}$     C.  $[\text{Ca}^{+2}][\text{SO}_4^{2-}] < K_{sp}$     D. can not be determined
34. In the following reaction :  $(\text{BF}_3(\text{aq}) + \text{F}^-(\text{aq}) \rightarrow \text{BF}_4^-(\text{aq}))$  which of the following is Lewis base?  
 A.  $\text{F}^-$     B.  $\text{BF}_3$     C.  $\text{BF}_4^-$     D. none of them is correct
35. For an exothermic dissolution process, the increasing of the temperature causes:  
 A. increasing dissolution    B. decreasing dissolution    C. decreasing crystallization    D. Both (A+C) are correct
36. The value of equilibrium constant for this gaseous reaction :  $(\text{N}_2\text{O}_4 \rightleftharpoons 2\text{NO}_2)$  is 0.1 at a specified temperature, what would be the value of that constant for the reverse reaction at the same condition?  
 A. 0.05    B. 0.1    C. 10    D. 5
37. A reaction has  $\Delta H = -74.8 \text{ kJ/mol}$ ,  $\Delta S = -0.081 \text{ kJ/mol.K}$  at  $27^\circ\text{C}$  which of the following is correct?  
 A.  $\Delta G = 50.5 \text{ kJ/mol}$ , nonspontaneous.    B.  $\Delta G = -72.8 \text{ kJ/mol}$ , spontaneous.  
 C.  $\Delta G = 72.8 \text{ kJ/mol}$ , nonspontaneous    D.  $\Delta G = -50.5 \text{ kJ/mol}$ , spontaneous.
38. A proposed mechanism for the reaction is:-  $2\text{NO} + \text{H}_2 \rightarrow \text{N}_2\text{O} + \text{H}_2\text{O}$   
 fast :  $\text{N}_2\text{O} + \text{H}_2 \rightarrow \text{N}_2 + \text{H}_2\text{O}$  which of the following is correct ?  
 A.  $R = k[\text{NO}][\text{H}_2]$     B. overall balanced equation for the reaction is :  $2\text{NO} + 2\text{H}_2 \rightarrow \text{N}_2 + 2\text{H}_2\text{O}$   
 C. the reaction order is second    D. Both (A+C) are correct
39. While mixing a small quantity of water with a large quantity of ethanol, water considered as :-  
 A. solvent    B. solute    C. solution    D. none of them
40. The enthalpy change that occurs during the complete combustion of one mole of an element or compound is called:  
 A. Enthalpy of formation.    B. Enthalpy of solution.    C. Enthalpy of combustion.    D. Specific Heat
41. The common-ion causes:  
 A. increasing precipitation.    B. decreasing ionization.  
 C. shifting equilibrium to left.    D. all of them are correct.
42. Which of the following ions hydrolyze in aqueous solution?  
 A.  $\text{NO}_3^-$     B.  $\text{CO}_3^{2-}$     C.  $\text{SO}_4^{2-}$     D. none of them is correct
43. Which of the following is homogenous mixture?  
 A. milk    B. 24-karat gold    C. tap water    D. oil and water
44. A substance that can react as an acid or a base :  
 A.  $\text{SO}_4^{2-}$     B.  $\text{HSO}_3^-$     C.  $\text{CH}_3\text{COO}^-$     D.  $\text{NH}_4^+$
45. The entropy increases at:  
 A. evaporating of liquid    B. temperature raising.    C. increase pressure    D. both(A+B) are correct
46. the spectator ion in the following reaction  $(\text{Al}(\text{s}) + \text{H}_2\text{SO}_4(\text{aq}) \rightarrow \quad)$ , is;  
 A.  $\text{SO}_4^{2-}$     B.  $\text{Al}^{+3}$     C.  $\text{H}_3\text{O}^+$     D. all of them are correct.
47. In the following reaction :  $(2\text{HCl}(\text{g}) + 184.6 \text{ kJ} \rightarrow \text{H}_2(\text{g}) + \text{Cl}_2(\text{g}))$ , the standard formation enthalpy of  $\text{HCl}$  equals :  
 A.  $184.6 \text{ kJ/mol}$     B.  $-184.6 \text{ kJ/mol}$     C.  $-92.3 \text{ kJ/mol}$     D.  $92.3 \text{ kJ/mol}$
48. Which one of the following statements is incorrect?  
 A. Many solids dissolve more quickly in a cold solvent than in warm solvent.  
 B. Gases are generally more soluble in water at low temperature.  
 C. Aqueous solution is a mixture containing the solute soluble in water as a solvent.  
 D. The effect of stirring is similar to that of crushing a solid – contact between the solvent and the solute surface is increased.
