



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

- Which of the following pairs of solutions produce a precipitate when combined?
 A. NH_4Cl and NaOH B. KCl and Na_2SO_4 C. $\text{Fe}(\text{NO}_3)_3$ and KCl D. NH_4Cl and AgNO_3
- An aqueous solution of hydrogen fluoride weakly conducts an electric current because :-
 A. it is ionized partially B. the hydrogen- fluorine bond is strong
 C. the hydrogen- fluorine bond is weak D. both (A and B) are correct
- How many moles of nitrate ions are produced by dissolving 0.15 mol of zinc nitrate in water?
 A. 0.30 B. 0.15 C. 0.45 D. 2.0
- The molal boiling-point constant (K_b) depends on the:-
 A. nature of solute B. number of solvent moles C. nature of solvent D. solute concentration
- Which of the following solutions with the same concentration has the highest vapor- pressure?
 A. AlCl_3 B. NaNO_3 C. $\text{C}_6\text{H}_{12}\text{O}_6$ D. CaCl_2
- When comparing the expected and actual freezing point of an aqueous solution of MgI_2 with 1.0 *m* concentration, which of the following is correct? If the actual freezing point is equal to -4.78°C and K_f of water= $-1.86^\circ\text{C}/m$.
 A. the expected freezing point is equal to the actual freezing point.
 B. the expected freezing point is lower than the actual freezing point
 C. the expected freezing point is higher than the actual freezing point
 D. none of them
- The anion of the acid that stomach produces:-
 A. is a strong conjugate base B. it acts as amphoteric
 C. is a weak conjugate acid D. it has a little tendency to attract a proton
- When the ammonia molecule reacts with the hydrogen ion (proton) :-
 A. ammonia molecule is an electron-pair accepter B. ammonia acts as Arrhenius base
 C. proton acts as Lewis acid D. both (A and C) are correct
- The calcium sulfate salt is produce by the reaction between the:-
 A. Ca and H_2SO_4 B. $\text{Ca}(\text{OH})_2$ and H_2SO_4 C. $\text{Ca}(\text{OH})_2$ and H_2SO_3 D. both (A and B) are correct
- Which of the following exhibits properties of an Arrhenius acid?
 A. hydrogen chloride that is dissolved in water B. the pure hydrogen chloride gas
 C. hydrogen chloride that is dissolved in nonpolar solvent D. all of them
- In this reaction: $\text{Al}(\text{s}) + \text{H}_2\text{SO}_4(\text{aq}) \longrightarrow$,which of the following is the net ionic equation?
 A. $\text{H}_3\text{O}^+(\text{aq}) + \text{OH}^-(\text{aq}) \longrightarrow 2\text{H}_2\text{O}(\text{l})$ B. $2\text{Al}(\text{s}) + 6\text{H}_3\text{O}^+(\text{aq}) \longrightarrow 2\text{Al}^{3+}(\text{aq}) + 9\text{H}_2(\text{g})$
 C. $2\text{Al}(\text{s}) + 6\text{H}_3\text{O}^+(\text{aq}) \longrightarrow 2\text{Al}^{3+}(\text{aq}) + 6\text{H}_2\text{O}(\text{l}) + 3\text{H}_2(\text{g})$ D. none of them
- In the reaction NO_2^- ions with water, which of the following is conjugate acid –base pair?
 A. H_2O and H_3O^+ B. HNO_2 and NO_2^- C. H_2O and OH^- D. both (B and C) are correct

13. In the second ionization stage of phosphoric acid in its aqueous solution.....are produced.

- A. HPO_4^{2-} and H_3O^+ B. H_2PO_4^- and H_3O^+ C. PO_4^{3-} and H_3O^+ D. all of them

14. In the titration acid and base process the equivalence point is determined by :-

- A. suitable indicator B. pH meter C. transition interval D. both (A and B) are correct

15. The equilibrium self-ionization equation of water at 25°C is: $2\text{H}_2\text{O}(\text{l}) + \text{energy} \rightleftharpoons \text{H}_3\text{O}^+(\text{aq}) + \text{OH}^-(\text{aq})$, by decreasing the temperature which of the following is incorrect?

- A. the pH value increases B. the pOH value decreases
 C. the K_w value decreases D. none of them

16. Suppose that 15mL of 0.025M H_2SO_4 is required to neutralize 10mL of KOH solution, what is the molarity of the base?

- A. 0.025 B. 0.0125 C. 0.075 D. 0.0075

17. If the $[\text{H}_3\text{O}^+]$ of aqueous solution of $\text{Ca}(\text{OH})_2$ is equal to $1.0 \times 10^{-8}\text{M}$, what is the molarity of $\text{Ca}(\text{OH})_2$?

- A. 1.0×10^{-6} B. 5.0×10^{-7} C. 1.0×10^{-8} D. 2.0×10^{-6}

18. The acidity of which of the following aqueous solutions at 25°C is highest?

- A. $\text{pOH}=13$ B. $[\text{H}_3\text{O}^+]=1.0 \times 10^{-7}\text{M}$ C. $[\text{OH}^-]=1.0 \times 10^{-4}\text{M}$ D. $\text{pH}=12$

19. In a titration experiment, by using phenolphthalein indicator ($\text{pH}=8.0-10.0$), 0.5mol of which of the following acids neutralizes 0.5mol of NaOH ? A. H_3PO_4 B. HF C. HCl D. both (A and B)

20. In this reaction: $2\text{H}_2(\text{g}) + \text{O}_2(\text{g}) \longrightarrow 2\text{H}_2\text{O}(\text{l}) + 571.6 \text{ kJ}$, which of the following is correct?

- A. ΔH_f° of water= -285.8 kJ/mol B. ΔH_f° of water= $+285.8 \text{ kJ/mol}$
 C. ΔH° of reverse reaction= $+571.6 \text{ kJ/mol}$ D. both (A and C) are correct

21. By using the information in the adjacent table, 55g of which of the following element absorbed 3.562 kJ of energy if it was heated from 22.4°C to 94.6°C ?

- A. Ca B. Al
 C. Fe D. Au

Element	Ca	Al	Fe	Au
Specific heat J/(g.K)	0.647	0.897	0.449	0.129

22. Which of the following two conditions will favor a spontaneous reaction?

- A. $\Delta H < 0$ and $\Delta S > 0$ B. $\Delta H > 0$ and $\Delta S > 0$ C. $\Delta H > 0$ and $\Delta S < 0$ D. $\Delta H < 0$ and $\Delta S < 0$

23. In a reaction, $\Delta G^\circ = 142.0 \text{ kJ/mol}$ and $\Delta H^\circ = 206.1 \text{ kJ/mol}$, at room temperature which of the following is correct?

- A. the entropy of the reactants is greater B. the entropy of the products is greater
 C. the entropy of reactants and the products is equal D. none of them

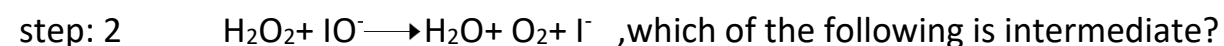
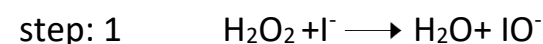
24. In the following hypothetical reaction: $\text{A} + \text{B} \longrightarrow \text{C} + \text{D}$ $\Delta H > 0$, which of the following is correct?

- A. the products are more stable B. the reactants are more stable
 C. the reaction is an exothermic D. none of them

25. When one gram of iron is heated to 100.0°C and cooled to 50.0°C in a calorimeter transfers 22.5 J of energy to the surrounding water. But one gram of silver transfers 11.8 J of energy under the same conditions, the difference of the value of transfer energy depends on the:-

- A. mass of the material B. temperature change C. nature of the material D. all of them

26. This reaction: $2\text{H}_2\text{O}_2 \longrightarrow 2\text{H}_2\text{O} + \text{O}_2$, by using catalyst has the following proposed mechanism:-



- A. I^- B. H_2O C. IO^- D. both (A and C) are correct

27. This hypothetical reaction: $\text{A} + \text{B} \longrightarrow 2\text{C}$, is occur in one step-mechanism, what is the value of the specific rate constant for reverse reaction when $[\text{C}] = 0.015\text{M}$ and the rate of reaction is equal to $1.1 \times 10^{-3}\text{M/s}$?

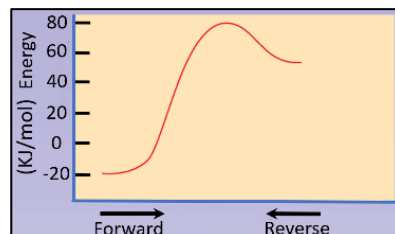
- A. $4.9\text{ M}^{-1}\text{s}^{-1}$ B. 4.9 s^{-1} C. $0.2\text{ M}^{-1}\text{s}^{-1}$ D. 0.2 s^{-1}

28. The rate law for a reaction is found to be: $\text{R} = k[\text{X}][\text{Y}]^2$, by what factor does the rate increase if $[\text{Y}]$ tripled?

- A. 3 B. 6 C. 27 D. 9

29. In the adjacent energy diagram after using catalyst the value of E_a :-

- A. is equal to 100 kJ/mol
B. is greater than 100 kJ/mol
C. is less than 100 kJ/mol
D. cannot be determined



30. Changing the temperature affects the rate of reaction because it affects:-

- A. the energy of activated complex B. the enthalpy of reaction
C. the number of effective collision D. the properties of reactants

31. All of the following are affect the rate of reaction between hydrogen gas and chlorine gas **EXCEPT**:-

- A. surface area B. temperature C. presence catalyst D. concentration

32. If a small amounts of HCl added to a solution of HNO_2 and KNO_2 , which of the following decreases?

- A. pH B. ionization of HNO_2 C. $[\text{OH}^-]$ D. all of them are Correct

33. Which of the following reactions represent the hydrolysis reaction?

- A. $\text{H}_2\text{CO}_3(\text{aq}) + \text{H}_2\text{O}(\text{l}) \rightleftharpoons \text{HCO}_3^-(\text{aq}) + \text{H}_3\text{O}^+(\text{aq})$ B. $\text{CH}_3\text{NH}_2(\text{aq}) + \text{H}_2\text{O}(\text{l}) \rightleftharpoons \text{CH}_3\text{NH}_3^+(\text{aq}) + \text{OH}^-(\text{aq})$
C. $\text{NH}_4^+(\text{aq}) + \text{H}_2\text{O}(\text{l}) \rightleftharpoons \text{NH}_3(\text{aq}) + \text{H}_3\text{O}^+(\text{aq})$ D. all of them are correct

34. In the aqueous solution of KCN , the water reacts with:-

- A. K^+ and produces strong base B. K^+ and produces weak base
C. CN^- and produces strong acid D. CN^- and produces weak acid

35. In this reaction: $\text{H}_2(\text{g}) + \text{I}_2(\text{g}) \rightleftharpoons 2\text{HI}(\text{g})$, at 425°C is found at equilibrium:

$[\text{H}_2] = 1.83 \times 10^{-3}\text{M}$, $[\text{I}_2] = 3.13 \times 10^{-3}\text{M}$ and $[\text{HI}] = 1.77 \times 10^{-2}\text{M}$, which of the following is correct?

- A. reactants are favored B. a small amount of reactants converted into products
C. products are favored D. both (A and B) are correct.

36. If the value of equilibrium constant for gaseous reaction is equal to 300 at given temperature, what is the value of equilibrium constant for the reaction by doubling the volume of reaction vessel, at the same temperature?

- A. 300 B. 600 C. 900 D. 150

37. In a saturated solution the concentration.....

- A. is always high B. is always low
C. may be high or low, depending on the solubility of the solute D. cannot be determined

38. Determine the concentration of fluoride ions in a saturated solution of CaF_2 , If the

- K_{sp} of CaF_2 is 5.3×10^{-9} . A. $2.2 \times 10^{-3}\text{M}$ B. $1.1 \times 10^{-3}\text{M}$ C. $1.325 \times 10^{-5}\text{M}$ D. $1.1 \times 10^{-4}\text{M}$

39. All of the following may be alkene and cycloalkane **EXCEPT**:-

- A. C_3H_6 B. C_2H_4 C. C_5H_{10} D. C_4H_8

40. Which of the following is correct?

- A. the boiling point of pentane greater than 2-methyl butane.
B. the carbon atom hybridization type of C_2H_2 is sp^2 .
C. the graphite is a good conductor of heat.
D. the molecular formula of methyl benzene is C_6H_8 .

41. A hydrocarbon that contains delocalized electrons:-

- A. graphite B. benzene C. cyclohexane D. both (A and B) are correct

42. The correct name for this compound: (1-ethyl-3-methyl propane) according to IUPAC system is:

- A. hexane B. 2-methyl pentane C. 3-methyl pentane D. 2,3-dimethyl butane

43. Which of the following types of molecular representations **cannot** be used to show differences between isomers?

- A. molecular formula B. three-dimensional drawing or model
C. structural formula D. both (B and C) are correct

44. Which of the following can have geometric isomers?

- A. CH_2Cl_2 B. $\text{C}_2\text{H}_4\text{Cl}_2$ C. $\text{C}_2\text{H}_2\text{Cl}_2$ D. none of them

45. Which of the following compounds **cannot** be monomer for the addition polymer?

- A. C_2H_4 B. CH_3COOH C. C_2F_4 D. $\text{CH}_2=\text{CH}-\text{CH}_3$

46. One of the following **cannot** be isomer for $\text{C}_3\text{H}_8\text{O}$:-

- A. 2-propanol B. 1-propanol C. ethyl methyl ether D. 2-propanon

47. Which of the following compounds formed hydrogen bond with water?

- A. ethers B. benzene C. alcohols D. both (A and C) are correct

48. This reaction: $\text{CH}_2=\text{CH}-\text{CH}_3 + \text{HCl} \longrightarrow 2\text{-chloro propane}$, is called:-

- A. substitution B. addition C. condensation D. elimination

49. Used in biology laboratories as a preservative for dead animals:-

- A. methanol B. acetic acid C. methanal D. methyl amine

50. The general formula for esters is:-

- A. $\text{R}-\text{CO}-\text{R}$ B. $\text{R}-\text{COO}-\text{R}$ C. $\text{R}-\text{COOH}$ D. $\text{R}-\text{O}-\text{R}$



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- A. $\text{H}_3\text{O}^+(\text{aq}) + \text{OH}^-(\text{aq}) \rightarrow 2\text{H}_2\text{O}(\text{l})$
 B. $2\text{Al}(\text{s}) + 6\text{H}_3\text{O}^+(\text{aq}) \rightarrow 2\text{Al}^{3+}(\text{aq}) + 9\text{H}_2(\text{g})$
 C. $2\text{Al}(\text{s}) + 6\text{H}_3\text{O}^+(\text{aq}) \rightarrow 2\text{Al}^{3+}(\text{aq}) + 6\text{H}_2\text{O}(\text{l}) + 3\text{H}_2(\text{g})$
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21. In the reaction NO_2^- ions with water, which of the following is conjugate acid –base pair?

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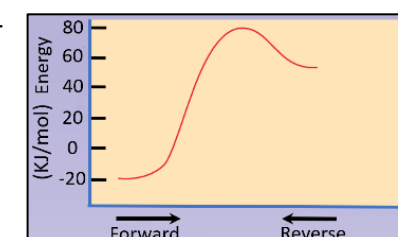
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 $[H_2] = 1.83 \times 10^{-3}\text{M}$, $[I_2] = 3.13 \times 10^{-3}\text{M}$ and $[HI] = 1.77 \times 10^{-2}\text{M}$, which of the following is correct?
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C. products are favored **D.** both (A and B) are correct.
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- 39.** This reaction: $2\text{H}_2\text{O}_2 \longrightarrow 2\text{H}_2\text{O}+ \text{O}_2$, by using catalyst has the following proposed mechanism:-
 step: 1 $\text{H}_2\text{O}_2 + \text{I}^- \longrightarrow \text{H}_2\text{O}+ \text{IO}^-$
 step: 2 $\text{H}_2\text{O}_2 + \text{IO}^- \longrightarrow \text{H}_2\text{O}+ \text{O}_2+ \text{I}^-$, which of the following is intermediate?
A. I^- **B.** H_2O **C.** IO^- **D.** both (A and C) are correct
- 40.** All of the following are affect the rate of reaction between hydrogen gas and chlorine gas **EXCEPT**:-
A. surface area **B.** temperature **C.** presence catalyst **D.** concentration
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A. 1.0×10^{-6} **B.** 5.0×10^{-7} **C.** 1.0×10^{-8} **D.** 2.0×10^{-6}

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C. CN^- and produces strong acid **D.** CN^- and produces weak acid

- 47.** All of the following may be alkene and cycloalkane **EXCEPT**:-
A. C_3H_6 **B.** C_2H_4 **C.** C_5H_{10} **D.** C_4H_8

- 48.** By using the information in the adjacent table, 55g of which of the following element absorbed 3.562 kJ of energy if it was heated from 22.4°C to 94.6°C ?