49. All of them are correct except:  
 A. An ionic compound at solid state does not conduct electric current.  
 B. Alloy is a mixture the atoms of two or more metals are uniformly mixed.  
 C. The Brownian motion is a motion due to collision rapidly moving molecules.  
 D.  $\text{HCl}$  does not soluble in water.
50. The solution that contains the precisely known concentration of a solute is known as:  
 A. saturated solution    B. dilute solution    C. standard solution    D. buffer solution

**X**



Answer the following questions : ( two marks for each right choice )

- In the following reaction :  $(BF_3(aq) + F^-(aq) \rightarrow BF_4^-(aq))$  which of the following is Lewis base?  
 A.  $F^-$  B.  $BF_3$  C.  $BF_4^-$  D. none of them is correct
- Which of the following solutions with the same concentrations has lower  $[H_3O^+]$ ?  
 A. HCl B.  $H_2O$  C.  $NH_3$  D. HF
- The rate law of the following reaction:  $A + 2B \rightarrow AB_2$ , is  $R = k[B]^2$ , what happens to the reaction rate when the concentration of both reactants is doubled?  
 A. the reaction rate remains the same. B. the reaction rate increases by a factor of two.  
 C. the reaction rate increases by a factor of four. D. the reaction rate increases by a factor eight.
- A substance that formed when a strong acid has lost a proton  
 A. strong conjugate base B. weak conjugate acid C. weak conjugate base D. cations
- Adding  $NH_4Cl$  to  $NH_3$  solution leads to:  
 A. decrease  $[NH_3]$  B. increase  $[OH^-]$  C. increase ionization of  $NH_3$  D. increase  $[H_3O^+]$
- The methyl orange is used to determine the equivalence point in one of the following titration: If the pH range for transition interval is (3.1- 4.4):  
 A. HCl,  $NH_3$  B.  $CH_3COOH$ , NaOH C.  $HNO_3$ , NaOH D.  $NH_3$ ,  $CH_3COOH$
- The strength of an acid does not depend on:  
 A. The polarity of the bond between hydrogen and the element it is bonded. B. the bond energy  
 C. the number of hydrogen atoms in the chemical acid formula. D. both (A+B) are correct
- Unknown liquid miscible with toluene and immiscible with water which of the following statements is correct?  
 A. an aqueous solution for the liquid conducts electric current. B. a liquid is nonpolar molecular compound.  
 C. a liquid is polar molecular compound. D. none of them
- In the following gaseous reaction:  $(N_2 + 3H_2 \rightleftharpoons 2NH_3)$  it was found the  $[NH_3] = 0.62 M$ ,  $[H_2] = 0.14 M$ ,  $[N_2] = 0.45 M$  the value of the equilibrium constant equals:  
 A.  $3.2 \times 10^{-3}$  B.  $3.11 \times 10^2$  C.  $3.11 \times 10^{-2}$  D. 9.84
- The dilute aqueous solution of a weak acid contains:  
 A. hydronium ions. B. acid molecules. C. anions. D. all of them are correct
- Calculate the moles of NaOH if 100 mL of its solution neutralized with 200 mL of 0.01M HBr ?  
 A. 0.01mol B. 0.002mol C. 0.001mol D. 0.02mol
- While mixing a small quantity of water with a large quantity of ethanol, water considered as :-  
 A. solvent B. solute C. solution D. none of them
- Which of the following ions hydrolyze in aqueous solution?  