- A.** Ca **B.** Al
C. Fe **D.** Au

Element	Ca	Al	Fe	Au
Specific heat J/(g.K)	0.647	0.897	0.449	0.129

- 49.** The correct name for this compound: (1-ethyl-3-methyl propane) according to IUPAC system is:
A. hexane **B.** 2-methyl pentane **C.** 3-methyl pentane **D.** 2,3-dimethyl butane
- 50.** In the titration acid and base process the equivalence point is determined by :-
A. suitable indicator **B.** pH meter **C.** transition interval **D.** both (A and B) are correct



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

- Which of the following can have geometric isomers?
 A. CH_2Cl_2 B. $\text{C}_2\text{H}_4\text{Cl}_2$ C. $\text{C}_2\text{H}_2\text{Cl}_2$ D. none of them
 - In this reaction: $\text{Al(s)} + \text{H}_2\text{SO}_4(\text{aq}) \longrightarrow$,which of the following is the net ionic equation?
 A. $\text{H}_3\text{O}^+(\text{aq}) + \text{OH}^-(\text{aq}) \longrightarrow 2\text{H}_2\text{O}(\text{l})$ B. $2\text{Al(s)} + 6\text{H}_3\text{O}^+(\text{aq}) \longrightarrow 2\text{Al}^{3+}(\text{aq}) + 9\text{H}_2(\text{g})$
 C. $2\text{Al(s)} + 6\text{H}_3\text{O}^+(\text{aq}) \longrightarrow 2\text{Al}^{3+}(\text{aq}) + 6\text{H}_2\text{O}(\text{l}) + 3\text{H}_2(\text{g})$ D. none of them
 - The general formula for esters is:-
 A. R-CO-R B. R-COO-R C. R-COOH D. R-O-R
 - Which of the following reactions represent the hydrolysis reaction?
 A. $\text{H}_2\text{CO}_3(\text{aq}) + \text{H}_2\text{O}(\text{l}) \rightleftharpoons \text{HCO}_3^-(\text{aq}) + \text{H}_3\text{O}^+(\text{aq})$ B. $\text{CH}_3\text{NH}_2(\text{aq}) + \text{H}_2\text{O}(\text{l}) \rightleftharpoons \text{CH}_3\text{NH}_3^+(\text{aq}) + \text{OH}^-(\text{aq})$
 C. $\text{NH}_4^+(\text{aq}) + \text{H}_2\text{O}(\text{l}) \rightleftharpoons \text{NH}_3(\text{aq}) + \text{H}_3\text{O}^+(\text{aq})$ D. all of them are correct
 - When one gram of iron is heated to 100.0°C and cooled to 50.0°C in a calorimeter transfers 22.5 J of energy to the surrounding water. But one gram of silver transfers 11.8 J of energy under the same conditions, the difference of the value of transfer energy depends on the:-
 A. mass of the material B. temperature change C. nature of the material D. all of them
 - By using the information in the adjacent table,55g of which of the following element absorbed 3.562 kJ of energy if it was heated from 22.4°C to 94.6°C ?
 A. Ca B. Al
 C. Fe D. Au
- | Element | Ca | Al | Fe | Au |
|-----------------------|-------|-------|-------|-------|
| Specific heat J/(g.K) | 0.647 | 0.897 | 0.449 | 0.129 |
- In this reaction: $\text{H}_2(\text{g}) + \text{I}_2(\text{g}) \rightleftharpoons 2\text{HI}(\text{g})$,at 425°C is found at equilibrium:
 $[\text{H}_2] = 1.83 \times 10^{-3}\text{M}$, $[\text{I}_2] = 3.13 \times 10^{-3}\text{M}$ and $[\text{HI}] = 1.77 \times 10^{-2}\text{M}$,which of the following is correct?
 A. reactants are favored B. a small amount of reactants converted into products
 C. products are favored D. both (A and B) are correct.
 - Which of the following compounds **cannot** be monomer for the addition polymer?
 A. C_2H_4 B. CH_3COOH C. C_2F_4 D. $\text{CH}_2=\text{CH}-\text{CH}_3$
 - In a saturated solution the concentration.....
 A. is always high B. is always low
 C. may be high or low, depending on the solubility of the solute D. cannot be determined
 - In the following hypothetical reaction: $\text{A} + \text{B} \longrightarrow \text{C} + \text{D}$ $\Delta\text{H} > 0$, which of the following is correct?
 A. the products are more stable B. the reactants are more stable
 C. the reaction is an exothermic D. none of them
 - In a titration experiment, by using phenolphthalein indicator ($\text{pH}=8.0-10.0$), 0.5mol of which of the following acids neutralizes 0.5mol of NaOH? A. H_3PO_4 B. HF C. HCl D. both (A and B)
 - Suppose that 15mL of 0.025M H_2SO_4 is required to neutralize 10mL of KOH solution, what is the molarity of the base? A. 0.025 B. 0.0125 C. 0.075 D. 0.0075

13. All of the following may be alkene and cycloalkane **EXCEPT**:-

- A. C_3H_6 B. C_2H_4 C. C_5H_{10} D. C_4H_8

14. When the ammonia molecule reacts with the hydrogen ion (proton) :-

- A. ammonia molecule is an electron-pair accepter B. ammonia acts as Arrhenius base
 C. proton acts as Lewis acid D. both (A and C) are correct

15. This hypothetical reaction: $\text{A} + \text{B} \longrightarrow 2\text{C}$, is occur in one step-mechanism, what is the value of the specific rate constant for reverse reaction when $[\text{C}] = 0.015\text{M}$ and the rate of reaction is equal to $1.1 \times 10^{-3}\text{M/s}$? A. $4.9 \text{ M}^{-1}\text{s}^{-1}$ B. 4.9 s^{-1} C. $0.2 \text{ M}^{-1}\text{s}^{-1}$ D. 0.2 s^{-1}

16. In a reaction, $\Delta G^0 = 142.0 \text{ kJ/mol}$ and $\Delta H^0 = 206.1 \text{ kJ/mol}$, at room temperature which of the following is correct?

- A. the entropy of the reactants is greater B. the entropy of the products is greater
 C. the entropy of reactants and the products is equal D. none of them

17. This reaction: $\text{CH}_2=\text{CH}-\text{CH}_3 + \text{HCl} \longrightarrow$ 2-chloro propane, is called:-

- A. substitution B. addition C. condensation D. elimination

18. The correct name for this compound: (1-ethyl-3-methyl propane) according to IUPAC system is:

- A. hexane B. 2-methyl pentane C. 3-methyl pentane D. 2,3-dimethyl butane

19. Used in biology laboratories as a preservative for dead animals:-

- A. methanol B. acetic acid C. methanal D. methyl amine

20. The acidity of which of the following aqueous solutions at 25°C is highest?

- A. $\text{pOH}=13$ B. $[\text{H}_3\text{O}^+] = 1.0 \times 10^{-7}\text{M}$ C. $[\text{OH}^-] = 1.0 \times 10^{-4}\text{M}$ D. $\text{pH}=12$

21. Which of the following is correct?

- A. the boiling point of pentane greater than 2-methyl butane.
 B. the carbon atom hybridization type of C_2H_2 is sp^2 .
 C. the graphite is a good conductor of heat.
 D. the molecular formula of methyl benzene is C_6H_8 .

22. Which of the following solutions with the same concentration has the highest vapor- pressure?

- A. AlCl_3 B. NaNO_3 C. $\text{C}_6\text{H}_{12}\text{O}_6$ D. CaCl_2

23. All of the following are affect the rate of reaction between hydrogen gas and chlorine gas **EXCEPT**:-

- A. surface area B. temperature C. presence catalyst D. concentration

24. In the second ionization stage of phosphoric acid in its aqueous solution.....are produced.

- A. HPO_4^{2-} and H_3O^+ B. H_2PO_4^- and H_3O^+ C. PO_4^{3-} and H_3O^+ D. all of them

25. Changing the temperature affects the rate of reaction because it affects:-

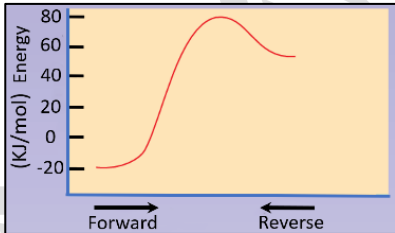
- A. the energy of activated complex B. the enthalpy of reaction
 C. the number of effective collision D. the properties of reactants

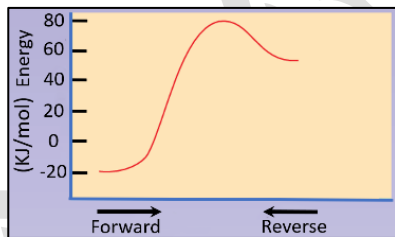
26. If the $[\text{H}_3\text{O}^+]$ of aqueous solution of $\text{Ca}(\text{OH})_2$ is equal to $1.0 \times 10^{-8}\text{M}$, what is the molarity of $\text{Ca}(\text{OH})_2$?

- A. 1.0×10^{-6} B. 5.0×10^{-7} C. 1.0×10^{-8} D. 2.0×10^{-6}

27. In the aqueous solution of KCN, the water reacts with:-

- A. K^+ and produces strong base B. K^+ and produces weak base
 C. CN^- and produces strong acid D. CN^- and produces weak acid

28. The rate law for a reaction is found to be: $R=k[X][Y]^2$, by what factor does the rate increase if [Y] tripled?
A. 3 B. 6 C. 27 D. 9
29. Which of the following compounds formed hydrogen bond with water?
A. ethers B. benzene C. alcohols D. both (A and C) are correct
30. If a small amounts of HCl added to a solution of HNO_2 and KNO_2 , which of the following decreases?
A. pH B. ionization of HNO_2 C. $[\text{OH}^-]$ D. all of them are Correct
31. How many moles of nitrate ions are produced by dissolving 0.15 mol of zinc nitrate in water?
A. 0.30 B. 0.15 C. 0.45 D. 2.0
32. Which of the following exhibits properties of an Arrhenius acid?
A. hydrogen chloride that is dissolved in water B. the pure hydrogen chloride gas
C. hydrogen chloride that is dissolved in nonpolar solvent D. all of them
33. When comparing the expected and actual freezing point of an aqueous solution of MgI_2 with 1.0 *m* concentration, which of the following is correct? If the actual freezing point is equal to -4.78°C and K_f of water= $-1.86^\circ\text{C}/m$.
A. the expected freezing point is equal to the actual freezing point.
B. the expected freezing point is lower than the actual freezing point
C. the expected freezing point is higher than the actual freezing point
D. none of them
34. In this reaction: $2\text{H}_2(\text{g}) + \text{O}_2(\text{g}) \longrightarrow 2\text{H}_2\text{O}(\text{l}) + 571.6 \text{ kJ}$, which of the following is correct?
A. ΔH_f° of water= -285.8 kJ/mol B. ΔH_f° of water= $+285.8 \text{ kJ/mol}$
C. ΔH° of reverse reaction= $+571.6 \text{ kJ/mol}$ D. both (A and C) are correct
35. In the adjacent energy diagram after using catalyst the value of E_a :-
A. is equal to 100 kJ/mol
B. is greater than 100 kJ/mol
C. is less than 100 kJ/mol
D. cannot be determined
- 
36. The molal boiling-point constant (K_b) depends on the:-
A. nature of solute B. number of solvent moles C. nature of solvent D. solute concentration
37. If the value of equilibrium constant for gaseous reaction is equal to 300 at given temperature, what is the value of equilibrium constant for the reaction by doubling the volume of reaction vessel, at the same temperature?
A. 300 B. 600 C. 900 D. 150
38. This reaction: $2\text{H}_2\text{O}_2 \longrightarrow 2\text{H}_2\text{O} + \text{O}_2$, by using catalyst has the following proposed mechanism:-
step: 1 $\text{H}_2\text{O}_2 + \text{I}^- \longrightarrow \text{H}_2\text{O} + \text{IO}^-$
step: 2 $\text{H}_2\text{O}_2 + \text{IO}^- \longrightarrow \text{H}_2\text{O} + \text{O}_2 + \text{I}^-$, which of the following is intermediate?
A. I^- B. H_2O C. IO^- D. both (A and C) are correct
39. Which of the following pairs of solutions produce a precipitate when combined?
A. NH_4Cl and NaOH B. KCl and Na_2SO_4 C. $\text{Fe}(\text{NO}_3)_3$ and KCl D. NH_4Cl and AgNO_3



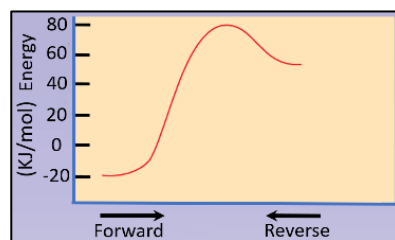
- 40.** The anion of the acid that stomach produces:-
A. is a strong conjugate base **B.** it acts as amphoteric
C. is a weak conjugate acid **D.** it has a little tendency to attract a proton
- 41.** Which of the following two conditions will favor a spontaneous reaction?
A. $\Delta H < 0$ and $\Delta S > 0$ **B.** $\Delta H > 0$ and $\Delta S > 0$ **C.** $\Delta H > 0$ and $\Delta S < 0$ **D.** $\Delta H < 0$ and $\Delta S < 0$
- 42.** One of the following **cannot** be isomer for C_3H_8O :-
A. 2-propanol **B.** 1-propanol **C.** ethyl methyl ether **D.** 2-propanon
- 43.** The equilibrium self-ionization equation of water at $25^\circ C$ is: $2H_2O(l) + \text{energy} \rightleftharpoons H_3O^+(aq) + OH^-(aq)$, by decreasing the temperature which of the following is incorrect?
A. the pH value increases **B.** the pOH value decreases
C. the K_w value decreases **D.** none of them
- 44.** In the titration acid and base process the equivalence point is determined by :-
A. suitable indicator **B.** pH meter **C.** transition interval **D.** both (A and B) are correct
- 45.** Which of the following types of molecular representations **cannot** be used to show differences between isomers?
A. molecular formula **B.** three-dimensional drawing or model
C. structural formula **D.** both (B and C) are correct
- 46.** In the reaction NO_2^- ions with water, which of the following is conjugate acid –base pair?
A. H_2O and H_3O^+ **B.** HNO_2 and NO_2^- **C.** H_2O and OH^- **D.** both (B and C) are correct
- 47.** The calcium sulfate salt is produce by the reaction between the:-
A. Ca and H_2SO_4 **B.** $Ca(OH)_2$ and H_2SO_4 **C.** $Ca(OH)_2$ and H_2SO_3 **D.** both (A and B) are correct
- 48.** An aqueous solution of hydrogen fluoride weakly conducts an electric current because :-
A. it is ionized partially **B.** the hydrogen- fluorine bond is strong
C. the hydrogen- fluorine bond is weak **D.** both (A and B) are correct
- 49.** Determine the concentration of fluoride ions in a saturated solution of CaF_2 , If the K_{sp} of CaF_2 is 5.3×10^{-9} . **A.** $2.2 \times 10^{-3} M$ **B.** $1.1 \times 10^{-3} M$ **C.** $1.325 \times 10^{-5} M$ **D.** $1.1 \times 10^{-4} M$
- 50.** A hydrocarbon that contains delocalized electrons:-
A. graphite **B.** benzene **C.** cyclohexane **D.** both (A and B) are correct



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

1. In the adjacent energy diagram after using catalyst the value of E_a :-

- A. is equal to 100 kJ/mol
- B. is greater than 100 kJ/mol
- C. is less than 100 kJ/mol
- D. cannot be determined



2. The rate law for a reaction is found to be: $R=k[X][Y]^2$, by what factor does the rate increase if $[Y]$ tripled?

- A. 3
- B. 6
- C. 27
- D. 9

3. Which of the following compounds **cannot** be monomer for the addition polymer?

- A. C_2H_4
- B. CH_3COOH
- C. C_2F_4
- D. $CH_2=CH-CH_3$

4. Which of the following compounds formed hydrogen bond with water?

- A. ethers
- B. benzene
- C. alcohols
- D. both (A and C) are correct

5. The correct name for this compound: (1-ethyl-3-methyl propane) according to IUPAC system is:

- A. hexane
- B. 2-methyl pentane
- C. 3-methyl pentane
- D. 2,3-dimethyl butane

6. Which of the following reactions represent the hydrolysis reaction?

- A. $H_2CO_3(aq) + H_2O(l) \rightleftharpoons HCO_3^-(aq) + H_3O^+(aq)$
- B. $CH_3NH_2(aq) + H_2O(l) \rightleftharpoons CH_3NH_3^+(aq) + OH^-(aq)$
- C. $NH_4^+(aq) + H_2O(l) \rightleftharpoons NH_3(aq) + H_3O^+(aq)$
- D. all of them are correct

7. The acidity of which of the following aqueous solutions at $25^\circ C$ is highest?

- A. $pOH=13$
- B. $[H_3O^+]=1.0 \times 10^{-7} M$
- C. $[OH^-]=1.0 \times 10^{-4} M$
- D. $pH=12$

8. This hypothetical reaction: $A+B \rightarrow 2C$, is occur in one step-mechanism, what is the value of the specific rate constant for reverse reaction when $[C]=0.015M$ and the rate of reaction is equal to $1.1 \times 10^{-3} M/s$?

- A. $4.9 M^{-1}s^{-1}$
- B. $4.9 s^{-1}$
- C. $0.2 M^{-1}s^{-1}$
- D. $0.2 s^{-1}$

9. If the value of equilibrium constant for gaseous reaction is equal to 300 at given temperature, what is the value of equilibrium constant for the reaction by doubling the volume of reaction vessel, at the same temperature?

- A. 300
- B. 600
- C. 900
- D. 150

10. All of the following may be alkene and cycloalkane **EXCEPT**:-

- A. C_3H_6
- B. C_2H_4
- C. C_5H_{10}
- D. C_4H_8

11. If a small amounts of HCl added to a solution of HNO_2 and KNO_2 , which of the following decreases?

- A. pH
- B. ionization of HNO_2
- C. $[OH^-]$
- D. all of them are Correct

12. How many moles of nitrate ions are produced by dissolving 0.15 mol of zinc nitrate in water?

- A. 0.30
- B. 0.15
- C. 0.45
- D. 2.0

13. When comparing the expected and actual freezing point of an aqueous solution of MgI_2 with 1.0 m concentration, which of the following is correct? If the actual freezing point is equal to $-4.78^\circ C$ and K_f of water = $-1.86^\circ C/m$.

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- A. hydrogen chloride that is dissolved in water
- B. the pure hydrogen chloride gas
- C. hydrogen chloride that is dissolved in nonpolar solvent
- D. all of them

15. Which of the following pairs of solutions produce a precipitate when combined?

- A. NH_4Cl and $NaOH$
- B. KCl and Na_2SO_4
- C. $Fe(NO_3)_3$ and KCl
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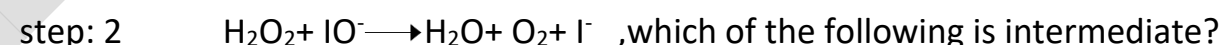
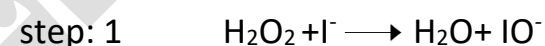
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- A. I^-
- B. H_2O
- C. IO^-
- D. both (A and C) are correct

19. One of the following **cannot** be isomer for C_3H_8O :-

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- B. $Ca(OH)_2$ and H_2SO_4
- C. $Ca(OH)_2$ and H_2SO_3
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21. Which of the following solutions with the same concentration has the highest vapor- pressure?

- A. $AlCl_3$
- B. $NaNO_3$
- C. $C_6H_{12}O_6$
- D. $CaCl_2$

22. Changing the temperature affects the rate of reaction because it affects:-

- A. the energy of activated complex
- B. the enthalpy of reaction
- C. the number of effective collision
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23. Which of the following can have geometric isomers?