 A.  $NO_3^-$  B.  $CO_3^{2-}$  C.  $SO_4^{2-}$  D. none of them is correct
- When polar compound ionizes completely in water the compound is:  
 A. ionic electrolyte. B. weak electrolyte. C. non-electrolyte molecular. D. strong molecular electrolyte.

- The energy required to raise the reactant to the level of the activated complex is:  
 A. Activation energy B. Free energy C. Kinetic energy D. Energy of reaction
- The rate of the slow reaction increases by :  
 A. the addition of a catalyst. B. increasing activation energy  
 C. increasing concentration. D. Both (A+C) are correct
- The net ionic equation for the precipitation Nickel ( II )sulfide is :  
 A.  $NiS(s) \rightarrow Ni^{2+}(aq) + S^{2-}(aq)$  B.  $2Ni^{2+}(aq) + 2S^{2-}(aq) \rightarrow Ni_2S_2(s)$   
 C.  $Ni^{2+}(aq) + S^{2-}(aq) \rightarrow NiS(s)$  D. it does not have precipitate equation because it is soluble in water.
- How much energy would be absorbed as heat by 75g of iron when heated from 295K to 301K if its specific heat is 0.449J/g.K?  
 A. 202kJ B. 27.83J C. 1002J D. 202J
- In equilibrium gaseous reaction:  $2NO + Cl_2 \rightleftharpoons 2NOCl + \text{energy}$ , which of the following shift the reaction to the right ?  
 A. adding catalyst B. decreasing system volume C. increasing temperature D. decreasing pressure
- When barium chloride solution is mixed with sodium nitrate:  
 A. sodium chloride precipitates B. barium nitrate precipitates  
 C. precipitation does not occur D. Both ( A + B ) are correct
- The entropy increases at:  
 A. evaporating of liquid B. temperature raising. C. increase pressure D. both(A+B) are correct
- Which of the following is the equilibrium constant for an anion hydrolysis reaction?  
 A.  $\frac{[HB][OH^-]}{[B^-]}$  B.  $\frac{[B^-]}{[HB][OH^-]}$  C.  $\frac{[HB]}{[B^-][OH^-]}$  D.  $\frac{[B^-][OH^-]}{[HB]}$
- Which of the following is a binary acid?  
 A.  $H_2S$  B.  $H_2CO_3$  C.  $H_2O_2$  D. all of them are correct
- Which of the following is homogenous mixture?  
 A. milk B. 24-karat gold C. tap water D. oil and water
- The enthalpy change that occurs during the complete combustion of one mole of an element or compound is called:  
 A. Enthalpy of formation. B. Enthalpy of solution. C. Enthalpy of combustion. D. Specific Heat
- All of them are correct except:  
 A. An ionic compound at solid state does not conduct electric current.  
 B. Alloy is a mixture the atoms of two or more metals are uniformly mixed.  
 C. The Brownian motion is a motion due to collision rapidly moving molecules.  
 D. HCl does not soluble in water.
- The pH of an aqueous solution composed  $2 \times 10^{-4}$  mol of  $H_3O^+$  ions in 250 mL of its solution is equal to :-  
 A. 3.1 B. 3.7 C. 10.9 D. 10.3
- In the following hypothetical reaction :  $(A_2 + B_2 \rightarrow 2AB + 30kJ)$ , the activation energy for the forward reaction equal 50kJ/mol ,the activation energy for reverse reaction is equal to  
 A. 20kJ/mol B. 80kJ/mol C. -80kJ/mol D. 10kJ/mol

29. The common-ion causes:  
 A. increasing precipitation. B. decreasing ionization.  
 C. shifting equilibrium to left. D. all of them are correct.
30. The boiling point of a solution is higher than that of a pure solvent because :-  
 A. Vapor-pressure lowering B. Freezing- point heightening  
 C. Vapor-pressure heightening D. none of them
31. All of the following statements are true about the collision theory except:  
 A. all collisions between particles of reactant leads to the occurrence of the chemical reaction  
 B. the reaction rate is directly proportional with the number of effective collision.  
 C. in order for chemical reaction to occur, the reacting particles must collide  
 D. the particles of reactants must have enough energy to initiate the reaction.
32. the spectator ion in the following reaction ( $\text{Al}_{(\text{s})} + \text{H}_2\text{SO}_{4(\text{aq})} \rightarrow$  ), is;  
 A.  $\text{SO}_4^{2-}$  B.  $\text{Al}^{+3}$  C.  $\text{H}_3\text{O}^+$  D. all of them are correct.
33. A substance that can react as an acid or a base :  
 A.  $\text{SO}_4^{2-}$  B.  $\text{HSO}_3^-$  C.  $\text{CH}_3\text{COO}^-$  D.  $\text{NH}_4^+$
34. The value of equilibrium constant for this gaseous reaction : ( $\text{N}_2\text{O}_4 \rightleftharpoons 2\text{NO}_2$ ) is 0.1 at a specified temperature, what would be the value of that constant for the reverse reaction at the same condition?  
 A. 0.05 B. 0.1 C. 10 D. 5
35. Aqueous solution of  $\text{NH}_3$  is an Arrhenius base because:  
 A. it is proton accepter. B. it increases the concentration of hydronium ion.  
 C. it is an electron pair donor. D. it increases the concentration of hydroxide ion.
36. In the following an exothermic gaseous reaction : ( $2\text{CO} + \text{O}_2 \rightarrow 2\text{CO}_2$ ) , which of the following statements is true about the reaction ?  
 A. The reaction is always spontaneous. B. The reaction is never spontaneous.  
 C. The reaction is spontaneous at low temperature. D. The reaction is spontaneous at high temperature.
37. In the following reaction : ( $2\text{HCl}_{(\text{g})} + 184.6\text{kJ} \rightarrow \text{H}_{2(\text{g})} + \text{Cl}_{2(\text{g})}$ ) , the standard formation enthalpy of HCl equals :  
 A. 184.6kJ/mol B. -184.6kJ/mol C. -92.3kJ/mol D. 92.3kJ/mol
38. A reaction has  $\Delta H = -74.8\text{kJ/mol}$  ,  $\Delta S = -0.081\text{kJ/mol.K}$  at  $27^\circ\text{C}$  which of the following is correct?  
 A.  $\Delta G = 50.5\text{kJ/mol}$  , nonspontaneous . B.  $\Delta G = -72.8\text{kJ/mol}$  , spontaneous.  
 C.  $\Delta G = 72.8\text{kJ/mol}$  , nonspontaneous D.  $\Delta G = -50.5\text{kJ/mol}$  , spontaneous.
39. The boiling-point elevation of a solvent is  $2.4^\circ\text{C}$ , when the concentration of the solution containing a nonelectrolyte solute is  $3.1\text{m}$ , what is the value of molal boiling-point constant?  
 A.  $1.29^\circ\text{C/m}$  B.  $-0.77^\circ\text{C/m}$  C.  $7.44^\circ\text{C/m}$  D.  $0.77^\circ\text{C/m}$
40. Which one of the following statements is incorrect?  
 A. Many solids dissolve more quickly in a cold solvent than in warm solvent.  
 B. Gases are generally more soluble in water at low temperature.  
 C. Aqueous solution is a mixture containing the solute soluble in water as a solvent.  
 D. The effect of stirring is similar to that of crushing a solid – contact between the solvent and the solute surface is increased.
41. The solution that contains the precisely known concentration of a solute is known as:  
 A. saturated solution B. dilute solution C. standard solution D. buffer solution
42. How many moles of ammonium sulfate must be dissociate to produce 0.4 mol of sulfate ion?  
 A. 0.2 mol B. 0.4 mol C. 0.6 mol D. 0.8 mol
43. The following reaction : ( $2\text{A} + \text{B} \rightarrow \text{A}_2\text{B}$ ) is occur by one step mechanism the rate law for the reaction is:  
 A.  $R = k[\text{A}][\text{B}]$  B.  $R = k[\text{A}_2\text{B}]$  C.  $R = k[\text{A}]^2[\text{B}]$  D.  $R = k[\text{A}][\text{B}]^2$
44. In aqueous solution contains,  $\text{Ca}^{+2}$ ,  $\text{SO}_4^{2-}$  ions,  $\text{CaSO}_4$  precipitates if :  
 A.  $[\text{Ca}^{+2}][\text{SO}_4^{2-}] = K_{sp}$  B.  $[\text{Ca}^{+2}][\text{SO}_4^{2-}] > K_{sp}$  C.  $[\text{Ca}^{+2}][\text{SO}_4^{2-}] < K_{sp}$  D. can not be determined
45. The concentration of  $\text{H}_3\text{O}^+$  ions in aqueous solution of  $\text{Ba}(\text{OH})_2$  is  $1 \times 10^{-11}\text{M}$ , what is the molar concentration of solution?  