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- C. $C_2H_2Cl_2$
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A. is always high **B.** is always low
C. may be high or low, depending on the solubility of the solute **D.** cannot be determined
- 27.** All of the following are affect the rate of reaction between hydrogen gas and chlorine gas **EXCEPT**:-
A. surface area **B.** temperature **C.** presence catalyst **D.** concentration
- 28.** Suppose that 15mL of 0.025M H₂SO₄ is required to neutralize 10mL of KOH solution, what is the molarity of the base?
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- 33.** In the reaction NO₂⁻ ions with water, which of the following is conjugate acid –base pair?
A. H₂O and H₃O⁺ **B.** HNO₂ and NO₂⁻ **C.** H₂O and OH⁻ **D.** both (B and C) are correct
- 34.** In this reaction: Al(s)+ H₂SO₄ (aq) → , which of the following is the net ionic equation?
A. H₃O⁺(aq)+OH⁻(aq) → 2H₂O(l) **B.** 2Al(s) +6H₃O⁺ (aq)→2Al³⁺(aq)+9H₂(g)
C. 2Al(s) +6H₃O⁺ (aq) → 2Al³⁺(aq)+6H₂O(l)+3H₂(g) **D.** none of them
- 35.** Which of the following two conditions will favor a spontaneous reaction?
A. ΔH<0 and ΔS>0 **B.** ΔH>0 and ΔS>0 **C.** ΔH>0 and ΔS<0 **D.** ΔH<0 and ΔS<0
- 36.** Which of the following is correct?
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C. proton acts as Lewis acid **D.** both (A and C) are correct
- 39.** If the [H₃O⁺] of aqueous solution of Ca(OH)₂ is equal to $1.0 \times 10^{-8}M$, what is the molarity of Ca(OH)₂?
A. 1.0×10^{-6} **B.** 5.0×10^{-7} **C.** 1.0×10^{-8} **D.** 2.0×10^{-6}

- 40.** Which of the following types of molecular representations **cannot** be used to show differences between isomers?
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- 43.** In this reaction: H₂(g)+ I₂(g) ⇌ 2HI(g) , at 425°C is found at equilibrium:
[H₂] = $1.83 \times 10^{-3}M$, [I₂] = $3.13 \times 10^{-3}M$ and [HI] = $1.77 \times 10^{-2}M$, which of the following is correct?
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C. products are favored **D.** both (A and B) are correct.
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- 45.** The equilibrium self-ionization equation of water at 25°C is: 2H₂O(l)+energy ⇌ H₃O⁺(aq)+OH⁻(aq), by decreasing the temperature which of the following is incorrect?
A. the pH value increases **B.** the pOH value decreases
C. the K_w value decreases **D.** none of them
- 46.** In this reaction: 2H₂(g)+ O₂(g) → 2H₂O (l)+ 571.6 kJ, which of the following is correct?
A. ΔH⁰_f of water= -285.8 kJ/mol **B.** ΔH⁰_f of water= +285.8 kJ/mol
C. ΔH⁰ of reverse reaction= +571.6 kJ/mol **D.** both (A and C) are correct
- 47.** By using the information in the adjacent table, 55g of which of the following element absorbed 3.562 kJ of energy if it was heated from 22.4°C to 94.6°C?
- | Element | Ca | Al | Fe | Au |
|-----------------------|-------|-------|-------|-------|
| Specific heat J/(g.K) | 0.647 | 0.897 | 0.449 | 0.129 |
- A.** Ca **B.** Al
C. Fe **D.** Au
- 48.** Used in biology laboratories as a preservative for dead animals:-
A. methanol **B.** acetic acid **C.** methanal **D.** methyl amine
- 49.** In the second ionization stage of phosphoric acid in its aqueous solution.....are produced.
A. HPO₄²⁻ and H₃O⁺ **B.** H₂PO₄⁻ and H₃O⁺ **C.** PO₄³⁻ and H₃O⁺ **D.** all of them
- 50.** In the following hypothetical reaction: A+B → C+D ΔH>0 , which of the following is correct?
A. the products are more stable **B.** the reactants are more stable
C. the reaction is an exothermic **D.** none of them



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

- Which of the following reactions represent the hydrolysis reaction?
 A. $\text{H}_2\text{CO}_3(\text{aq}) + \text{H}_2\text{O}(\text{l}) \rightleftharpoons \text{HCO}_3^-(\text{aq}) + \text{H}_3\text{O}^+(\text{aq})$
 B. $\text{CH}_3\text{NH}_2(\text{aq}) + \text{H}_2\text{O}(\text{l}) \rightleftharpoons \text{CH}_3\text{NH}_3^+(\text{aq}) + \text{OH}^-(\text{aq})$
 C. $\text{NH}_4^+(\text{aq}) + \text{H}_2\text{O}(\text{l}) \rightleftharpoons \text{NH}_3(\text{aq}) + \text{H}_3\text{O}^+(\text{aq})$
 D. all of them are correct
- If the $[\text{H}_3\text{O}^+]$ of aqueous solution of $\text{Ca}(\text{OH})_2$ is equal to $1.0 \times 10^{-8} \text{M}$, what is the molarity of $\text{Ca}(\text{OH})_2$?
 A. 1.0×10^{-6} B. 5.0×10^{-7} C. 1.0×10^{-8} D. 2.0×10^{-6}
- In a titration experiment, by using phenolphthalein indicator ($\text{pH}=8.0-10.0$), 0.5mol of which of the following acids neutralizes 0.5mol of NaOH?
 A. H_3PO_4 B. HF C. HCl D. both (A and B)
- The anion of the acid that stomach produces:-
 A. is a strong conjugate base B. it acts as amphoteric
 C. is a weak conjugate acid D. it has a little tendency to attract a proton
- The general formula for esters is:-
 A. R-CO-R B. R-COO-R C. R-COOH D. R-O-R
- Which of the following compounds formed hydrogen bond with water?
 A. ethers B. benzene C. alcohols D. both (A and C) are correct
- Which of the following types of molecular representations **cannot** be used to show differences between isomers?
 A. molecular formula B. three-dimensional drawing or model
 C. structural formula D. both (B and C) are correct
- How many moles of nitrate ions are produced by dissolving 0.15 mol of zinc nitrate in water?
 A. 0.30 B. 0.15 C. 0.45 D. 2.0
- This hypothetical reaction: $\text{A} + \text{B} \rightarrow 2\text{C}$, is occur in one step-mechanism, what is the value of the specific rate constant for reverse reaction when $[\text{C}] = 0.015 \text{M}$ and the rate of reaction is equal to $1.1 \times 10^{-3} \text{M/s}$?
 A. $4.9 \text{ M}^{-1}\text{s}^{-1}$ B. 4.9 s^{-1} C. $0.2 \text{ M}^{-1}\text{s}^{-1}$ D. 0.2 s^{-1}
- When comparing the expected and actual freezing point of an aqueous solution of MgI_2 with 1.0 *m* concentration, which of the following is correct? If the actual freezing point is equal to -4.78°C and K_f of water = $-1.86^\circ\text{C}/m$.
 A. the expected freezing point is equal to the actual freezing point.
 B. the expected freezing point is lower than the actual freezing point
 C. the expected freezing point is higher than the actual freezing point
 D. none of them
- All of the following may be alkene and cycloalkane **EXCEPT**:-
 A. C_3H_6 B. C_2H_4 C. C_5H_{10} D. C_4H_8

- In the aqueous solution of KCN, the water reacts with:-
 A. K^+ and produces strong base B. K^+ and produces weak base
 C. CN^- and produces strong acid D. CN^- and produces weak acid
- Changing the temperature affects the rate of reaction because it affects:-
 A. the energy of activated complex B. the enthalpy of reaction
 C. the number of effective collision D. the properties of reactants
- In this reaction: $2\text{H}_2(\text{g}) + \text{O}_2(\text{g}) \rightarrow 2\text{H}_2\text{O}(\text{l}) + 571.6 \text{ kJ}$, which of the following is correct?
 A. ΔH_f° of water = -285.8 kJ/mol B. ΔH_f° of water = $+285.8 \text{ kJ/mol}$
 C. ΔH° of reverse reaction = $+571.6 \text{ kJ/mol}$ D. both (A and C) are correct
- In a reaction, $\Delta G^\circ = 142.0 \text{ kJ/mol}$ and $\Delta H^\circ = 206.1 \text{ kJ/mol}$, at room temperature which of the following is correct?
 A. the entropy of the reactants is greater B. the entropy of the products is greater
 C. the entropy of reactants and the products is equal D. none of them
- One of the following **cannot** be isomer for $\text{C}_3\text{H}_8\text{O}$:-
 A. 2-propanol B. 1-propanol C. ethyl methyl ether D. 2-propanon
- Determine the concentration of fluoride ions in a saturated solution of CaF_2 , If the K_{sp} of CaF_2 is 5.3×10^{-9} .
 A. $2.2 \times 10^{-3} \text{M}$ B. $1.1 \times 10^{-3} \text{M}$ C. $1.325 \times 10^{-5} \text{M}$ D. $1.1 \times 10^{-4} \text{M}$
- In the second ionization stage of phosphoric acid in its aqueous solution.....are produced.
 A. HPO_4^{2-} and H_3O^+ B. H_2PO_4^- and H_3O^+ C. PO_4^{3-} and H_3O^+ D. all of them
- When one gram of iron is heated to 100.0°C and cooled to 50.0°C in a calorimeter transfers 22.5 J of energy to the surrounding water. But one gram of silver transfers 11.8 J of energy under the same conditions, the difference of the value of transfer energy depends on the:-
 A. mass of the material B. temperature change C. nature of the material D. all of them
- Which of the following can have geometric isomers?
 A. CH_2Cl_2 B. $\text{C}_2\text{H}_4\text{Cl}_2$ C. $\text{C}_2\text{H}_2\text{Cl}_2$ D. none of them
- In a saturated solution the concentration.....
 A. is always high B. is always low
 C. may be high or low, depending on the solubility of the solute D. cannot be determined
- An aqueous solution of hydrogen fluoride weakly conducts an electric current because :-
 A. it is ionized partially B. the hydrogen- fluorine bond is strong
 C. the hydrogen- fluorine bond is weak D. both (A and B) are correct
- Which of the following pairs of solutions produce a precipitate when combined?
 A. NH_4Cl and NaOH B. KCl and Na_2SO_4 C. $\text{Fe}(\text{NO}_3)_3$ and KCl D. NH_4Cl and AgNO_3
- Which of the following exhibits properties of an Arrhenius acid?
 A. hydrogen chloride that is dissolved in water B. the pure hydrogen chloride gas
 C. hydrogen chloride that is dissolved in nonpolar solvent D. all of them
- Which of the following solutions with the same concentration has the highest vapor- pressure?
 A. AlCl_3 B. NaNO_3 C. $\text{C}_6\text{H}_{12}\text{O}_6$ D. CaCl_2

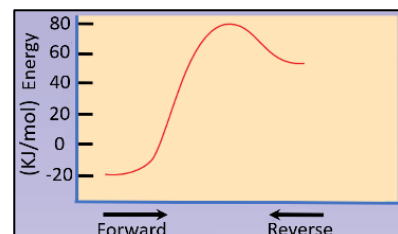
26. Which of the following two conditions will favor a spontaneous reaction?
 A. $\Delta H < 0$ and $\Delta S > 0$ B. $\Delta H > 0$ and $\Delta S > 0$ C. $\Delta H > 0$ and $\Delta S < 0$ D. $\Delta H < 0$ and $\Delta S < 0$

27. In this reaction: $\text{H}_2(\text{g}) + \text{I}_2(\text{g}) \rightleftharpoons 2\text{HI}(\text{g})$, at 425°C is found at equilibrium:
 $[\text{H}_2] = 1.83 \times 10^{-3}\text{M}$, $[\text{I}_2] = 3.13 \times 10^{-3}\text{M}$ and $[\text{HI}] = 1.77 \times 10^{-2}\text{M}$, which of the following is correct?
 A. reactants are favored B. a small amount of reactants converted into products
 C. products are favored D. both (A and B) are correct.

28. If a small amounts of HCl added to a solution of HNO_2 and KNO_2 , which of the following decreases?
 A. pH B. ionization of HNO_2 C. $[\text{OH}^-]$ D. all of them are Correct

29. In the adjacent energy diagram after using catalyst the value of E_a :-

- A. is equal to 100 kJ/mol
 B. is greater than 100 kJ/mol
 C. is less than 100 kJ/mol
 D. cannot be determined



30. The rate law for a reaction is found to be: $R = k[X][Y]^2$, by what factor does the rate increase if $[Y]$ tripled?
 A. 3 B. 6 C. 27 D. 9

31. In this reaction: $\text{Al}(\text{s}) + \text{H}_2\text{SO}_4(\text{aq}) \longrightarrow$, which of the following is the net ionic equation?
 A. $\text{H}_3\text{O}^+(\text{aq}) + \text{OH}^-(\text{aq}) \longrightarrow 2\text{H}_2\text{O}(\text{l})$ B. $2\text{Al}(\text{s}) + 6\text{H}_3\text{O}^+(\text{aq}) \longrightarrow 2\text{Al}^{3+}(\text{aq}) + 9\text{H}_2(\text{g})$
 C. $2\text{Al}(\text{s}) + 6\text{H}_3\text{O}^+(\text{aq}) \longrightarrow 2\text{Al}^{3+}(\text{aq}) + 6\text{H}_2\text{O}(\text{l}) + 3\text{H}_2(\text{g})$ D. none of them

32. This reaction: $2\text{H}_2\text{O}_2 \longrightarrow 2\text{H}_2\text{O} + \text{O}_2$, by using catalyst has the following proposed mechanism:-

step: 1 $\text{H}_2\text{O}_2 + \text{I}^- \longrightarrow \text{H}_2\text{O} + \text{IO}^-$

step: 2 $\text{H}_2\text{O}_2 + \text{IO}^- \longrightarrow \text{H}_2\text{O} + \text{O}_2 + \text{I}^-$, which of the following is intermediate?

- A. I^- B. H_2O C. IO^- D. both (A and C) are correct

33. When the ammonia molecule reacts with the hydrogen ion (proton) :-

- A. ammonia molecule is an electron-pair accepter B. ammonia acts as Arrhenius base
 C. proton acts as Lewis acid D. both (A and C) are correct

34. The correct name for this compound: (1-ethyl-3-methyl propane) according to IUPAC system is:

- A. hexane B. 2-methyl pentane C. 3-methyl pentane D. 2,3-dimethyl butane

35. If the value of equilibrium constant for gaseous reaction is equal to 300 at given temperature, what is the value of equilibrium constant for the reaction by doubling the volume of reaction vessel, at the same temperature?
 A. 300 B. 600 C. 900 D. 150

36. The molal boiling-point constant (K_b) depends on the:-

- A. nature of solute B. number of solvent moles C. nature of solvent D. solute concentration

37. A hydrocarbon that contains delocalized electrons:-

- A. graphite B. benzene C. cyclohexane D. both (A and B) are correct

38. By using the information in the adjacent table, 55g of which of the following element absorbed 3.562 kJ of energy if it was heated from 22.4°C to 94.6°C ?

- A. Ca B. Al
 C. Fe D. Au

Element	Ca	Al	Fe	Au
Specific heat J/(g.K)	0.647	0.897	0.449	0.129

39. This reaction: $\text{CH}_2=\text{CH}-\text{CH}_3 + \text{HCl} \longrightarrow$ 2-chloro propane, is called:-

- A. substitution B. addition C. condensation D. elimination

40. The equilibrium self-ionization equation of water at 25°C is: $2\text{H}_2\text{O}(\text{l}) + \text{energy} \rightleftharpoons \text{H}_3\text{O}^+(\text{aq}) + \text{OH}^-(\text{aq})$, by decreasing the temperature which of the following is incorrect?

- A. the pH value increases B. the pOH value decreases
 C. the K_w value decreases D. none of them

41. In the reaction NO_2^- ions with water, which of the following is conjugate acid-base pair?

- A. H_2O and H_3O^+ B. HNO_2 and NO_2^- C. H_2O and OH^- D. both (B and C) are correct

42. In the titration acid and base process the equivalence point is determined by :-

- A. suitable indicator B. pH meter C. transition interval D. both (A and B) are correct

43. All of the following are affect the rate of reaction between hydrogen gas and chlorine gas **EXCEPT**:-

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44. Used in biology laboratories as a preservative for dead animals:-

- A. methanol B. acetic acid C. methanal D. methyl amine

45. The acidity of which of the following aqueous solutions at 25°C is highest?

- A. $\text{pOH}=13$ B. $[\text{H}_3\text{O}^+]=1.0 \times 10^{-7}\text{M}$ C. $[\text{OH}^-]=1.0 \times 10^{-4}\text{M}$ D. $\text{pH}=12$

46. In the following hypothetical reaction: $\text{A} + \text{B} \longrightarrow \text{C} + \text{D}$ $\Delta H > 0$, which of the following is correct?

- A. the products are more stable B. the reactants are more stable
 C. the reaction is an exothermic D. none of them

47. Suppose that 15mL of 0.025M H_2SO_4 is required to neutralize 10mL of KOH solution, what is the molarity of the base?
 A. 0.025 B. 0.0125 C. 0.075 D. 0.0075

48. Which of the following is correct?

- A. the boiling point of pentane greater than 2-methyl butane.
 B. the carbon atom hybridization type of C_2H_2 is sp^2 .
 C. the graphite is a good conductor of heat.
 D. the molecular formula of methyl benzene is C_6H_8 .

49. The calcium sulfate salt is produce by the reaction between the:-

- A. Ca and H_2SO_4 B. $\text{Ca}(\text{OH})_2$ and H_2SO_4 C. $\text{Ca}(\text{OH})_2$ and H_2SO_3 D. both (A and B) are correct

50. Which of the following compounds **cannot** be monomer for the addition polymer?

- A. C_2H_4 B. CH_3COOH C. C_2F_4 D. $\text{CH}_2=\text{CH}-\text{CH}_3$



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

- All of the following may be alkene and cycloalkane **EXCEPT**:-
 A. C_3H_6 B. C_2H_4 C. C_5H_{10} D. C_4H_8
- The molal boiling-point constant (K_b) depends on the:-
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- When comparing the expected and actual freezing point of an aqueous solution of MgI_2 with 1.0 *m* concentration, which of the following is correct? If the actual freezing point is equal to $-4.78^\circ C$ and K_f of water = $-1.86^\circ C/m$.
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- The correct name for this compound: (1-ethyl-3-methyl propane) according to IUPAC system is:
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 A. $pOH = 13$ B. $[H_3O^+] = 1.0 \times 10^{-7} M$ C. $[OH^-] = 1.0 \times 10^{-4} M$ D. $pH = 12$

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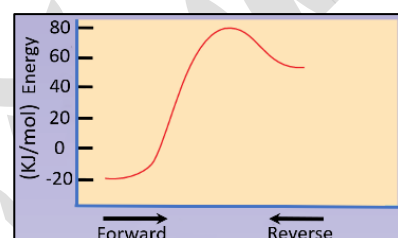
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C. the graphite is a good conductor of heat.
D. the molecular formula of methyl benzene is C₆H₈ .

45. The general formula for esters is:-

- A. R-CO-R B. R-COO-R C. R-COOH D. R-O-R

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49. Used in biology laboratories as a preservative for dead animals:-

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4. Which of the following compounds **cannot** be monomer for the addition polymer?

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5. An aqueous solution of hydrogen fluoride weakly conducts an electric current because :-

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6. By using the information in the adjacent table, 55g of which of the following element absorbed 3.562 kJ of energy if it was heated from 22.4°C to 94.6°C ?

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 C. Fe D. Au

Element	Ca	Al	Fe	Au
Specific heat J/(g.K)	0.647	0.897	0.449	0.129

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8. In the reaction NO_2^- ions with water, which of the following is conjugate acid –base pair?

- A. H_2O and H_3O^+ B. HNO_2 and NO_2^- C. H_2O and OH^- D. both (B and C) are correct

9. The equilibrium self-ionization equation of water at 25°C is: $2\text{H}_2\text{O}(\text{l})+\text{energy} \rightleftharpoons \text{H}_3\text{O}^+(\text{aq})+\text{OH}^-(\text{aq})$, by decreasing the temperature which of the following is incorrect?

- A. the pH value increases B. the pOH value decreases
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10. Which of the following two conditions will favor a spontaneous reaction?

- A. $\Delta\text{H}<0$ and $\Delta\text{S}>0$ B. $\Delta\text{H}>0$ and $\Delta\text{S}>0$ C. $\Delta\text{H}>0$ and $\Delta\text{S}<0$ D. $\Delta\text{H}<0$ and $\Delta\text{S}<0$

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- A. 2-propanol B. 1-propanol C. ethyl methyl ether D. 2-propanon

12. Which of the following reactions represent the hydrolysis reaction?

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13. In a reaction, $\Delta\text{G}^0=142.0\text{ kJ/mol}$ and $\Delta\text{H}^0=206.1\text{ kJ/mol}$, at room temperature which of the following is correct?

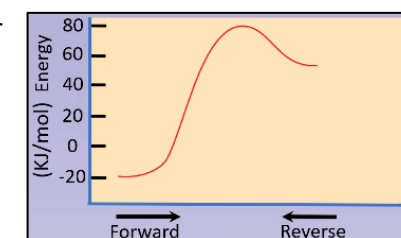
- A. the entropy of the reactants is greater B. the entropy of the products is greater
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14. In this reaction: $\text{Al}(\text{s})+\text{H}_2\text{SO}_4(\text{aq}) \longrightarrow$, which of the following is the net ionic equation?