 A.  $1 \times 10^{-3}\text{M}$  B.  $2 \times 10^{-4}\text{M}$  C.  $2 \times 10^{-3}\text{M}$  D.  $5 \times 10^{-4}\text{M}$
46. A solution made from ethanol ,  $\text{C}_2\text{H}_5\text{OH}$ , and water is  $1.76\text{m}$  in ethanol .How many moles of ethanol are contained per 250g of water?  
 A. 0.142mol B. 0.44mol C. 20.24mol D. 7.04mol
47. The solubility product of cadmium carbonate,  $\text{CdCO}_3$  , is  $1.0 \times 10^{-12}$  .In a saturated solution of this salt, the concentration of carbonate ions is:  
 A.  $5 \times 10^{-13}\text{M}$  B.  $3 \times 10^{-6}\text{M}$  C.  $1 \times 10^{-6}\text{M}$  D.  $5 \times 10^{-7}\text{M}$
48. A proposed mechanism for the reaction is:- slow :  $2\text{NO} + \text{H}_2 \rightarrow \text{N}_2\text{O} + \text{H}_2\text{O}$   
 fast :  $\text{N}_2\text{O} + \text{H}_2 \rightarrow \text{N}_2 + \text{H}_2\text{O}$  which of the following is correct ?  
 A.  $R = k[\text{NO}][\text{H}_2]$  B. overall balanced equation for the reaction is :  $2\text{NO} + 2\text{H}_2 \rightarrow \text{N}_2 + 2\text{H}_2\text{O}$   
 C. the reaction order is second D. Both (A+C) are correct
49. For an exothermic dissolution process, the increasing of the temperature causes:  
 A. increasing dissolution B. decreasing dissolution C. decreasing crystallization D. Both (A+C) are correct
50. Which of the following represents the formation equation?  
 A.  $\text{N}_2 + \text{O}_2 \rightarrow 2\text{NO}$  B.  $\text{C}_{(\text{graphite})} + \text{O}_2 \rightarrow \text{CO}_2$  C.  $\text{CO} + 1/2 \text{O}_2 \rightarrow \text{CO}_2$  D.  $\text{CO}_2 \rightarrow \text{C}_{(\text{graphite})} + \text{O}_2$

Y

Answer the following questions : ( two marks for each right choice )

- The common-ion causes:
  - increasing precipitation.
  - decreasing ionization.
  - shifting equilibrium to left.
  - all of them are correct.
- The solubility product of cadmium carbonate,  $\text{CdCO}_3$ , is  $1.0 \times 10^{-12}$ . In a saturated solution of this salt, the concentration of carbonate ions is:
  - $5 \times 10^{-13} \text{ M}$
  - $3 \times 10^{-6} \text{ M}$
  - $1 \times 10^{-6} \text{ M}$
  - $5 \times 10^{-7} \text{ M}$
- The following reaction :  $(2\text{A} + \text{B} \rightarrow \text{A}_2\text{B})$  is occur by one step mechanism the rate law for the reaction is:
  - $\text{R} = k[\text{A}][\text{B}]$
  - $\text{R} = k[\text{A}_2\text{B}]$
  - $\text{R} = k[\text{A}]^2[\text{B}]$
  - $\text{R} = k[\text{A}][\text{B}]^2$
- In the following an exothermic gaseous reaction :  $(2\text{CO} + \text{O}_2 \rightarrow 2\text{CO}_2)$ , which of the following statements is true about the reaction ?
  - The reaction is always spontaneous.
  - The reaction is never spontaneous.
  - The reaction is spontaneous at low temperature.
  - The reaction is spontaneous at high temperature.
- The pH of an aqueous solution composed  $2 \times 10^{-4} \text{ mol}$  of  $\text{H}_3\text{O}^+$  ions in 250 mL of its solution is equal to :-
  - 3.1
  - 3.7
  - 10.9
  - 10.3
- All of them are correct except:
  - An ionic compound at solid state does not conduct electric current.