- A. $\text{H}_3\text{O}^+(\text{aq})+\text{OH}^-(\text{aq}) \longrightarrow 2\text{H}_2\text{O}(\text{l})$ B. $2\text{Al}(\text{s})+6\text{H}_3\text{O}^+(\text{aq}) \longrightarrow 2\text{Al}^{3+}(\text{aq})+9\text{H}_2(\text{g})$
 C. $2\text{Al}(\text{s})+6\text{H}_3\text{O}^+(\text{aq}) \longrightarrow 2\text{Al}^{3+}(\text{aq})+6\text{H}_2\text{O}(\text{l})+3\text{H}_2(\text{g})$ D. none of them

15. In the adjacent energy diagram after using catalyst the value of E_a :-

- A. is equal to 100 kJ/mol
 B. is greater than 100 kJ/mol
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16. In a titration experiment, by using phenolphthalein indicator ($\text{pH}=8.0-10.0$), 0.5mol of which of the following acids neutralizes 0.5mol of NaOH? A. H_3PO_4 B. HF C. HCl D. both (A and B)

17. In this reaction: $\text{H}_2(\text{g})+\text{I}_2(\text{g}) \rightleftharpoons 2\text{HI}(\text{g})$, at 425°C is found at equilibrium:

$[\text{H}_2] = 1.83 \times 10^{-3}\text{M}$, $[\text{I}_2] = 3.13 \times 10^{-3}\text{M}$ and $[\text{HI}] = 1.77 \times 10^{-2}\text{M}$, which of the following is correct?

- A. reactants are favored B. a small amount of reactants converted into products
 C. products are favored D. both (A and B) are correct.

18. Suppose that 15mL of 0.025M H_2SO_4 is required to neutralize 10mL of KOH solution, what is the molarity of the base? A. 0.025 B. 0.0125 C. 0.075 D. 0.0075

19. All of the following are affect the rate of reaction between hydrogen gas and chlorine gas **EXCEPT**:-

- A. surface area B. temperature C. presence catalyst D. concentration

20. If the value of equilibrium constant for gaseous reaction is equal to 300 at given temperature, what is the value of equilibrium constant for the reaction by doubling the volume of reaction vessel, at the same temperature? A. 300 B. 600 C. 900 D. 150

21. The molal boiling-point constant (K_b) depends on the:-

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23. In the second ionization stage of phosphoric acid in its aqueous solution.....are produced.

- A. HPO_4^{2-} and H_3O^+ B. H_2PO_4^- and H_3O^+ C. PO_4^{3-} and H_3O^+ D. all of them

24. The anion of the acid that stomach produces:-

- A. is a strong conjugate base B. it acts as amphoteric
 C. is a weak conjugate acid D. it has a little tendency to attract a proton

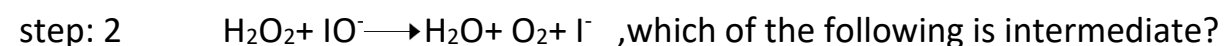
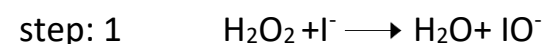
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26. The acidity of which of the following aqueous solutions at 25°C is highest?

- A. $\text{pOH}=13$ B. $[\text{H}_3\text{O}^+]=1.0 \times 10^{-7}\text{M}$ C. $[\text{OH}^-]=1.0 \times 10^{-4}\text{M}$ D. $\text{pH}=12$

27. This reaction: $2\text{H}_2\text{O}_2 \longrightarrow 2\text{H}_2\text{O} + \text{O}_2$, by using catalyst has the following proposed mechanism:-



- A. I^- B. H_2O C. IO^- D. both (A and C) are correct

28. This hypothetical reaction: $\text{A} + \text{B} \longrightarrow 2\text{C}$, is occur in one step-mechanism, what is the value of the specific rate constant for reverse reaction when $[\text{C}] = 0.015\text{M}$ and the rate of reaction is equal to $1.1 \times 10^{-3}\text{M/s}$? A. $4.9\text{ M}^{-1}\text{s}^{-1}$ B. 4.9 s^{-1} C. $0.2\text{ M}^{-1}\text{s}^{-1}$ D. 0.2 s^{-1}

29. The rate law for a reaction is found to be: $\text{R} = k[\text{X}][\text{Y}]^2$, by what factor does the rate increase if $[\text{Y}]$ tripled? A. 3 B. 6 C. 27 D. 9

30. All of the following may be alkene and cycloalkane **EXCEPT**:-

- A. C_3H_6 B. C_2H_4 C. C_5H_{10} D. C_4H_8

31. Changing the temperature affects the rate of reaction because it affects:-

- A. the energy of activated complex B. the enthalpy of reaction
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32. Which of the following compounds formed hydrogen bond with water?

- A. ethers B. benzene C. alcohols D. both (A and C) are correct

33. Determine the concentration of fluoride ions in a saturated solution of CaF_2 , If the K_{sp} of CaF_2 is 5.3×10^{-9} . A. $2.2 \times 10^{-3}\text{M}$ B. $1.1 \times 10^{-3}\text{M}$ C. $1.325 \times 10^{-5}\text{M}$ D. $1.1 \times 10^{-4}\text{M}$

34. When the ammonia molecule reacts with the hydrogen ion (proton) :-

- A. ammonia molecule is an electron-pair accepter B. ammonia acts as Arrhenius base
C. proton acts as Lewis acid D. both (A and C) are correct

35. How many moles of nitrate ions are produced by dissolving 0.15 mol of zinc nitrate in water?

- A. 0.30 B. 0.15 C. 0.45 D. 2.0

36. If the $[\text{H}_3\text{O}^+]$ of aqueous solution of $\text{Ca}(\text{OH})_2$ is equal to $1.0 \times 10^{-8}\text{M}$, what is the molarity of $\text{Ca}(\text{OH})_2$?

- A. 1.0×10^{-6} B. 5.0×10^{-7} C. 1.0×10^{-8} D. 2.0×10^{-6}

37. In this reaction: $2\text{H}_2(\text{g}) + \text{O}_2(\text{g}) \longrightarrow 2\text{H}_2\text{O}(\text{l}) + 571.6\text{ kJ}$, which of the following is correct?

- A. ΔH_f° of water = -285.8 kJ/mol B. ΔH_f° of water = $+285.8\text{ kJ/mol}$
C. ΔH° of reverse reaction = $+571.6\text{ kJ/mol}$ D. both (A and C) are correct

38. A hydrocarbon that contains delocalized electrons:-

- A. graphite B. benzene C. cyclohexane D. both (A and B) are correct

39. This reaction: $\text{CH}_2=\text{CH}-\text{CH}_3 + \text{HCl} \longrightarrow 2\text{-chloro propane}$, is called:-

- A. substitution B. addition C. condensation D. elimination

40. When comparing the expected and actual freezing point of an aqueous solution of MgI_2 with 1.0 m concentration, which of the following is correct? If the actual freezing point is equal to -4.78°C and K_f of water = $-1.86^\circ\text{C}/m$.

- A. the expected freezing point is equal to the actual freezing point.
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C. the expected freezing point is higher than the actual freezing point
D. none of them

41. Which of the following exhibits properties of an Arrhenius acid?

- A. hydrogen chloride that is dissolved in water B. the pure hydrogen chloride gas
C. hydrogen chloride that is dissolved in nonpolar solvent D. all of them

42. The correct name for this compound: (1-ethyl-3-methyl propane) according to IUPAC system is:

- A. hexane B. 2-methyl pentane C. 3-methyl pentane D. 2,3-dimethyl butane

43. If a small amounts of HCl added to a solution of HNO_2 and KNO_2 , which of the following decreases?

- A. pH B. ionization of HNO_2 C. $[\text{OH}^-]$ D. all of them are Correct

44. Which of the following is correct?

- A. the boiling point of pentane greater than 2-methyl butane.
B. the carbon atom hybridization type of C_2H_2 is sp^2 .
C. the graphite is a good conductor of heat.
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45. Which of the following solutions with the same concentration has the highest vapor- pressure?

- A. AlCl_3 B. NaNO_3 C. $\text{C}_6\text{H}_{12}\text{O}_6$ D. CaCl_2

46. Which of the following types of molecular representations **cannot** be used to show differences between isomers?

- A. molecular formula B. three-dimensional drawing or model
C. structural formula D. both (B and C) are correct

47. The calcium sulfate salt is produce by the reaction between the:-

- A. Ca and H_2SO_4 B. $\text{Ca}(\text{OH})_2$ and H_2SO_4 C. $\text{Ca}(\text{OH})_2$ and H_2SO_3 D. both (A and B) are correct

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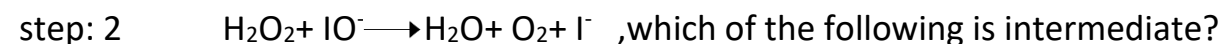
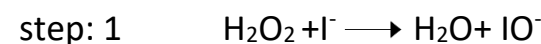
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Answer the following questions: (two marks for each correct choice)

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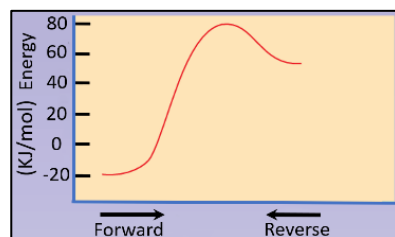
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44. The equilibrium self-ionization equation of water at 25°C is: $2\text{H}_2\text{O}(\text{l}) + \text{energy} \rightleftharpoons \text{H}_3\text{O}^+(\text{aq}) + \text{OH}^-(\text{aq})$, by decreasing the temperature which of the following is incorrect?

- A. the pH value increases B. the pOH value decreases
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45. In the titration acid and base process the equivalence point is determined by :-

- A. suitable indicator B. pH meter C. transition interval D. both (A and B) are correct

46. This reaction: $\text{CH}_2=\text{CH}-\text{CH}_3 + \text{HCl} \longrightarrow$ 2-chloro propane, is called:-

- A. substitution B. addition C. condensation D. elimination

47. When comparing the expected and actual freezing point of an aqueous solution of MgI_2 with 1.0 m concentration, which of the following is correct? If the actual freezing point is equal to -4.78°C and K_f of water = $-1.86^\circ\text{C}/m$.

- A. the expected freezing point is equal to the actual freezing point.
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 C. the expected freezing point is higher than the actual freezing point
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48. In this reaction: $\text{H}_2(\text{g}) + \text{I}_2(\text{g}) \rightleftharpoons 2\text{HI}(\text{g})$, at 425°C is found at equilibrium:

$[\text{H}_2] = 1.83 \times 10^{-3}\text{M}$, $[\text{I}_2] = 3.13 \times 10^{-3}\text{M}$ and $[\text{HI}] = 1.77 \times 10^{-2}\text{M}$, which of the following is correct?

- A. reactants are favored B. a small amount of reactants converted into products
 C. products are favored D. both (A and B) are correct.

49. When the ammonia molecule reacts with the hydrogen ion (proton) :-

- A. ammonia molecule is an electron-pair acceptor B. ammonia acts as Arrhenius base
 C. proton acts as Lewis acid D. both (A and C) are correct

50. The rate law for a reaction is found to be: $R = k[\text{X}][\text{Y}]^2$, by what factor does the rate increase if [Y] tripled?

- A. 3 B. 6 C. 27 D. 9



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

- Which of the following pairs of solutions produce a precipitate when combined?
 A. NH_4Cl and NaOH B. KCl and Na_2SO_4 C. $\text{Fe}(\text{NO}_3)_3$ and KCl D. NH_4Cl and AgNO_3
- In this reaction: $2\text{H}_2(\text{g}) + \text{O}_2(\text{g}) \rightarrow 2\text{H}_2\text{O}(\text{l}) + 571.6 \text{ kJ}$, which of the following is correct?
 A. ΔH_f° of water = -285.8 kJ/mol B. ΔH_f° of water = $+285.8 \text{ kJ/mol}$
 C. ΔH° of reverse reaction = $+571.6 \text{ kJ/mol}$ D. both (A and C) are correct
- This hypothetical reaction: $\text{A} + \text{B} \rightarrow 2\text{C}$, is occur in one step-mechanism, what is the value of the specific rate constant for reverse reaction when $[\text{C}] = 0.015\text{M}$ and the rate of reaction is equal to $1.1 \times 10^{-3} \text{ M/s}$?
 A. $4.9 \text{ M}^{-1}\text{s}^{-1}$ B. 4.9 s^{-1} C. $0.2 \text{ M}^{-1}\text{s}^{-1}$ D. 0.2 s^{-1}
- The rate law for a reaction is found to be: $\text{R} = k[\text{X}][\text{Y}]^2$, by what factor does the rate increase if $[\text{Y}]$ tripled?
 A. 3 B. 6 C. 27 D. 9
- Changing the temperature affects the rate of reaction because it affects:-
 A. the energy of activated complex B. the enthalpy of reaction
 C. the number of effective collision D. the properties of reactants
- How many moles of nitrate ions are produced by dissolving 0.15 mol of zinc nitrate in water?
 A. 0.30 B. 0.15 C. 0.45 D. 2.0
- Which of the following solutions with the same concentration has the highest vapor- pressure?
 A. AlCl_3 B. NaNO_3 C. $\text{C}_6\text{H}_{12}\text{O}_6$ D. CaCl_2
- The acidity of which of the following aqueous solutions at 25°C is highest?
 A. $\text{pOH} = 13$ B. $[\text{H}_3\text{O}^+] = 1.0 \times 10^{-7} \text{ M}$ C. $[\text{OH}^-] = 1.0 \times 10^{-4} \text{ M}$ D. $\text{pH} = 12$
- All of the following are affect the rate of reaction between hydrogen gas and chlorine gas **EXCEPT**:-
 A. surface area B. temperature C. presence catalyst D. concentration
- Suppose that 15mL of 0.025M H_2SO_4 is required to neutralize 10mL of KOH solution, what is the molarity of the base?
 A. 0.025 B. 0.0125 C. 0.075 D. 0.0075
- Which of the following compounds formed hydrogen bond with water?
 A. ethers B. benzene C. alcohols D. both (A and C) are correct
- Which of the following types of molecular representations **cannot** be used to show differences between isomers?
 A. molecular formula B. three-dimensional drawing or model
 C. structural formula D. both (B and C) are correct
- The molal boiling-point constant (K_b) depends on the:-
 A. nature of solute B. number of solvent moles C. nature of solvent D. solute concentration
- This reaction: $\text{CH}_2=\text{CH}-\text{CH}_3 + \text{HCl} \rightarrow 2\text{-chloro propane}$, is called:-
 A. substitution B. addition C. condensation D. elimination

- The anion of the acid that stomach produces:-
 A. is a strong conjugate base B. it acts as amphoteric
 C. is a weak conjugate acid D. it has a little tendency to attract a proton
- Which of the following reactions represent the hydrolysis reaction?
 A. $\text{H}_2\text{CO}_3(\text{aq}) + \text{H}_2\text{O}(\text{l}) \rightleftharpoons \text{HCO}_3^-(\text{aq}) + \text{H}_3\text{O}^+(\text{aq})$ B. $\text{CH}_3\text{NH}_2(\text{aq}) + \text{H}_2\text{O}(\text{l}) \rightleftharpoons \text{CH}_3\text{NH}_3^+(\text{aq}) + \text{OH}^-(\text{aq})$
 C. $\text{NH}_4^+(\text{aq}) + \text{H}_2\text{O}(\text{l}) \rightleftharpoons \text{NH}_3(\text{aq}) + \text{H}_3\text{O}^+(\text{aq})$ D. all of them are correct
- If the value of equilibrium constant for gaseous reaction is equal to 300 at given temperature, what is the value of equilibrium constant for the reaction by doubling the volume of reaction vessel, at the same temperature?
 A. 300 B. 600 C. 900 D. 150
- Which of the following two conditions will favor a spontaneous reaction?
 A. $\Delta H < 0$ and $\Delta S > 0$ B. $\Delta H > 0$ and $\Delta S > 0$ C. $\Delta H > 0$ and $\Delta S < 0$ D. $\Delta H < 0$ and $\Delta S < 0$
- In the titration acid and base process the equivalence point is determined by :-
 A. suitable indicator B. pH meter C. transition interval D. both (A and B) are correct
- In a saturated solution the concentration.....
 A. is always high B. is always low
 C. may be high or low, depending on the solubility of the solute D. cannot be determined
- In the reaction NO_2^- ions with water, which of the following is conjugate acid –base pair?
 A. H_2O and H_3O^+ B. HNO_2 and NO_2^- C. H_2O and OH^- D. both (B and C) are correct
- In a titration experiment, by using phenolphthalein indicator ($\text{pH} = 8.0 - 10.0$), 0.5mol of which of the following acids neutralizes 0.5mol of NaOH ?
 A. H_3PO_4 B. HF C. HCl D. both (A and B)
- In this reaction: $\text{H}_2(\text{g}) + \text{I}_2(\text{g}) \rightleftharpoons 2\text{HI}(\text{g})$, at 425°C is found at equilibrium:
 $[\text{H}_2] = 1.83 \times 10^{-3} \text{ M}$, $[\text{I}_2] = 3.13 \times 10^{-3} \text{ M}$ and $[\text{HI}] = 1.77 \times 10^{-2} \text{ M}$, which of the following is correct?
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 A. the expected freezing point is equal to the actual freezing point.
 B. the expected freezing point is lower than the actual freezing point
 C. the expected freezing point is higher than the actual freezing point
 D. none of them
- Used in biology laboratories as a preservative for dead animals:-
 A. methanol B. acetic acid C. methanal D. methyl amine
- When the ammonia molecule reacts with the hydrogen ion (proton) :-
 A. ammonia molecule is an electron-pair acceptor B. ammonia acts as Arrhenius base
 C. proton acts as Lewis acid D. both (A and C) are correct
- In the following hypothetical reaction: $\text{A} + \text{B} \rightarrow \text{C} + \text{D}$ $\Delta H > 0$, which of the following is correct?
 A. the products are more stable B. the reactants are more stable
 C. the reaction is an exothermic D. none of them

28. In the second ionization stage of phosphoric acid in its aqueous solution.....are produced.

- A. HPO_4^{2-} and H_3O^+ B. H_2PO_4^- and H_3O^+ C. PO_4^{3-} and H_3O^+ D. all of them

29. If a small amounts of HCl added to a solution of HNO_2 and KNO_2 , which of the following decreases?

- A. pH B. ionization of HNO_2 C. $[\text{OH}^-]$ D. all of them are Correct

30. Which of the following is correct?

- A. the boiling point of pentane greater than 2-methyl butane.
B. the carbon atom hybridization type of C_2H_2 is sp^2 .
C. the graphite is a good conductor of heat.
D. the molecular formula of methyl benzene is C_6H_8 .

31. An aqueous solution of hydrogen fluoride weakly conducts an electric current because :-

- A. it is ionized partially B. the hydrogen- fluorine bond is strong
C. the hydrogen- fluorine bond is weak D. both (A and B) are correct

32. All of the following may be alkene and cycloalkane **EXCEPT**:-

- A. C_3H_6 B. C_2H_4 C. C_5H_{10} D. C_4H_8

33. When one gram of iron is heated to 100.0°C and cooled to 50.0°C in a calorimeter transfers 22.5 J of energy to the surrounding water. But one gram of silver transfers 11.8 J of energy under the same conditions, the difference of the value of transfer energy depends on the:-

- A. mass of the material B. temperature change C. nature of the material D. all of them

34. Which of the following exhibits properties of an Arrhenius acid?

- A. hydrogen chloride that is dissolved in water B. the pure hydrogen chloride gas
C. hydrogen chloride that is dissolved in nonpolar solvent D. all of them

35. Which of the following can have geometric isomers?

- A. CH_2Cl_2 B. $\text{C}_2\text{H}_4\text{Cl}_2$ C. $\text{C}_2\text{H}_2\text{Cl}_2$ D. none of them

36. If the $[\text{H}_3\text{O}^+]$ of aqueous solution of $\text{Ca}(\text{OH})_2$ is equal to $1.0 \times 10^{-8}\text{M}$, what is the molarity of $\text{Ca}(\text{OH})_2$?

- A. 1.0×10^{-6} B. 5.0×10^{-7} C. 1.0×10^{-8} D. 2.0×10^{-6}

37. In the adjacent energy diagram after using catalyst the value of E_a :-

- A. is equal to 100 kJ/mol
B. is greater than 100 kJ/mol
C. is less than 100 kJ/mol
D. cannot be determined



38. The correct name for this compound: (1-ethyl-3-methyl propane) according to IUPAC system is:

- A. hexane B. 2-methyl pentane C. 3-methyl pentane D. 2,3-dimethyl butane

39. In the aqueous solution of KCN, the water reacts with:-

- A. K^+ and produces strong base B. K^+ and produces weak base
C. CN^- and produces strong acid D. CN^- and produces weak acid

40. A hydrocarbon that contains delocalized electrons:-

- A. graphite B. benzene C. cyclohexane D. both (A and B) are correct

41. The general formula for esters is:-

- A. R-CO-R B. R-COO-R C. R-COOH D. R-O-R

42. In this reaction: $\text{Al}(\text{s}) + \text{H}_2\text{SO}_4(\text{aq}) \longrightarrow$, which of the following is the net ionic equation?

- A. $\text{H}_3\text{O}^+(\text{aq}) + \text{OH}^-(\text{aq}) \longrightarrow 2\text{H}_2\text{O}(\text{l})$ B. $2\text{Al}(\text{s}) + 6\text{H}_3\text{O}^+(\text{aq}) \longrightarrow 2\text{Al}^{3+}(\text{aq}) + 9\text{H}_2(\text{g})$
C. $2\text{Al}(\text{s}) + 6\text{H}_3\text{O}^+(\text{aq}) \longrightarrow 2\text{Al}^{3+}(\text{aq}) + 6\text{H}_2\text{O}(\text{l}) + 3\text{H}_2(\text{g})$ D. none of them

43. Determine the concentration of fluoride ions in a saturated solution of CaF_2 , If the

- K_{sp} of CaF_2 is 5.3×10^{-9} . A. $2.2 \times 10^{-3}\text{M}$ B. $1.1 \times 10^{-3}\text{M}$ C. $1.325 \times 10^{-5}\text{M}$ D. $1.1 \times 10^{-4}\text{M}$

44. One of the following **cannot** be isomer for $\text{C}_3\text{H}_8\text{O}$:-

- A. 2-propanol B. 1-propanol C. ethyl methyl ether D. 2-propanon

45. In a reaction, $\Delta G^0 = 142.0 \text{ kJ/mol}$ and $\Delta H^0 = 206.1 \text{ kJ/mol}$, at room temperature which of the following is correct?

- A. the entropy of the reactants is greater B. the entropy of the products is greater
C. the entropy of reactants and the products is equal D. none of them

46. The calcium sulfate salt is produce by the reaction between the:-

- A. Ca and H_2SO_4 B. $\text{Ca}(\text{OH})_2$ and H_2SO_4 C. $\text{Ca}(\text{OH})_2$ and H_2SO_3 D. both (A and B) are correct

47. The equilibrium self-ionization equation of water at 25°C is: $2\text{H}_2\text{O}(\text{l}) + \text{energy} \rightleftharpoons \text{H}_3\text{O}^+(\text{aq}) + \text{OH}^-(\text{aq})$, by decreasing the temperature which of the following is incorrect?

- A. the pH value increases B. the pOH value decreases
C. the K_w value decreases D. none of them

48. By using the information in the adjacent table, 55g of which of the following element absorbed 3.562 kJ of energy if it was heated from 22.4°C to 94.6°C ?

- A. Ca B. Al
C. Fe D. Au

Element	Ca	Al	Fe	Au
Specific heat J/(g.K)	0.647	0.897	0.449	0.129

49. Which of the following compounds **cannot** be monomer for the addition polymer?

- A. C_2H_4 B. CH_3COOH C. C_2F_4 D. $\text{CH}_2=\text{CH}-\text{CH}_3$

50. This reaction: $2\text{H}_2\text{O}_2 \longrightarrow 2\text{H}_2\text{O} + \text{O}_2$, by using catalyst has the following proposed mechanism:-

step: 1 $\text{H}_2\text{O}_2 + \text{I}^- \longrightarrow \text{H}_2\text{O} + \text{IO}^-$

step: 2 $\text{H}_2\text{O}_2 + \text{IO}^- \longrightarrow \text{H}_2\text{O} + \text{O}_2 + \text{I}^-$, which of the following is intermediate?

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

1. This hypothetical reaction: $A + B \rightarrow 2C$, is occur in one step-mechanism, what is the value of the specific rate constant for reverse reaction when $[C] = 0.015M$ and the rate of reaction is equal to $1.1 \times 10^{-3} M/s$?
 A. $4.9 M^{-1}s^{-1}$ B. $4.9 s^{-1}$ C. $0.2 M^{-1}s^{-1}$ D. $0.2 s^{-1}$

2. By using the information in the adjacent table, 55g of which of the following element absorbed 3.562 kJ of energy if it was heated from $22.4^{\circ}C$ to $94.6^{\circ}C$?

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Element	Ca	Al	Fe	Au
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3. Which of the following two conditions will favor a spontaneous reaction?

- A. $\Delta H < 0$ and $\Delta S > 0$ B. $\Delta H > 0$ and $\Delta S > 0$ C. $\Delta H > 0$ and $\Delta S < 0$ D. $\Delta H < 0$ and $\Delta S < 0$

4. In a titration experiment, by using phenolphthalein indicator ($pH = 8.0-10.0$), 0.5mol of which of the following acids neutralizes 0.5mol of NaOH? A. H_3PO_4 B. HF C. HCl D. both (A and B)

5. Which of the following is correct?

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 D. the molecular formula of methyl benzene is C_6H_8 .

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8. How many moles of nitrate ions are produced by dissolving 0.15 mol of zinc nitrate in water?

- A. 0.30 B. 0.15 C. 0.45 D. 2.0

9. If the $[H_3O^+]$ of aqueous solution of $Ca(OH)_2$ is equal to $1.0 \times 10^{-8} M$, what is the molarity of $Ca(OH)_2$?

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12. One of the following **cannot** be isomer for C_3H_8O :-

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18. When comparing the expected and actual freezing point of an aqueous solution of MgI_2 with 1.0 m concentration, which of the following is correct? If the actual freezing point is equal to $-4.78^{\circ}C$ and K_f of water = $-1.86^{\circ}C/m$.

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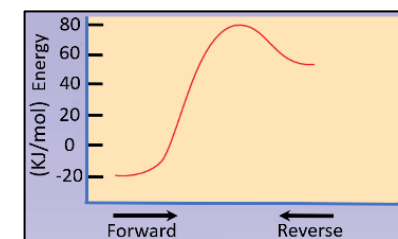
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22. The correct name for this compound: (1-ethyl-3-methyl propane) according to IUPAC system is:

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23. In the adjacent energy diagram after using catalyst the value of E_a :-

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24. The acidity of which of the following aqueous solutions at $25^{\circ}C$ is highest?

- A. $pOH = 13$ B. $[H_3O^+] = 1.0 \times 10^{-7} M$ C. $[OH^-] = 1.0 \times 10^{-4} M$ D. $pH = 12$

25. Which of the following reactions represent the hydrolysis reaction?

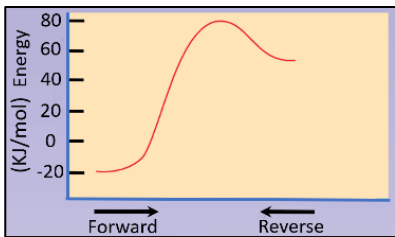
- A. $H_2CO_3(aq) + H_2O(l) \rightleftharpoons HCO_3^-(aq) + H_3O^+(aq)$ B. $CH_3NH_2(aq) + H_2O(l) \rightleftharpoons CH_3NH_3^+(aq) + OH^-(aq)$
 C. $NH_4^+(aq) + H_2O(l) \rightleftharpoons NH_3(aq) + H_3O^+(aq)$ D. all of them are correct

- 26.** Which of the following types of molecular representations **cannot** be used to show differences between isomers?
- A. molecular formula B. three-dimensional drawing or model
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- A. methanol B. acetic acid C. methanal D. methyl amine
- 35.** Which of the following solutions with the same concentration has the highest vapor- pressure?
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- 41.** Which of the following pairs of solutions produce a precipitate when combined?
- A. NH_4Cl and NaOH B. KCl and Na_2SO_4 C. $\text{Fe}(\text{NO}_3)_3$ and KCl D. NH_4Cl and AgNO_3
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- 43.** In this reaction: $2\text{H}_2(\text{g}) + \text{O}_2(\text{g}) \longrightarrow 2\text{H}_2\text{O}(\text{l}) + 571.6 \text{ kJ}$, which of the following is correct?
- A. ΔH_f° of water = -285.8 kJ/mol B. ΔH_f° of water = +285.8 kJ/mol
C. ΔH° of reverse reaction = +571.6 kJ/mol D. both (A and C) are correct
- 44.** Which of the following compounds formed hydrogen bond with water?
- A. ethers B. benzene C. alcohols D. both (A and C) are correct
- 45.** In this reaction: $\text{Al}(\text{s}) + \text{H}_2\text{SO}_4(\text{aq}) \longrightarrow$, which of the following is the net ionic equation?
- A. $\text{H}_3\text{O}^+(\text{aq}) + \text{OH}^-(\text{aq}) \longrightarrow 2\text{H}_2\text{O}(\text{l})$ B. $2\text{Al}(\text{s}) + 6\text{H}_3\text{O}^+(\text{aq}) \longrightarrow 2\text{Al}^{3+}(\text{aq}) + 9\text{H}_2(\text{g})$
C. $2\text{Al}(\text{s}) + 6\text{H}_3\text{O}^+(\text{aq}) \longrightarrow 2\text{Al}^{3+}(\text{aq}) + 6\text{H}_2\text{O}(\text{l}) + 3\text{H}_2(\text{g})$ D. none of them
- 46.** Changing the temperature affects the rate of reaction because it affects:-
- A. the energy of activated complex B. the enthalpy of reaction
C. the number of effective collision D. the properties of reactants
- 47.** When the ammonia molecule reacts with the hydrogen ion (proton) :-
- A. ammonia molecule is an electron-pair acceptor B. ammonia acts as Arrhenius base
C. proton acts as Lewis acid D. both (A and C) are correct
- 48.** In the reaction NO_2^- ions with water, which of the following is conjugate acid –base pair?
- A. H_2O and H_3O^+ B. HNO_2 and NO_2^- C. H_2O and OH^- D. both (B and C) are correct
- 49.** If a small amounts of HCl added to a solution of HNO_2 and KNO_2 , which of the following decreases?
- A. pH B. ionization of HNO_2 C. $[\text{OH}^-]$ D. all of them are Correct
- 50.** The calcium sulfate salt is produce by the reaction between the:-
- A. Ca and H_2SO_4 B. $\text{Ca}(\text{OH})_2$ and H_2SO_4 C. $\text{Ca}(\text{OH})_2$ and H_2SO_3 D. both (A and B) are correct



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

- All of the following affect the rate of reaction between hydrogen gas and chlorine gas **EXCEPT**:-
 A. surface area B. temperature C. presence catalyst D. concentration
 - In the adjacent energy diagram after using catalyst the value of E_a :-
 A. is equal to 100 kJ/mol
 B. is greater than 100 kJ/mol
 C. is less than 100 kJ/mol
 D. cannot be determined
- 
- The anion of the acid that stomach produces:-
 A. is a strong conjugate base B. it acts as amphoteric
 C. is a weak conjugate acid D. it has a little tendency to attract a proton
 - All of the following may be alkene and cycloalkane **EXCEPT**:-
 A. C_3H_6 B. C_2H_4 C. C_5H_{10} D. C_4H_8
 - Which of the following compounds form hydrogen bond with water?
 A. ethers B. benzene C. alcohols D. both (A and C) are correct
 - The molal boiling-point constant (K_b) depends on the:-
 A. nature of solute B. number of solvent moles C. nature of solvent D. solute concentration
 - Which of the following pairs of solutions produce a precipitate when combined?
 A. NH_4Cl and $NaOH$ B. KCl and Na_2SO_4 C. $Fe(NO_3)_3$ and KCl D. NH_4Cl and $AgNO_3$
 - A hydrocarbon that contains delocalized electrons:-
 A. graphite B. benzene C. cyclohexane D. both (A and B) are correct
 - This reaction: $CH_2=CH-CH_3 + HCl \longrightarrow$ 2-chloro propane, is called:-
 A. substitution B. addition C. condensation D. elimination
 - Which of the following exhibits properties of an Arrhenius acid?
 A. hydrogen chloride that is dissolved in water B. the pure hydrogen chloride gas
 C. hydrogen chloride that is dissolved in nonpolar solvent D. all of them
 - Suppose that 15mL of 0.025M H_2SO_4 is required to neutralize 10mL of KOH solution, what is the molarity of the base?
 A. 0.025 B. 0.0125 C. 0.075 D. 0.0075
 - In the titration acid and base process the equivalence point is determined by :-
 A. suitable indicator B. pH meter C. transition interval D. both (A and B) are correct
 - Which of the following two conditions will favor a spontaneous reaction?
 A. $\Delta H < 0$ and $\Delta S > 0$ B. $\Delta H > 0$ and $\Delta S > 0$ C. $\Delta H > 0$ and $\Delta S < 0$ D. $\Delta H < 0$ and $\Delta S < 0$
 - Which of the following compounds **cannot** be monomer for the addition polymer?
 A. C_2H_4 B. CH_3COOH C. C_2F_4 D. $CH_2=CH-CH_3$

- In the second ionization stage of phosphoric acid in its aqueous solution.....are produced.
 A. HPO_4^{2-} and H_3O^+ B. $H_2PO_4^-$ and H_3O^+ C. PO_4^{3-} and H_3O^+ D. all of them
- Which of the following solutions with the same concentration has the highest vapor- pressure?
 A. $AlCl_3$ B. $NaNO_3$ C. $C_6H_{12}O_6$ D. $CaCl_2$
- When comparing the expected and actual freezing point of an aqueous solution of MgI_2 with 1.0 m concentration, which of the following is correct? If the actual freezing point is equal to $-4.78^\circ C$ and K_f of water = $-1.86^\circ C/m$.
 A. the expected freezing point is equal to the actual freezing point.
 B. the expected freezing point is lower than the actual freezing point
 C. the expected freezing point is higher than the actual freezing point
 D. none of them
- Which of the following types of molecular representations **cannot** be used to show differences between isomers?
 A. molecular formula B. three-dimensional drawing or model
 C. structural formula D. both (B and C) are correct
- If a small amount of HCl added to a solution of HNO_2 and KNO_2 , which of the following decreases?
 A. pH B. ionization of HNO_2 C. $[OH^-]$ D. all of them are correct
- The calcium sulfate salt is produced by the reaction between the:-
 A. Ca and H_2SO_4 B. $Ca(OH)_2$ and H_2SO_4 C. $Ca(OH)_2$ and H_2SO_3 D. both (A and B) are correct
- If the value of equilibrium constant for gaseous reaction is equal to 300 at given temperature, what is the value of equilibrium constant for the reaction by doubling the volume of reaction vessel, at the same temperature?
 A. 300 B. 600 C. 900 D. 150
- If the $[H_3O^+]$ of aqueous solution of $Ca(OH)_2$ is equal to $1.0 \times 10^{-8} M$, what is the molarity of $Ca(OH)_2$?
 A. 1.0×10^{-6} B. 5.0×10^{-7} C. 1.0×10^{-8} D. 2.0×10^{-6}
- In the following hypothetical reaction: $A+B \longrightarrow C+D$ $\Delta H > 0$, which of the following is correct?
 A. the products are more stable B. the reactants are more stable
 C. the reaction is an exothermic D. none of them
- How many moles of nitrate ions are produced by dissolving 0.15 mol of zinc nitrate in water?
 A. 0.30 B. 0.15 C. 0.45 D. 2.0
- In a reaction, $\Delta G^0 = 142.0 \text{ kJ/mol}$ and $\Delta H^0 = 206.1 \text{ kJ/mol}$, at room temperature which of the following is correct?
 A. the entropy of the reactants is greater B. the entropy of the products is greater
 C. the entropy of reactants and the products is equal D. none of them
- The correct name for this compound: (1-ethyl-3-methyl propane) according to IUPAC system is:
 A. hexane B. 2-methyl pentane C. 3-methyl pentane D. 2,3-dimethyl butane
- An aqueous solution of hydrogen fluoride weakly conducts an electric current because :-
 A. it is ionized partially B. the hydrogen- fluorine bond is strong
 C. the hydrogen- fluorine bond is weak D. both (A and B) are correct

- 28.** In the reaction NO_2^- ions with water, which of the following is conjugate acid –base pair?
A. H_2O and H_3O^+ **B.** HNO_2 and NO_2^- **C.** H_2O and OH^- **D.** both (B and C) are correct
- 29.** Determine the concentration of fluoride ions in a saturated solution of CaF_2 , If the K_{sp} of CaF_2 is 5.3×10^{-9} .
A. $2.2 \times 10^{-3}\text{M}$ **B.** $1.1 \times 10^{-3}\text{M}$ **C.** $1.325 \times 10^{-5}\text{M}$ **D.** $1.1 \times 10^{-4}\text{M}$
- 30.** In this reaction: $\text{H}_2(\text{g}) + \text{I}_2(\text{g}) \rightleftharpoons 2\text{HI}(\text{g})$, at 425°C is found at equilibrium:
 $[\text{H}_2] = 1.83 \times 10^{-3}\text{M}$, $[\text{I}_2] = 3.13 \times 10^{-3}\text{M}$ and $[\text{HI}] = 1.77 \times 10^{-2}\text{M}$, which of the following is correct?
A. reactants are favored **B.** a small amount of reactants converted into products
C. products are favored **D.** both (A and B) are correct.
- 31.** Which of the following can have geometric isomers?
A. CH_2Cl_2 **B.** $\text{C}_2\text{H}_4\text{Cl}_2$ **C.** $\text{C}_2\text{H}_2\text{Cl}_2$ **D.** none of them
- 32.** Changing the temperature affects the rate of reaction because it affects:-
A. the energy of activated complex **B.** the enthalpy of reaction
C. the number of effective collision **D.** the properties of reactants
- 33.** One of the following **cannot** be isomer for $\text{C}_3\text{H}_8\text{O}$:-
A. 2-propanol **B.** 1-propanol **C.** ethyl methyl ether **D.** 2-propanon
- 34.** In this reaction: $\text{Al}(\text{s}) + \text{H}_2\text{SO}_4(\text{aq}) \longrightarrow$, which of the following is the net ionic equation?
A. $\text{H}_3\text{O}^+(\text{aq}) + \text{OH}^-(\text{aq}) \longrightarrow 2\text{H}_2\text{O}(\text{l})$ **B.** $2\text{Al}(\text{s}) + 6\text{H}_3\text{O}^+(\text{aq}) \longrightarrow 2\text{Al}^{3+}(\text{aq}) + 9\text{H}_2(\text{g})$
C. $2\text{Al}(\text{s}) + 6\text{H}_3\text{O}^+(\text{aq}) \longrightarrow 2\text{Al}^{3+}(\text{aq}) + 6\text{H}_2\text{O}(\text{l}) + 3\text{H}_2(\text{g})$ **D.** none of them
- 35.** In a saturated solution the concentration.....
A. is always high **B.** is always low
C. may be high or low, depending on the solubility of the solute **D.** cannot be determined
- 36.** When the ammonia molecule reacts with the hydrogen ion (proton) :-
A. ammonia molecule is an electron-pair accepter **B.** ammonia acts as Arrhenius base
C. proton acts as Lewis acid **D.** both (A and C) are correct
- 37.** When one gram of iron is heated to 100.0°C and cooled to 50.0°C in a calorimeter transfers 22.5 J of energy to the surrounding water. But one gram of silver transfers 11.8 J of energy under the same conditions, the difference of the value of transfer energy depends on the:-
A. mass of the material **B.** temperature change **C.** nature of the material **D.** all of them
- 38.** The general formula for esters is:-
A. $\text{R}-\text{CO}-\text{R}$ **B.** $\text{R}-\text{COO}-\text{R}$ **C.** $\text{R}-\text{COOH}$ **D.** $\text{R}-\text{O}-\text{R}$
- 39.** In this reaction: $2\text{H}_2(\text{g}) + \text{O}_2(\text{g}) \longrightarrow 2\text{H}_2\text{O}(\text{l}) + 571.6 \text{ kJ}$, which of the following is correct?
A. ΔH_f° of water = -285.8 kJ/mol **B.** ΔH_f° of water = $+285.8 \text{ kJ/mol}$
C. ΔH° of reverse reaction = $+571.6 \text{ kJ/mol}$ **D.** both (A and C) are correct
- 40.** In a titration experiment, by using phenolphthalein indicator ($\text{pH}=8.0-10.0$), 0.5mol of which of the following acids neutralizes 0.5mol of NaOH ? **A.** H_3PO_4 **B.** HF **C.** HCl **D.** both (A and B)
- 41.** The acidity of which of the following aqueous solutions at 25°C is highest?
A. $\text{pOH}=13$ **B.** $[\text{H}_3\text{O}^+]=1.0 \times 10^{-7}\text{M}$ **C.** $[\text{OH}^-]=1.0 \times 10^{-4}\text{M}$ **D.** $\text{pH}=12$