  - Alloy is a mixture the atoms of two or more metals are uniformly mixed.
  - The Brownian motion is a motion due to collision rapidly moving molecules.
  - HCl does not soluble in water.
- Which of the following solutions with the same concentrations has lower  $[\text{H}_3\text{O}^+]$ ?
  - HCl
  - $\text{H}_2\text{O}$
  - $\text{NH}_3$
  - HF
- The net ionic equation for the precipitation Nickel ( II )sulfide is :
  - $\text{NiS}_{(\text{s})} \rightarrow \text{Ni}^{+2}_{(\text{aq})} + \text{S}^{-2}_{(\text{aq})}$
  - $2\text{Ni}^{+2}_{(\text{aq})} + 2\text{S}^{-2}_{(\text{aq})} \rightarrow \text{Ni}_2\text{S}_{2(\text{s})}$
  - $\text{Ni}^{+2}_{(\text{aq})} + \text{S}^{-2}_{(\text{aq})} \rightarrow \text{NiS}_{(\text{s})}$
  - it does not have precipitate equation because it is soluble in water.
- For an exothermic dissolution process, the increasing of the temperature causes:
  - increasing dissolution
  - decreasing dissolution
  - decreasing crystallization
  - Both (A+C) are correct
- A substance that can react as an acid or a base :
  - $\text{SO}_4^{2-}$
  - $\text{HSO}_3^-$
  - $\text{CH}_3\text{COO}^-$
  - $\text{NH}_4^+$
- The boiling point of a solution is higher than that of a pure solvent because :-
  - Vapor-pressure lowering
  - Freezing- point heightening
  - Vapor-pressure heightening
  - none of them
- In the following gaseous reaction:  $(\text{N}_2 + 3\text{H}_2 \rightleftharpoons 2\text{NH}_3)$  it was found the  $[\text{NH}_3] = 0.62 \text{ M}$ ,  $[\text{H}_2] = 0.14 \text{ M}$ ,  $[\text{N}_2] = 0.45 \text{ M}$  the value of the equilibrium constant equals:
  - $3.2 \times 10^{-3}$
  - $3.11 \times 10^2$
  - $3.11 \times 10^{-2}$
  - 9.84

- A solution made from ethanol,  $\text{C}_2\text{H}_5\text{OH}$ , and water is 1.76m in ethanol .How many moles of ethanol are contained per 250g of water?
  - 0.142mol
  - 0.44mol
  - 20.24mol
  - 7.04mol
- In the following reaction :  $(2\text{HCl}_{(\text{g})} + 184.6\text{kJ} \rightarrow \text{H}_{2(\text{g})} + \text{Cl}_{2(\text{g})})$ , the standard formation enthalpy of HCl equals :
  - 184.6kJ/mol
  - 184.6kJ/mol
  - 92.3kJ/mol
  - 92.3kJ/mol
- How much energy would be absorbed as heat by 75g of iron when heated from 295K to 301K if its specific heat is 0.449J/g.K?
  - 202kJ
  - 27.83J
  - 1002J
  - 202J
- When polar compound ionizes completely in water the compound is:
  - ionic electrolyte.
  - weak electrolyte.
  - non-electrolyte molecular.
  - strong molecular electrolyte.
- The entropy increases at:
  - evaporating of liquid
  - temperature raising.
  - increase pressure
  - both(A+B) are correct
- Which of the following ions hydrolyze in aqueous solution?
  - $\text{NO}_3^-$
  - $\text{CO}_3^{2-}$
  - $\text{SO}_4^{2-}$
  - none of them is correct
- Unknown liquid miscible with toluene and immiscible with water which of the following statements is correct?
  - an aqueous solution for the liquid conducts electric current.
  - a liquid is nonpolar molecular compound.
  - a liquid is polar molecular compound.
  - none of them
- The enthalpy change that occurs during the complete combustion of one mole of an element or compound is called:
  - Enthalpy of formation.
  - Enthalpy of solution.
  - Enthalpy of combustion.
  - Specific Heat
- Adding  $\text{NH}_4\text{Cl}$  to  $\text{NH}_3$  solution leads to:
  - decrease  $[\text{NH}_3]$
  - increase  $[\text{OH}^-]$
  - increase ionization of  $\text{NH}_3$
  - increase  $[\text{H}_3\text{O}^+]$
- Which of the following represents the formation equation?
  - $\text{N}_2 + \text{O}_2 \rightarrow 2\text{NO}$
  - $\text{C}_{(\text{graphite})} + \text{O}_2 \rightarrow \text{CO}_2$
  - $\text{CO} + 1/2 \text{O}_2 \rightarrow \text{CO}_2$
  - $\text{CO}_2 \rightarrow \text{C}_{(\text{graphite})} + \text{O}_2$
- How many moles of ammonium sulfate must be dissociate to produce 0.4 mol of sulfate ion?
  - 0.2 mol
  - 0.4 mol
  - 0.6 mol
  - 0.8 mol
- Which of the following is a binary acid?
  - $\text{H}_2\text{S}$
  - $\text{H}_2\text{CO}_3$
  - $\text{H}_2\text{O}_2$
  - all of them are correct
- The value of equilibrium constant for this gaseous reaction :  $(\text{N}_2\text{O}_4 \rightleftharpoons 2\text{NO}_2)$  is 0.1 at a specified temperature, what would be the value of that constant for the reverse reaction at the same condition?
  - 0.05
  - 0.1
  - 10
  - 5
- A proposed mechanism for the reaction is:- slow :  $2\text{NO} + \text{H}_2 \rightarrow \text{N}_2\text{O} + \text{H}_2\text{O}$   
 fast :  $\text{N}_2\text{O} + \text{H}_2 \rightarrow \text{N}_2 + \text{H}_2\text{O}$  which of the following is correct ?
  - $\text{R} = k[\text{NO}][\text{H}_2]$
  - overall balanced equation for the reaction is :  $2\text{NO} + 2\text{H}_2 \rightarrow \text{N}_2 + 2\text{H}_2\text{O}$
  - the reaction order is second
  - Both (A+C) are correct
- A substance that formed when a strong acid has lost a proton
  - strong conjugate base
  - weak conjugate acid
  - weak conjugate base
  - cations

28. The solution that contains the precisely known concentration of a solute is known as:  
 A. saturated solution      B. dilute solution      C. standard solution      D. buffer solution
29. In the following hypothetical reaction :  $(A_2+B_2 \rightarrow 2AB+30kJ)$ , the activation energy for the forward reaction equal 50kJ/mol ,the activation energy for reverse reaction is equal to  
 A.20kJ/mol      B. 80kJ/mol      C. -80kJ/mol      D.10kJ/mol
30. The strength of an acid does not depend on:  
 A. The polarity of the bond between hydrogen and the element it is bonded.      B. the bond energy  
 C. the number of hydrogen atoms in the chemical acid formula.      D. both (A+B) are correct
31. The rate of the slow reaction increases by :  
 A. the addition of a catalyst.      B. increasing activation energy  
 C. increasing concentration.      D. Both (A+C) are correct
32. In aqueous solution contains,  $Ca^{+2}, SO_4^{2-}$  ions,  $CaSO_4$  precipitates if :  
 A.  $[Ca^{+2}][SO_4^{2-}] = K_{sp}$       B.  $[Ca^{+2}][SO_4^{2-}] > K_{sp}$       C.  $[Ca^{+2}][SO_4^{2-}] < K_{sp}$       D. can not be determined
33. While mixing a small quantity of water with a large quantity of ethanol, water considered as :-  
 A. solvent      B. solute      C. solution      D. none of them
34. the spectator ion in the following reaction  $(Al_{(s)} + H_2SO_{4(aq)} \rightarrow \quad)$ , is;  
 A.  $SO_4^{2-}$       B.  $Al^{+3}$       C.  $H_3O^+$       D. all of them are correct.
35. Which of the following is the equilibrium constant for an anion hydrolysis reaction?  
 A.  $\frac{[HB][OH^-]}{[B^-]}$       B.  $\frac{[B^-]}{[HB][OH^-]}$       C.  $\frac{[HB]}{[B^-][OH^-]}$       D.  $\frac{[B^-][OH^-]}{[HB]}$
36. In the following reaction :  $(BF_{3(aq)} + F^-_{(aq)} \rightarrow BF_4^-_{(aq)})$  which of the following is Lewis base?  