- 42.** The equilibrium self-ionization equation of water at 25°C is: $2\text{H}_2\text{O}(\text{l}) + \text{energy} \rightleftharpoons \text{H}_3\text{O}^+(\text{aq}) + \text{OH}^-(\text{aq})$, by decreasing the temperature which of the following is incorrect?
A. the pH value increases **B.** the pOH value decreases
C. the K_w value decreases **D.** none of them
- 43.** The rate law for a reaction is found to be: $R=k[\text{X}][\text{Y}]^2$, by what factor does the rate increase if $[\text{Y}]$ tripled?
A. 3 **B.** 6 **C.** 27 **D.** 9
- 44.** In the aqueous solution of KCN , the water reacts with:-
A. K^+ and produces strong base **B.** K^+ and produces weak base
C. CN^- and produces strong acid **D.** CN^- and produces weak acid
- 45.** By using the information in the adjacent table, 55g of which of the following element absorbed 3.562 kJ of energy if it was heated from 22.4°C to 94.6°C ?
A. Ca **B.** Al
C. Fe **D.** Au
- | Element | Ca | Al | Fe | Au |
|-----------------------|-------|-------|-------|-------|
| Specific heat J/(g.K) | 0.647 | 0.897 | 0.449 | 0.129 |
- 46.** Which of the following reactions represent the hydrolysis reaction?
A. $\text{H}_2\text{CO}_3(\text{aq}) + \text{H}_2\text{O}(\text{l}) \rightleftharpoons \text{HCO}_3^-(\text{aq}) + \text{H}_3\text{O}^+(\text{aq})$ **B.** $\text{CH}_3\text{NH}_2(\text{aq}) + \text{H}_2\text{O}(\text{l}) \rightleftharpoons \text{CH}_3\text{NH}_3^+(\text{aq}) + \text{OH}^-(\text{aq})$
C. $\text{NH}_4^+(\text{aq}) + \text{H}_2\text{O}(\text{l}) \rightleftharpoons \text{NH}_3(\text{aq}) + \text{H}_3\text{O}^+(\text{aq})$ **D.** all of them are correct
- 47.** Used in biology laboratories as a preservative for dead animals:-
A. methanol **B.** acetic acid **C.** methanal **D.** methyl amine
- 48.** Which of the following is correct?
A. the boiling point of pentane greater than 2-methyl butane.
B. the carbon atom hybridization type of C_2H_2 is sp^2 .
C. the graphite is a good conductor of heat.
D. the molecular formula of methyl benzene is C_6H_8 .
- 49.** This hypothetical reaction: $\text{A} + \text{B} \longrightarrow 2\text{C}$, is occur in one step-mechanism, what is the value of the specific rate constant for reverse reaction when $[\text{C}] = 0.015\text{M}$ and the rate of reaction is equal to $1.1 \times 10^{-3}\text{M/s}$?
A. $4.9 \text{ M}^{-1}\text{s}^{-1}$ **B.** 4.9 s^{-1} **C.** $0.2 \text{ M}^{-1}\text{s}^{-1}$ **D.** 0.2 s^{-1}
- 50.** This reaction: $2\text{H}_2\text{O}_2 \longrightarrow 2\text{H}_2\text{O} + \text{O}_2$, by using catalyst has the following proposed mechanism:-
step: 1 $\text{H}_2\text{O}_2 + \text{I}^- \longrightarrow \text{H}_2\text{O} + \text{IO}^-$
step: 2 $\text{H}_2\text{O}_2 + \text{IO}^- \longrightarrow \text{H}_2\text{O} + \text{O}_2 + \text{I}^-$, which of the following is intermediate?
A. I^- **B.** H_2O **C.** IO^- **D.** both (A and C) are correct



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

- When the ammonia molecule reacts with the hydrogen ion (proton) :-
 A. ammonia molecule is an electron-pair accepter B. ammonia acts as Arrhenius base
 C. proton acts as Lewis acid D. both (A and C) are correct
- Which of the following compounds **cannot** be monomer for the addition polymer?
 A. C₂H₄ B. CH₃COOH C. C₂F₄ D. CH₂=CH-CH₃
- The calcium sulfate salt is produce by the reaction between the:-
 A. Ca and H₂SO₄ B. Ca(OH)₂ and H₂SO₄ C. Ca(OH)₂ and H₂SO₃ D. both (A and B) are correct
- The rate law for a reaction is found to be: $R=k[X][Y]^2$, by what factor does the rate increase if [Y] tripled?
 A. 3 B. 6 C. 27 D. 9
- If the [H₃O⁺] of aqueous solution of Ca(OH)₂ is equal to 1.0x10⁻⁸M, what is the molarity of Ca(OH)₂?
 A. 1.0x10⁻⁶ B. 5.0x10⁻⁷ C. 1.0x10⁻⁸ D. 2.0x10⁻⁶
- In a titration experiment, by using phenolphthalein indicator (pH=8.0-10.0), 0.5mol of which of the following acids neutralizes 0.5mol of NaOH?
 A. H₃PO₄ B. HF C. HCl D. both (A and B)
- The molal boiling-point constant (K_b) depends on the:-
 A. nature of solute B. number of solvent moles C. nature of solvent D. solute concentration
- Which of the following can have geometric isomers?
 A. CH₂Cl₂ B. C₂H₄Cl₂ C. C₂H₂Cl₂ D. none of them
- By using the information in the adjacent table, 55g of which of the following element absorbed 3.562 kJ of energy if it was heated from 22.4°C to 94.6°C?
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- In this reaction: $2H_2(g) + O_2(g) \longrightarrow 2H_2O(l) + 571.6 \text{ kJ}$, which of the following is correct?
 A. ΔH_f° of water = -285.8 kJ/mol B. ΔH_f° of water = +285.8 kJ/mol
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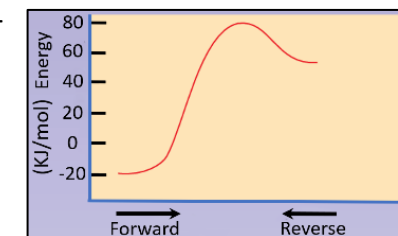
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- Determine the concentration of fluoride ions in a saturated solution of CaF₂, If the K_{sp} of CaF₂ is 5.3x10⁻⁹.
 A. 2.2x10⁻³M B. 1.1x10⁻³M C. 1.325x10⁻⁵M D. 1.1x10⁻⁴M
- This hypothetical reaction: $A + B \longrightarrow 2C$, is occur in one step-mechanism, what is the value of the specific rate constant for reverse reaction when [C]= 0.015M and the rate of reaction is equal to 1.1x10⁻³M/s?
 A. 4.9 M⁻¹s⁻¹ B. 4.9 s⁻¹ C. 0.2 M⁻¹s⁻¹ D. 0.2 s⁻¹
- This reaction: $2H_2O_2 \longrightarrow 2H_2O + O_2$, by using catalyst has the following proposed mechanism:-
 step: 1 $H_2O_2 + I^- \longrightarrow H_2O + IO^-$
 step: 2 $H_2O_2 + IO^- \longrightarrow H_2O + O_2 + I^-$, which of the following is intermediate?
 A. I⁻ B. H₂O C. IO⁻ D. both (A and C) are correct

- The acidity of which of the following aqueous solutions at 25°C is highest?
 A. pOH=13 B. [H₃O⁺]=1.0x10⁻⁷M C. [OH⁻]=1.0x10⁻⁴M D. pH=12
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- The equilibrium self-ionization equation of water at 25°C is: $2H_2O(l) + \text{energy} \rightleftharpoons H_3O^+(aq) + OH^-(aq)$, by decreasing the temperature which of the following is incorrect?
 A. the pH value increases B. the pOH value decreases
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- Which of the following solutions with the same concentration has the highest vapor- pressure?
 A. AlCl₃ B. NaNO₃ C. C₆H₁₂O₆ D. CaCl₂
- In a reaction, $\Delta G^\circ = 142.0 \text{ kJ/mol}$ and $\Delta H^\circ = 206.1 \text{ kJ/mol}$, at room temperature which of the following is correct?
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- Which of the following two conditions will favor a spontaneous reaction?
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- All of the following may be alkene and cycloalkane **EXCEPT**:-
 A. C₃H₆ B. C₂H₄ C. C₅H₁₀ D. C₄H₈
- Which of the following is correct?
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 D. the molecular formula of methyl benzene is C₆H₈.
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28. In the following hypothetical reaction: $A+B \longrightarrow C+D$ $\Delta H > 0$, which of the following is correct?
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 A. is always high B. is always low
 C. may be high or low, depending on the solubility of the solute D. cannot be determined
32. In this reaction: $Al(s) + H_2SO_4(aq) \longrightarrow$, which of the following is the net ionic equation?
 A. $H_3O^+(aq) + OH^-(aq) \longrightarrow 2H_2O(l)$ B. $2Al(s) + 6H_3O^+(aq) \longrightarrow 2Al^{3+}(aq) + 9H_2(g)$
 C. $2Al(s) + 6H_3O^+(aq) \longrightarrow 2Al^{3+}(aq) + 6H_2O(l) + 3H_2(g)$ D. none of them
33. Changing the temperature affects the rate of reaction because it affects:-
 A. the energy of activated complex B. the enthalpy of reaction
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34. In the reaction NO_2^- ions with water, which of the following is conjugate acid-base pair?
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 A. 2-propanol B. 1-propanol C. ethyl methyl ether D. 2-propanone
36. If the value of equilibrium constant for gaseous reaction is equal to 300 at given temperature, what is the value of equilibrium constant for the reaction by doubling the volume of reaction vessel, at the same temperature?
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41. A hydrocarbon that contains delocalized electrons:-
 A. graphite B. benzene C. cyclohexane D. both (A and B) are correct

42. Which of the following reactions represent the hydrolysis reaction?
 A. $H_2CO_3(aq) + H_2O(l) \rightleftharpoons HCO_3^-(aq) + H_3O^+(aq)$ B. $CH_3NH_2(aq) + H_2O(l) \rightleftharpoons CH_3NH_3^+(aq) + OH^-(aq)$
 C. $NH_4^+(aq) + H_2O(l) \rightleftharpoons NH_3(aq) + H_3O^+(aq)$ D. all of them are correct
43. Which of the following compounds form hydrogen bond with water?
 A. ethers B. benzene C. alcohols D. both (A and C) are correct
44. The general formula for esters is:-
 A. $R-CO-R$ B. $R-COO-R$ C. $R-COOH$ D. $R-O-R$
45. This reaction: $CH_2=CH-CH_3 + HCl \longrightarrow$ 2-chloro propane, is called:-
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46. In this reaction: $H_2(g) + I_2(g) \rightleftharpoons 2HI(g)$, at $425^\circ C$ is found at equilibrium:
 $[H_2] = 1.83 \times 10^{-3} M$, $[I_2] = 3.13 \times 10^{-3} M$ and $[HI] = 1.77 \times 10^{-2} M$, which of the following is correct?
 A. reactants are favored B. a small amount of reactants converted into products
 C. products are favored D. both (A and B) are correct.
47. When comparing the expected and actual freezing point of an aqueous solution of MgI_2 with 1.0 m concentration, which of the following is correct? If the actual freezing point is equal to $-4.78^\circ C$ and K_f of water = $-1.86^\circ C/m$.
 A. the expected freezing point is equal to the actual freezing point.
 B. the expected freezing point is lower than the actual freezing point
 C. the expected freezing point is higher than the actual freezing point
 D. none of them
48. Suppose that 15 mL of 0.025 M H_2SO_4 is required to neutralize 10 mL of KOH solution, what is the molarity of the base?
 A. 0.025 B. 0.0125 C. 0.075 D. 0.0075
49. In the second ionization stage of phosphoric acid in its aqueous solution.....are produced.
 A. HPO_4^{2-} and H_3O^+ B. $H_2PO_4^-$ and H_3O^+ C. PO_4^{3-} and H_3O^+ D. all of them
50. In the adjacent energy diagram after using catalyst the value of E_a :-
 A. is equal to 100 kJ/mol
 B. is greater than 100 kJ/mol
 C. is less than 100 kJ/mol
 D. cannot be determined





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

1. Which of the following solutions with the same concentration has the highest vapor- pressure?

- A. AlCl_3 B. NaNO_3 C. $\text{C}_6\text{H}_{12}\text{O}_6$ D. CaCl_2

2. In this reaction: $\text{H}_2(\text{g}) + \text{I}_2(\text{g}) \rightleftharpoons 2\text{HI}(\text{g})$, at 425°C is found at equilibrium:

$[\text{H}_2] = 1.83 \times 10^{-3}\text{M}$, $[\text{I}_2] = 3.13 \times 10^{-3}\text{M}$ and $[\text{HI}] = 1.77 \times 10^{-2}\text{M}$, which of the following is correct?

- A. reactants are favored B. a small amount of reactants converted into products
 C. products are favored D. both (A and B) are correct.

3. Which of the following compounds **cannot** be monomer for the addition polymer?

- A. C_2H_4 B. CH_3COOH C. C_2F_4 D. $\text{CH}_2=\text{CH}-\text{CH}_3$

4. The general formula for esters is:-

- A. $\text{R}-\text{CO}-\text{R}$ B. $\text{R}-\text{COO}-\text{R}$ C. $\text{R}-\text{COOH}$ D. $\text{R}-\text{O}-\text{R}$

5. Which of the following two conditions will favor a spontaneous reaction?

- A. $\Delta\text{H} < 0$ and $\Delta\text{S} > 0$ B. $\Delta\text{H} > 0$ and $\Delta\text{S} > 0$ C. $\Delta\text{H} > 0$ and $\Delta\text{S} < 0$ D. $\Delta\text{H} < 0$ and $\Delta\text{S} < 0$

6. In the aqueous solution of KCN, the water reacts with:-

- A. K^+ and produces strong base B. K^+ and produces weak base
 C. CN^- and produces strong acid D. CN^- and produces weak acid

7. The equilibrium self-ionization equation of water at 25°C is: $2\text{H}_2\text{O}(\text{l}) + \text{energy} \rightleftharpoons \text{H}_3\text{O}^+(\text{aq}) + \text{OH}^-(\text{aq})$, by decreasing the temperature which of the following is incorrect?

- A. the pH value increases B. the pOH value decreases
 C. the K_w value decreases D. none of them

8. An aqueous solution of hydrogen fluoride weakly conducts an electric current because :-

- A. it is ionized partially B. the hydrogen- fluorine bond is strong
 C. the hydrogen- fluorine bond is weak D. both (A and B) are correct

9. The anion of the acid that stomach produces:-

- A. is a strong conjugate base B. it acts as amphoteric
 C. is a weak conjugate acid D. it has a little tendency to attract a proton

10. When the ammonia molecule reacts with the hydrogen ion (proton) :-

- A. ammonia molecule is an electron-pair accepter B. ammonia acts as Arrhenius base
 C. proton acts as Lewis acid D. both (A and C) are correct

11. Suppose that 15mL of 0.025M H_2SO_4 is required to neutralize 10mL of KOH solution, what is the molarity of the base?

- A. 0.025 B. 0.0125 C. 0.075 D. 0.0075

12. In a saturated solution the concentration.....

- A. is always high B. is always low
 C. may be high or low, depending on the solubility of the solute D. cannot be determined

13. The correct name for this compound: (1-ethyl-3-methyl propane) according to IUPAC system is:

- A. hexane B. 2-methyl pentane C. 3-methyl pentane D. 2,3-dimethyl butane

14. In the titration acid and base process the equivalence point is determined by :-

- A. suitable indicator B. pH meter C. transition interval D. both (A and B) are correct

15. How many moles of nitrate ions are produced by dissolving 0.15 mol of zinc nitrate in water?

- A. 0.30 B. 0.15 C. 0.45 D. 2.0

16. Which of the following reactions represent the hydrolysis reaction?

- A. $\text{H}_2\text{CO}_3(\text{aq}) + \text{H}_2\text{O}(\text{l}) \rightleftharpoons \text{HCO}_3^-(\text{aq}) + \text{H}_3\text{O}^+(\text{aq})$ B. $\text{CH}_3\text{NH}_2(\text{aq}) + \text{H}_2\text{O}(\text{l}) \rightleftharpoons \text{CH}_3\text{NH}_3^+(\text{aq}) + \text{OH}^-(\text{aq})$
 C. $\text{NH}_4^+(\text{aq}) + \text{H}_2\text{O}(\text{l}) \rightleftharpoons \text{NH}_3(\text{aq}) + \text{H}_3\text{O}^+(\text{aq})$ D. all of them are correct

17. Which of the following pairs of solutions produce a precipitate when combined?

- A. NH_4Cl and NaOH B. KCl and Na_2SO_4 C. $\text{Fe}(\text{NO}_3)_3$ and KCl D. NH_4Cl and AgNO_3

18. When one gram of iron is heated to 100.0°C and cooled to 50.0°C in a calorimeter transfers 22.5 J of energy to the surrounding water. But one gram of silver transfers 11.8 J of energy under the same conditions, the difference of the value of transfer energy depends on the:-

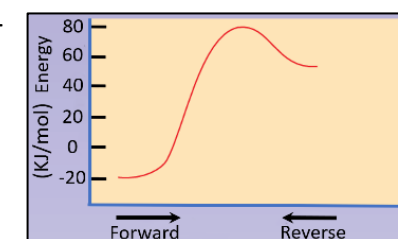
- A. mass of the material B. temperature change C. nature of the material D. all of them

19. The molal boiling-point constant (K_b) depends on the:-

- A. nature of solute B. number of solvent moles C. nature of solvent D. solute concentration

20. In the adjacent energy diagram after using catalyst the value of E_a :-

- A. is equal to 100 kJ/mol
 B. is greater than 100 kJ/mol
 C. is less than 100 kJ/mol
 D. cannot be determined



21. If the value of equilibrium constant for gaseous reaction is equal to 300 at given temperature, what is the value of equilibrium constant for the reaction by doubling the volume of reaction vessel, at the same temperature?

- A. 300 B. 600 C. 900 D. 150

22. Changing the temperature affects the rate of reaction because it affects:-

- A. the energy of activated complex B. the enthalpy of reaction
 C. the number of effective collision D. the properties of reactants

23. In this reaction: $\text{Al}(\text{s}) + \text{H}_2\text{SO}_4(\text{aq}) \longrightarrow$, which of the following is the net ionic equation?

- A. $\text{H}_3\text{O}^+(\text{aq}) + \text{OH}^-(\text{aq}) \longrightarrow 2\text{H}_2\text{O}(\text{l})$ B. $2\text{Al}(\text{s}) + 6\text{H}_3\text{O}^+(\text{aq}) \longrightarrow 2\text{Al}^{3+}(\text{aq}) + 9\text{H}_2(\text{g})$
 C. $2\text{Al}(\text{s}) + 6\text{H}_3\text{O}^+(\text{aq}) \longrightarrow 2\text{Al}^{3+}(\text{aq}) + 6\text{H}_2\text{O}(\text{l}) + 3\text{H}_2(\text{g})$ D. none of them

24. Which of the following compounds formed hydrogen bond with water?

- A. ethers B. benzene C. alcohols D. both (A and C) are correct

25. In a titration experiment, by using phenolphthalein indicator ($\text{pH}=8.0-10.0$), 0.5mol of which of the following acids neutralizes 0.5mol of NaOH ?

- A. H_3PO_4 B. HF C. HCl D. both (A and B)

26. The calcium sulfate salt is produce by the reaction between the:-

- A. Ca and H_2SO_4 B. $\text{Ca}(\text{OH})_2$ and H_2SO_4 C. $\text{Ca}(\text{OH})_2$ and H_2SO_3 D. both (A and B) are correct

27. Determine the concentration of fluoride ions in a saturated solution of CaF_2 , If the K_{sp} of CaF_2 is 5.3×10^{-9} .
 A. $2.2 \times 10^{-3} \text{M}$ B. $1.1 \times 10^{-3} \text{M}$ C. $1.325 \times 10^{-5} \text{M}$ D. $1.1 \times 10^{-4} \text{M}$
28. Which of the following exhibits properties of an Arrhenius acid?
 A. hydrogen chloride that is dissolved in water B. the pure hydrogen chloride gas
 C. hydrogen chloride that is dissolved in nonpolar solvent D. all of them
29. A hydrocarbon that contains delocalized electrons:-
 A. graphite B. benzene C. cyclohexane D. both (A and B) are correct
30. The rate law for a reaction is found to be: $R = k[X][Y]^2$, by what factor does the rate increase if [Y] tripled?
 A. 3 B. 6 C. 27 D. 9
31. In a reaction, $\Delta G^\circ = 142.0 \text{ kJ/mol}$ and $\Delta H^\circ = 206.1 \text{ kJ/mol}$, at room temperature which of the following is correct?
 A. the entropy of the reactants is greater B. the entropy of the products is greater
 C. the entropy of reactants and the products is equal D. none of them
32. In this reaction: $2\text{H}_2(\text{g}) + \text{O}_2(\text{g}) \longrightarrow 2\text{H}_2\text{O}(\text{l}) + 571.6 \text{ kJ}$, which of the following is correct?
 A. ΔH°_f of water = -285.8 kJ/mol B. ΔH°_f of water = $+285.8 \text{ kJ/mol}$
 C. ΔH° of reverse reaction = $+571.6 \text{ kJ/mol}$ D. both (A and C) are correct
33. One of the following **cannot** be isomer for $\text{C}_3\text{H}_8\text{O}$:-
 A. 2-propanol B. 1-propanol C. ethyl methyl ether D. 2-propanon
34. By using the information in the adjacent table, 55g of which of the following element absorbed 3.562 kJ of energy if it was heated from 22.4°C to 94.6°C ?
 A. Ca B. Al
 C. Fe D. Au
- | Element | Ca | Al | Fe | Au |
|-----------------------|-------|-------|-------|-------|
| Specific heat J/(g.K) | 0.647 | 0.897 | 0.449 | 0.129 |
35. In the following hypothetical reaction: $\text{A} + \text{B} \longrightarrow \text{C} + \text{D}$ $\Delta H > 0$, which of the following is correct?
 A. the products are more stable B. the reactants are more stable
 C. the reaction is an exothermic D. none of them
36. Used in biology laboratories as a preservative for dead animals:-
 A. methanol B. acetic acid C. methanal D. methyl amine
37. All of the following may be alkene and cycloalkane **EXCEPT**:-
 A. C_3H_6 B. C_2H_4 C. C_5H_{10} D. C_4H_8
38. This hypothetical reaction: $\text{A} + \text{B} \longrightarrow 2\text{C}$, is occur in one step-mechanism, what is the value of the specific rate constant for reverse reaction when $[\text{C}] = 0.015 \text{M}$ and the rate of reaction is equal to $1.1 \times 10^{-3} \text{M/s}$?
 A. $4.9 \text{ M}^{-1}\text{s}^{-1}$ B. 4.9 s^{-1} C. $0.2 \text{ M}^{-1}\text{s}^{-1}$ D. 0.2 s^{-1}
39. All of the following are affect the rate of reaction between hydrogen gas and chlorine gas **EXCEPT**:-
 A. surface area B. temperature C. presence catalyst D. concentration
40. In the reaction NO_2^- ions with water, which of the following is conjugate acid –base pair?
 A. H_2O and H_3O^+ B. HNO_2 and NO_2^- C. H_2O and OH^- D. both (B and C) are correct

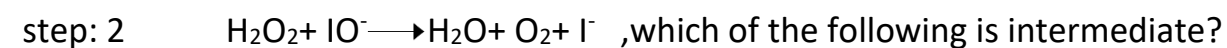
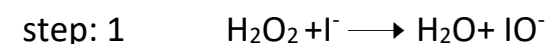
41. This reaction: $2\text{H}_2\text{O}_2 \longrightarrow 2\text{H}_2\text{O} + \text{O}_2$, by using catalyst has the following proposed mechanism:-
 step: 1 $\text{H}_2\text{O}_2 + \text{I}^- \longrightarrow \text{H}_2\text{O} + \text{IO}^-$
 step: 2 $\text{H}_2\text{O}_2 + \text{IO}^- \longrightarrow \text{H}_2\text{O} + \text{O}_2 + \text{I}^-$, which of the following is intermediate?
 A. I^- B. H_2O C. IO^- D. both (A and C) are correct
42. Which of the following is correct?
 A. the boiling point of pentane greater than 2-methyl butane.
 B. the carbon atom hybridization type of C_2H_2 is sp^2 .
 C. the graphite is a good conductor of heat.
 D. the molecular formula of methyl benzene is C_6H_8 .
43. Which of the following can have geometric isomers?
 A. CH_2Cl_2 B. $\text{C}_2\text{H}_4\text{Cl}_2$ C. $\text{C}_2\text{H}_2\text{Cl}_2$ D. none of them
44. This reaction: $\text{CH}_2=\text{CH}-\text{CH}_3 + \text{HCl} \longrightarrow$ 2-chloro propane, is called:-
 A. substitution B. addition C. condensation D. elimination
45. If a small amounts of HCl added to a solution of HNO_2 and KNO_2 , which of the following decreases?
 A. pH B. ionization of HNO_2 C. $[\text{OH}^-]$ D. all of them are Correct
46. Which of the following types of molecular representations **cannot** be used to show differences between isomers?
 A. molecular formula B. three-dimensional drawing or model
 C. structural formula D. both (B and C) are correct
47. If the $[\text{H}_3\text{O}^+]$ of aqueous solution of $\text{Ca}(\text{OH})_2$ is equal to $1.0 \times 10^{-8} \text{M}$, what is the molarity of $\text{Ca}(\text{OH})_2$?
 A. 1.0×10^{-6} B. 5.0×10^{-7} C. 1.0×10^{-8} D. 2.0×10^{-6}
48. The acidity of which of the following aqueous solutions at 25°C is highest?
 A. $\text{pOH} = 13$ B. $[\text{H}_3\text{O}^+] = 1.0 \times 10^{-7} \text{M}$ C. $[\text{OH}^-] = 1.0 \times 10^{-4} \text{M}$ D. $\text{pH} = 12$
49. In the second ionization stage of phosphoric acid in its aqueous solution.....are produced.
 A. HPO_4^{2-} and H_3O^+ B. H_2PO_4^- and H_3O^+ C. PO_4^{3-} and H_3O^+ D. all of them
50. When comparing the expected and actual freezing point of an aqueous solution of MgI_2 with 1.0 m concentration, which of the following is correct? If the actual freezing point is equal to -4.78°C and K_f of water = $-1.86^\circ\text{C}/m$.
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Answer the following questions: (two marks for each correct choice)

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 A. 2-propanol B. 1-propanol C. ethyl methyl ether D. 2-propanon
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 A. nature of solute B. number of solvent moles C. nature of solvent D. solute concentration
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 A. graphite B. benzene C. cyclohexane D. both (A and B) are correct
- If the value of equilibrium constant for gaseous reaction is equal to 300 at given temperature, what is the value of equilibrium constant for the reaction by doubling the volume of reaction vessel, at the same temperature?
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 $[\text{H}_2] = 1.83 \times 10^{-3}\text{M}$, $[\text{I}_2] = 3.13 \times 10^{-3}\text{M}$ and $[\text{HI}] = 1.77 \times 10^{-2}\text{M}$, which of the following is correct?
 A. reactants are favored B. a small amount of reactants converted into products
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- The correct name for this compound: (1-ethyl-3-methyl propane) according to IUPAC system is:
 A. hexane B. 2-methyl pentane C. 3-methyl pentane D. 2,3-dimethyl butane
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- A. 0.30 B. 0.15 C. 0.45 D. 2.0

21. Used in biology laboratories as a preservative for dead animals:-

- A. methanol B. acetic acid C. methanal D. methyl amine

22. Which of the following two conditions will favor a spontaneous reaction?

- A. $\Delta H < 0$ and $\Delta S > 0$ B. $\Delta H > 0$ and $\Delta S > 0$ C. $\Delta H > 0$ and $\Delta S < 0$ D. $\Delta H < 0$ and $\Delta S < 0$

23. If the $[\text{H}_3\text{O}^+]$ of aqueous solution of $\text{Ca}(\text{OH})_2$ is equal to $1.0 \times 10^{-8}\text{M}$, what is the molarity of $\text{Ca}(\text{OH})_2$?

- A. 1.0×10^{-6} B. 5.0×10^{-7} C. 1.0×10^{-8} D. 2.0×10^{-6}

24. When comparing the expected and actual freezing point of an aqueous solution of MgI_2 with 1.0 m concentration, which of the following is correct? If the actual freezing point is equal to -4.78°C and K_f of water = $-1.86^\circ\text{C}/m$.

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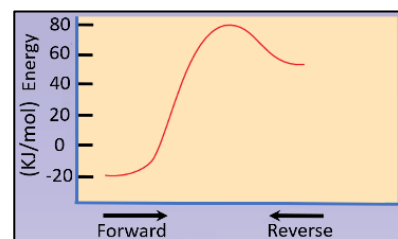
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27. The acidity of which of the following aqueous solutions at 25°C is highest?

- A. $\text{pOH}=13$ B. $[\text{H}_3\text{O}^+]=1.0 \times 10^{-7}\text{M}$ C. $[\text{OH}^-]=1.0 \times 10^{-4}\text{M}$ D. $\text{pH}=12$

28. In the adjacent energy diagram after using catalyst the value of E_a :-

- A. is equal to 100 kJ/mol
B. is greater than 100 kJ/mol
C. is less than 100 kJ/mol
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29. By using the information in the adjacent table, 55g of which of the following element absorbed 3.562 kJ of energy if it was heated from 22.4°C to 94.6°C?

- A. Ca
B. Al
C. Fe
D. Au

Element	Ca	Al	Fe	Au
Specific heat J/(g.K)	0.647	0.897	0.449	0.129

30. In the aqueous solution of KCN, the water reacts with:-

- A. K^+ and produces strong base
B. K^+ and produces weak base
C. CN^- and produces strong acid
D. CN^- and produces weak acid

31. Which of the following compounds formed hydrogen bond with water?

- A. ethers
B. benzene
C. alcohols
D. both (A and C) are correct

32. In a reaction, $\Delta G^0 = 142.0$ kJ/mol and $\Delta H^0 = 206.1$ kJ/mol, at room temperature which of the following is correct?

- A. the entropy of the reactants is greater
B. the entropy of the products is greater
C. the entropy of reactants and the products is equal
D. none of them

33. In this reaction: $2H_2(g) + O_2(g) \rightarrow 2H_2O(l) + 571.6$ kJ, which of the following is correct?

- A. ΔH_f^0 of water = -285.8 kJ/mol
B. ΔH_f^0 of water = +285.8 kJ/mol
C. ΔH^0 of reverse reaction = +571.6 kJ/mol
D. both (A and C) are correct

34. Which of the following solutions with the same concentration has the highest vapor- pressure?

- A. $AlCl_3$
B. $NaNO_3$
C. $C_6H_{12}O_6$
D. $CaCl_2$

35. Which of the following is correct?

- A. the boiling point of pentane greater than 2-methyl butane.
B. the carbon atom hybridization type of C_2H_2 is sp^2 .
C. the graphite is a good conductor of heat.
D. the molecular formula of methyl benzene is C_6H_8 .

36. In the reaction NO_2^- ions with water, which of the following is conjugate acid-base pair?

- A. H_2O and H_3O^+
B. HNO_2 and NO_2^-
C. H_2O and OH^-
D. both (B and C) are correct

37. Determine the concentration of fluoride ions in a saturated solution of CaF_2 , If the

- K_{sp} of CaF_2 is 5.3×10^{-9} .
A. $2.2 \times 10^{-3} M$
B. $1.1 \times 10^{-3} M$
C. $1.325 \times 10^{-5} M$
D. $1.1 \times 10^{-4} M$

38. In a saturated solution the concentration.....

- A. is always high
B. is always low
C. may be high or low, depending on the solubility of the solute
D. cannot be determined

39. Which of the following pairs of solutions produce a precipitate when combined?

- A. NH_4Cl and $NaOH$
B. KCl and Na_2SO_4
C. $Fe(NO_3)_3$ and KCl
D. NH_4Cl and $AgNO_3$

40. When the ammonia molecule reacts with the hydrogen ion (proton) :-

- A. ammonia molecule is an electron-pair acceptor
B. ammonia acts as Arrhenius base
C. proton acts as Lewis acid
D. both (A and C) are correct

41. Which of the following compounds **cannot** be monomer for the addition polymer?

- A. C_2H_4
B. CH_3COOH
C. C_2F_4
D. $CH_2=CH-CH_3$

42. The equilibrium self-ionization equation of water at 25°C is: $2H_2O(l) + \text{energy} \rightleftharpoons H_3O^+(aq) + OH^-(aq)$, by decreasing the temperature which of the following is incorrect?

- A. the pH value increases
B. the pOH value decreases
C. the K_w value decreases
D. none of them

43. The general formula for esters is:-

- A. $R-CO-R$
B. $R-COO-R$
C. $R-COOH$
D. $R-O-R$

44. In this reaction: $Al(s) + H_2SO_4(aq) \rightarrow$, which of the following is the net ionic equation?

- A. $H_3O^+(aq) + OH^-(aq) \rightarrow 2H_2O(l)$
B. $2Al(s) + 6H_3O^+(aq) \rightarrow 2Al^{3+}(aq) + 9H_2(g)$
C. $2Al(s) + 6H_3O^+(aq) \rightarrow 2Al^{3+}(aq) + 6H_2O(l) + 3H_2(g)$
D. none of them

45. An aqueous solution of hydrogen fluoride weakly conducts an electric current because :-

- A. it is ionized partially
B. the hydrogen- fluorine bond is strong
C. the hydrogen- fluorine bond is weak
D. both (A and B) are correct

46. The rate law for a reaction is found to be: $R = k[X][Y]^2$, by what factor does the rate increase if [Y] tripled?

- A. 3
B. 6
C. 27
D. 9

47. Which of the following reactions represent the hydrolysis reaction?

- A. $H_2CO_3(aq) + H_2O(l) \rightleftharpoons HCO_3^-(aq) + H_3O^+(aq)$
B. $CH_3NH_2(aq) + H_2O(l) \rightleftharpoons CH_3NH_3^+(aq) + OH^-(aq)$
C. $NH_4^+(aq) + H_2O(l) \rightleftharpoons NH_3(aq) + H_3O^+(aq)$
D. all of them are correct

48. This hypothetical reaction: $A + B \rightarrow 2C$, is occur in one step-mechanism, what is the value of the specific rate constant for reverse reaction when $[C] = 0.015 M$ and the rate of reaction is equal to $1.1 \times 10^{-3} M/s$?

- A. $4.9 M^{-1}s^{-1}$
B. $4.9 s^{-1}$
C. $0.2 M^{-1}s^{-1}$
D. $0.2 s^{-1}$

49. The calcium sulfate salt is produce by the reaction between the:-

- A. Ca and H_2SO_4
B. $Ca(OH)_2$ and H_2SO_4
C. $Ca(OH)_2$ and H_2SO_3
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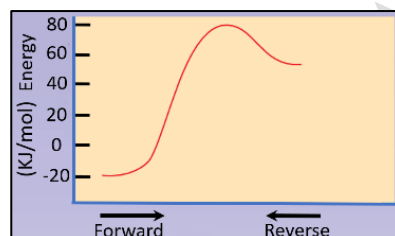
50. All of the following may be alkene and cycloalkane **EXCEPT**:-