 A.  $F^-$       B.  $BF_3$       C.  $BF_4^-$       D. none of them is correct
37. A reaction has  $\Delta H = -74.8 kJ/mol$ ,  $\Delta S = -0.081 kJ/mol.K$  at  $27^\circ C$  which of the following is correct?  
 A.  $\Delta G = 50.5 kJ/mol$ , nonspontaneous.      B.  $\Delta G = -72.8 kJ/mol$ , spontaneous.  
 C.  $\Delta G = 72.8 kJ/mol$ , nonspontaneous      D.  $\Delta G = -50.5 kJ/mol$ , spontaneous.
38. The energy required to raise the reactant to the level of the activated complex is:  
 A. Activation energy      B. Free energy      C. Kinetic energy      D. Energy of reaction
39. The dilute aqueous solution of a weak acid contains:  
 A. hydronium ions.      B. acid molecules.      C. anions.      D. all of them are correct
40. The boiling-point elevation of a solvent is  $2.4^\circ C$ , when the concentration of the solution containing a nonelectrolyte solute is  $3.1m$ , what is the value of molal boiling-point constant?  
 A.  $1.29^\circ C/m$       B.  $-0.77^\circ C/m$       C.  $7.44^\circ C/m$       D.  $0.77^\circ C/m$
41. Which of the following is homogenous mixture?  
 A. milk      B. 24-karat gold      C. tap water      D. oil and water
42. The concentration of  $H_3O^+$  ions in aqueous solution of  $Ba(OH)_2$  is  $1 \times 10^{-11} M$ , what is the molar concentration of solution?  
 A.  $1 \times 10^{-3} M$       B.  $2 \times 10^{-4} M$       C.  $2 \times 10^{-3} M$       D.  $5 \times 10^{-4} M$
43. When barium chloride solution is mixed with sodium nitrate:  
 A. sodium chloride precipitates      B. barium nitrate precipitates  
 C. precipitation does not occur      D. Both ( A + B ) are correct
44. The methyl orange is used to determine the equivalence point in one of the following titration: If the pH range for transition interval is (3.1- 4.4):  
 A.  $HCl, NH_3$       B.  $CH_3COOH, NaOH$       C.  $HNO_3, NaOH$       D.  $NH_3, CH_3COOH$
45. All of the following statements are true about the collision theory except:  
 A. all collisions between particles of reactant leads to the occurrence of the chemical reaction  
 B. the reaction rate is directly proportional with the number of effective collision.  
 C. in order for chemical reaction to occur, the reacting particles must collide  
 D. the particles of reactants must have enough energy to initiate the reaction.
46. Aqueous solution of  $NH_3$  is an Arrhenius base because:  
 A. it is proton acceptor.      B. it increases the concentration of hydronium ion.  
 C. it is an electron pair donor.      D. it increases the concentration of hydroxide ion.
47. The rate law of the following reaction:  $A+2B \rightarrow AB_2$ , is  $R=k[B]^2$ , what happens to the reaction rate when the concentration of both reactants is doubled?  
 A. the reaction rate remains the same.      B. the reaction rate increases by a factor of two.  
 C. the reaction rate increases by a factor of four.      D. the reaction rate increases by a factor eight.
48. Which one of the following statements is incorrect?  
 A. Many solids dissolve more quickly in a cold solvent than in warm solvent.  
 B. Gases are generally more soluble in water at low temperature.  
 C. Aqueous solution is a mixture containing the solute soluble in water as a solvent.  
 D. The effect of stirring is similar to that of crushing a solid – contact between the solvent and the solute surface is increased.
49. Calculate the moles of  $NaOH$  if 100 mL of its solution neutralized with 200 mL of 0.01M  $HBr$  ?  
 A. 0.01mol      B. 0.002mol      C. 0.001mol      D. 0.02mol
50. In equilibrium gaseous reaction:  $2NO + Cl_2 \rightleftharpoons 2NOCl + \text{energy}$ , which of the following shift the reaction to the right ?  
 A. adding catalyst      B. decreasing system volume      C. increasing temperature      D. decreasing pressure