- A. C_3H_6
B. C_2H_4
C. C_5H_{10}
D. C_4H_8



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

- Which of the following reactions represent the hydrolysis reaction?
 A. $\text{H}_2\text{CO}_3(\text{aq}) + \text{H}_2\text{O}(\text{l}) \rightleftharpoons \text{HCO}_3^-(\text{aq}) + \text{H}_3\text{O}^+(\text{aq})$
 B. $\text{CH}_3\text{NH}_2(\text{aq}) + \text{H}_2\text{O}(\text{l}) \rightleftharpoons \text{CH}_3\text{NH}_3^+(\text{aq}) + \text{OH}^-(\text{aq})$
 C. $\text{NH}_4^+(\text{aq}) + \text{H}_2\text{O}(\text{l}) \rightleftharpoons \text{NH}_3(\text{aq}) + \text{H}_3\text{O}^+(\text{aq})$
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- In the following hypothetical reaction: $\text{A} + \text{B} \rightarrow \text{C} + \text{D}$ $\Delta H > 0$, which of the following is correct?
 A. the products are more stable
 B. the reactants are more stable
 C. the reaction is an exothermic
 D. none of them
- Which of the following can have geometric isomers?
 A. CH_2Cl_2
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 C. $\text{C}_2\text{H}_2\text{Cl}_2$
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- Used in biology laboratories as a preservative for dead animals:-
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- A hydrocarbon that contains delocalized electrons:-
 A. graphite
 B. benzene
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- In the adjacent energy diagram after using catalyst the value of E_a :-
 A. is equal to 100 kJ/mol
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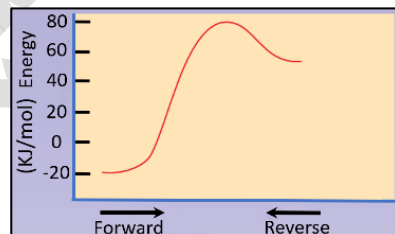
- Which of the following compounds **cannot** be monomer for the addition polymer?
 A. C_2H_4
 B. CH_3COOH
 C. C_2F_4
 D. $\text{CH}_2=\text{CH}-\text{CH}_3$
- Which of the following pairs of solutions produce a precipitate when combined?
 A. NH_4Cl and NaOH
 B. KCl and Na_2SO_4
 C. $\text{Fe}(\text{NO}_3)_3$ and KCl
 D. NH_4Cl and AgNO_3
- When comparing the expected and actual freezing point of an aqueous solution of MgI_2 with 1.0 *m* concentration, which of the following is correct? If the actual freezing point is equal to -4.78°C and K_f of water = $-1.86^\circ\text{C}/m$.
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- In the second ionization stage of phosphoric acid in its aqueous solution.....are produced.
 A. HPO_4^{2-} and H_3O^+
 B. H_2PO_4^- and H_3O^+
 C. PO_4^{3-} and H_3O^+
 D. all of them
- Suppose that 15mL of 0.025M H_2SO_4 is required to neutralize 10mL of KOH solution, what is the molarity of the base?
 A. 0.025
 B. 0.0125
 C. 0.075
 D. 0.0075
- The general formula for esters is:-
 A. $\text{R}-\text{CO}-\text{R}$
 B. $\text{R}-\text{COO}-\text{R}$
 C. $\text{R}-\text{COOH}$
 D. $\text{R}-\text{O}-\text{R}$
- When one gram of iron is heated to 100.0°C and cooled to 50.0°C in a calorimeter transfers 22.5 J of energy to the surrounding water. But one gram of silver transfers 11.8 J of energy under the same conditions, the difference of the value of transfer energy depends on the:-
 A. mass of the material
 B. temperature change
 C. nature of the material
 D. all of them
- If the value of equilibrium constant for gaseous reaction is equal to 300 at given temperature, what is the value of equilibrium constant for the reaction by doubling the volume of reaction vessel, at the same temperature?
 A. 300
 B. 600
 C. 900
 D. 150
- The equilibrium self-ionization equation of water at 25°C is: $2\text{H}_2\text{O}(\text{l}) + \text{energy} \rightleftharpoons \text{H}_3\text{O}^+(\text{aq}) + \text{OH}^-(\text{aq})$, by decreasing the temperature which of the following is incorrect?
 A. the pH value increases
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- Which of the following exhibits properties of an Arrhenius acid?
 A. hydrogen chloride that is dissolved in water
 B. the pure hydrogen chloride gas
 C. hydrogen chloride that is dissolved in nonpolar solvent
 D. all of them
- How many moles of nitrate ions are produced by dissolving 0.15 mol of zinc nitrate in water?
 A. 0.30
 B. 0.15
 C. 0.45
 D. 2.0
- Which of the following is correct?
 A. the boiling point of pentane greater than 2-methyl butane.
 B. the carbon atom hybridization type of C_2H_2 is sp^2 .
 C. the graphite is a good conductor of heat.
 D. the molecular formula of methyl benzene is C_6H_8 .
- In this reaction: $2\text{H}_2(\text{g}) + \text{O}_2(\text{g}) \rightarrow 2\text{H}_2\text{O}(\text{l}) + 571.6 \text{ kJ}$, which of the following is correct?
 A. ΔH_f° of water = -285.8 kJ/mol
 B. ΔH_f° of water = $+285.8 \text{ kJ/mol}$
 C. ΔH° of reverse reaction = $+571.6 \text{ kJ/mol}$
 D. both (A and C) are correct
- The correct name for this compound: (1-ethyl-3-methyl propane) according to IUPAC system is:
 A. hexane
 B. 2-methyl pentane
 C. 3-methyl pentane
 D. 2,3-dimethyl butane
- An aqueous solution of hydrogen fluoride weakly conducts an electric current because :-
 A. it is ionized partially
 B. the hydrogen- fluorine bond is strong
 C. the hydrogen- fluorine bond is weak
 D. both (A and B) are correct
- Which of the following two conditions will favor a spontaneous reaction?
 A. $\Delta H < 0$ and $\Delta S > 0$
 B. $\Delta H > 0$ and $\Delta S > 0$
 C. $\Delta H > 0$ and $\Delta S < 0$
 D. $\Delta H < 0$ and $\Delta S < 0$
- If the $[\text{H}_3\text{O}^+]$ of aqueous solution of $\text{Ca}(\text{OH})_2$ is equal to $1.0 \times 10^{-8} \text{ M}$, what is the molarity of $\text{Ca}(\text{OH})_2$?
 A. 1.0×10^{-6}
 B. 5.0×10^{-7}
 C. 1.0×10^{-8}
 D. 2.0×10^{-6}



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

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 A. hexane B. 2-methyl pentane C. 3-methyl pentane D. 2,3-dimethyl butane
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 A. the expected freezing point is equal to the actual freezing point.
 B. the expected freezing point is lower than the actual freezing point
 C. the expected freezing point is higher than the actual freezing point
 D. none of them
- If a small amounts of HCl added to a solution of HNO_2 and KNO_2 , which of the following decreases?
 A. pH B. ionization of HNO_2 C. $[OH^-]$ D. all of them are Correct
- In a saturated solution the concentration.....
 A. is always high B. is always low
 C. may be high or low, depending on the solubility of the solute D. cannot be determined
- All of the following are affect the rate of reaction between hydrogen gas and chlorine gas **EXCEPT**:-
 A. surface area B. temperature C. presence catalyst D. concentration
- When the ammonia molecule reacts with the hydrogen ion (proton) :-
 A. ammonia molecule is an electron-pair accepter B. ammonia acts as Arrhenius base
 C. proton acts as Lewis acid D. both (A and C) are correct
- In the titration acid and base process the equivalence point is determined by :-
 A. suitable indicator B. pH meter C. transition interval D. both (A and B) are correct
- In the aqueous solution of KCN, the water reacts with:-
 A. K^+ and produces strong base B. K^+ and produces weak base
 C. CN^- and produces strong acid D. CN^- and produces weak acid
- In the adjacent energy diagram after using catalyst the value of E_a :-
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 C. the hydrogen- fluorine bond is weak D. both (A and B) are correct
- This reaction: $2H_2O_2 \longrightarrow 2H_2O + O_2$, by using catalyst has the following proposed mechanism:-
 step: 1 $H_2O_2 + I^- \longrightarrow H_2O + IO^-$
 step: 2 $H_2O_2 + IO^- \longrightarrow H_2O + O_2 + I^-$, which of the following is intermediate?
 A. I^- B. H_2O C. IO^- D. both (A and C) are correct
- In this reaction: $2H_2(g) + O_2(g) \longrightarrow 2H_2O(l) + 571.6 kJ$, which of the following is correct?
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- Which of the following compounds **cannot** be monomer for the addition polymer?
 A. C_2H_4 B. CH_3COOH C. C_2F_4 D. $CH_2=CH-CH_3$
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 C. $NH_4^+(aq) + H_2O(l) \rightleftharpoons NH_3(aq) + H_3O^+(aq)$ D. all of them are correct
- Which of the following solutions with the same concentration has the highest vapor- pressure?
 A. $AlCl_3$ B. $NaNO_3$ C. $C_6H_{12}O_6$ D. $CaCl_2$
- In this reaction: $Al(s) + H_2SO_4(aq) \longrightarrow$, which of the following is the net ionic equation?
 A. $H_3O^+(aq) + OH^-(aq) \longrightarrow 2H_2O(l)$ B. $2Al(s) + 6H_3O^+(aq) \longrightarrow 2Al^{3+}(aq) + 9H_2(g)$
 C. $2Al(s) + 6H_3O^+(aq) \longrightarrow 2Al^{3+}(aq) + 6H_2O(l) + 3H_2(g)$ D. none of them
- Determine the concentration of fluoride ions in a saturated solution of CaF_2 , If the K_{sp} of CaF_2 is 5.3×10^{-9} .
 A. $2.2 \times 10^{-3} M$ B. $1.1 \times 10^{-3} M$ C. $1.325 \times 10^{-5} M$ D. $1.1 \times 10^{-4} M$
- In the second ionization stage of phosphoric acid in its aqueous solution.....are produced.
 A. HPO_4^{2-} and H_3O^+ B. $H_2PO_4^-$ and H_3O^+ C. PO_4^{3-} and H_3O^+ D. all of them
- This reaction: $CH_2=CH-CH_3 + HCl \longrightarrow$ 2-chloro propane, is called:-
 A. substitution B. addition C. condensation D. elimination
- Which of the following two conditions will favor a spontaneous reaction?
 A. $\Delta H < 0$ and $\Delta S > 0$ B. $\Delta H > 0$ and $\Delta S > 0$ C. $\Delta H > 0$ and $\Delta S < 0$ D. $\Delta H < 0$ and $\Delta S < 0$

25. By using the information in the adjacent table, 55g of which of the following element absorbed 3.562 kJ of energy if it was heated from 22.4°C to 94.6°C?

- A. Ca B. Al
C. Fe D. Au

Element	Ca	Al	Fe	Au
Specific heat J/(g.K)	0.647	0.897	0.449	0.129

26. The molal boiling-point constant (K_b) depends on the:-

- A. nature of solute B. number of solvent moles C. nature of solvent D. solute concentration

27. All of the following may be alkene and cycloalkane **EXCEPT**:-

- A. C_3H_6 B. C_2H_4 C. C_5H_{10} D. C_4H_8

28. In the following hypothetical reaction: $A+B \longrightarrow C+D$ $\Delta H > 0$, which of the following is correct?

- A. the products are more stable B. the reactants are more stable
C. the reaction is an exothermic D. none of them

29. In the reaction NO_2^- ions with water, which of the following is conjugate acid –base pair?

- A. H_2O and H_3O^+ B. HNO_2 and NO_2^- C. H_2O and OH^- D. both (B and C) are correct

30. Changing the temperature affects the rate of reaction because it affects:-

- A. the energy of activated complex B. the enthalpy of reaction
C. the number of effective collision D. the properties of reactants

31. How many moles of nitrate ions are produced by dissolving 0.15 mol of zinc nitrate in water?

- A. 0.30 B. 0.15 C. 0.45 D. 2.0

32. Which of the following is correct?

- A. the boiling point of pentane greater than 2-methyl butane.
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- A. hydrogen chloride that is dissolved in water B. the pure hydrogen chloride gas
C. hydrogen chloride that is dissolved in nonpolar solvent D. all of them

34. The general formula for esters is:-

- A. $R-CO-R$ B. $R-COO-R$ C. $R-COOH$ D. $R-O-R$

35. The acidity of which of the following aqueous solutions at 25°C is highest?

- A. $pOH=13$ B. $[H_3O^+]=1.0 \times 10^{-7}M$ C. $[OH^-]=1.0 \times 10^{-4}M$ D. $pH=12$

36. Which of the following compounds formed hydrogen bond with water?

- A. ethers B. benzene C. alcohols D. both (A and C) are correct

37. In a titration experiment, by using phenolphthalein indicator ($pH=8.0-10.0$), 0.5mol of which of the following acids neutralizes 0.5mol of NaOH? A. H_3PO_4 B. HF C. HCl D. both (A and B)

38. Which of the following pairs of solutions produce a precipitate when combined?

- A. NH_4Cl and NaOH B. KCl and Na_2SO_4 C. $Fe(NO_3)_3$ and KCl D. NH_4Cl and $AgNO_3$

39. The equilibrium self-ionization equation of water at 25°C is: $2H_2O(l)+energy \rightleftharpoons H_3O^+(aq)+OH^-(aq)$, by decreasing the temperature which of the following is incorrect?

- A. the pH value increases B. the pOH value decreases
C. the K_w value decreases D. none of them

40. A hydrocarbon that contains delocalized electrons:-

- A. graphite B. benzene C. cyclohexane D. both (A and B) are correct

41. In a reaction, $\Delta G^0=142.0$ kJ/mol and $\Delta H^0=206.1$ kJ/mol , at room temperature which of the following is correct?

- A. the entropy of the reactants is greater B. the entropy of the products is greater
C. the entropy of reactants and the products is equal D. none of them

42. The rate law for a reaction is found to be: $R=k[X][Y]^2$, by what factor does the rate increase if [Y] tripled? A. 3 B. 6 C. 27 D. 9

43. In this reaction: $H_2(g)+I_2(g) \rightleftharpoons 2HI(g)$, at 425°C is found at equilibrium:

$[H_2] = 1.83 \times 10^{-3}M$, $[I_2] = 3.13 \times 10^{-3}M$ and $[HI] = 1.77 \times 10^{-2}M$, which of the following is correct?

- A. reactants are favored B. a small amount of reactants converted into products
C. products are favored D. both (A and B) are correct.

44. If the value of equilibrium constant for gaseous reaction is equal to 300 at given temperature, what is the value of equilibrium constant for the reaction by doubling the volume of reaction vessel, at the same temperature? A. 300 B. 600 C. 900 D. 150

45. Which of the following can have geometric isomers?

- A. CH_2Cl_2 B. $C_2H_4Cl_2$ C. $C_2H_2Cl_2$ D. none of them

46. If the $[H_3O^+]$ of aqueous solution of $Ca(OH)_2$ is equal to $1.0 \times 10^{-8}M$, what is the molarity of $Ca(OH)_2$?

- A. 1.0×10^{-6} B. 5.0×10^{-7} C. 1.0×10^{-8} D. 2.0×10^{-6}

47. Which of the following types of molecular representations **cannot** be used to show differences between isomers?

- A. molecular formula B. three-dimensional drawing or model
C. structural formula D. both (B and C) are correct

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50. One of the following **cannot** be isomer for C_3H_8O :-

- A. 2-propanol B. 1-propanol C. ethyl methyl ether D. 2-propanon



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

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- The acidity of which of the following aqueous solutions at $25^\circ C$ is highest?
 A. $pOH = 13$ B. $[H_3O^+] = 1.0 \times 10^{-7} M$ C. $[OH^-] = 1.0 \times 10^{-4} M$ D. $pH = 12$
- The anion of the acid that stomach produces:-
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- When comparing the expected and actual freezing point of an aqueous solution of MgI_2 with $1.0 m$ concentration, which of the following is correct? If the actual freezing point is equal to $-4.78^\circ C$ and K_f of water = $-1.86^\circ C/m$.
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- An aqueous solution of hydrogen fluoride weakly conducts an electric current because :-
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 C. the hydrogen- fluorine bond is weak D. both (A and B) are correct
- This reaction: $CH_2=CH-CH_3 + HCl \longrightarrow$ 2-chloro propane, is called:-
 A. substitution B. addition C. condensation D. elimination

- 27.** The molal boiling-point constant (K_b) depends on the:-
A. nature of solute **B.** number of solvent moles **C.** nature of solvent **D.** solute concentration
- 28.** In a saturated solution the concentration.....
A. is always high **B.** is always low
C. may be high or low, depending on the solubility of the solute **D.** cannot be determined
- 29.** Which of the following is correct?
A. the boiling point of pentane greater than 2-methyl butane.
B. the carbon atom hybridization type of C_2H_2 is sp^2 .
C. the graphite is a good conductor of heat.
D. the molecular formula of methyl benzene is C_6H_8 .
- 30.** Which of the following exhibits properties of an Arrhenius acid?
A. hydrogen chloride that is dissolved in water **B.** the pure hydrogen chloride gas
C. hydrogen chloride that is dissolved in nonpolar solvent **D.** all of them
- 31.** Suppose that 15mL of 0.025M H_2SO_4 is required to neutralize 10mL of KOH solution, what is the molarity of the base?
A. 0.025 **B.** 0.0125 **C.** 0.075 **D.** 0.0075
- 32.** In this reaction: $2H_2(g) + O_2(g) \rightarrow 2H_2O(l) + 571.6 \text{ kJ}$, which of the following is correct?
A. ΔH_f° of water = -285.8 kJ/mol **B.** ΔH_f° of water = +285.8 kJ/mol
C. ΔH° of reverse reaction = +571.6 kJ/mol **D.** both (A and C) are correct
- 33.** The correct name for this compound: (1-ethyl-3-methyl propane) according to IUPAC system is:
A. hexane **B.** 2-methyl pentane **C.** 3-methyl pentane **D.** 2,3-dimethyl butane
- 34.** In this reaction: $Al(s) + H_2SO_4(aq) \rightarrow$, which of the following is the net ionic equation?
A. $H_3O^+(aq) + OH^-(aq) \rightarrow 2H_2O(l)$ **B.** $2Al(s) + 6H_3O^+(aq) \rightarrow 2Al^{3+}(aq) + 9H_2(g)$
C. $2Al(s) + 6H_3O^+(aq) \rightarrow 2Al^{3+}(aq) + 6H_2O(l) + 3H_2(g)$ **D.** none of them
- 35.** Which of the following pairs of solutions produce a precipitate when combined?
A. NH_4Cl and $NaOH$ **B.** KCl and Na_2SO_4 **C.** $Fe(NO_3)_3$ and KCl **D.** NH_4Cl and $AgNO_3$
- 36.** In the following hypothetical reaction: $A + B \rightarrow C + D$ $\Delta H > 0$, which of the following is correct?
A. the products are more stable **B.** the reactants are more stable
C. the reaction is an exothermic **D.** none of them
- 37.** When the ammonia molecule reacts with the hydrogen ion (proton) :-
A. ammonia molecule is an electron-pair accepter **B.** ammonia acts as Arrhenius base
C. proton acts as Lewis acid **D.** both (A and C) are correct
- 38.** If the $[H_3O^+]$ of aqueous solution of $Ca(OH)_2$ is equal to $1.0 \times 10^{-8} M$, what is the molarity of $Ca(OH)_2$?
A. 1.0×10^{-6} **B.** 5.0×10^{-7} **C.** 1.0×10^{-8} **D.** 2.0×10^{-6}
- 39.** How many moles of nitrate ions are produced by dissolving 0.15 mol of zinc nitrate in water?
A. 0.30 **B.** 0.15 **C.** 0.45 **D.** 2.0
- 40.** Which of the following two conditions will favor a spontaneous reaction?
A. $\Delta H < 0$ and $\Delta S > 0$ **B.** $\Delta H > 0$ and $\Delta S > 0$ **C.** $\Delta H > 0$ and $\Delta S < 0$ **D.** $\Delta H < 0$ and $\Delta S < 0$

- 41.** Which of the following compounds **cannot** be monomer for the addition polymer?
A. C_2H_4 **B.** CH_3COOH **C.** C_2F_4 **D.** $CH_2=CH-CH_3$
- 42.** The general formula for esters is:-
A. $R-CO-R$ **B.** $R-COO-R$ **C.** $R-COOH$ **D.** $R-O-R$
- 43.** By using the information in the adjacent table, 55g of which of the following element absorbed 3.562 kJ of energy if it was heated from $22.4^\circ C$ to $94.6^\circ C$?
A. Ca **B.** Al
C. Fe **D.** Au
- | Element | Ca | Al | Fe | Au |
|-----------------------|-------|-------|-------|-------|
| Specific heat J/(g.K) | 0.647 | 0.897 | 0.449 | 0.129 |
- 44.** Used in biology laboratories as a preservative for dead animals:-
A. methanol **B.** acetic acid **C.** methanal **D.** methyl amine
- 45.** If a small amounts of HCl added to a solution of HNO_2 and KNO_2 , which of the following decreases?
A. pH **B.** ionization of HNO_2 **C.** $[OH^-]$ **D.** all of them are Correct
- 46.** In the titration acid and base process the equivalence point is determined by :-
A. suitable indicator **B.** pH meter **C.** transition interval **D.** both (A and B) are correct
- 47.** In this reaction: $H_2(g) + I_2(g) \rightleftharpoons 2HI(g)$, at $425^\circ C$ is found at equilibrium:
 $[H_2] = 1.83 \times 10^{-3} M$, $[I_2] = 3.13 \times 10^{-3} M$ and $[HI] = 1.77 \times 10^{-2} M$, which of the following is correct?
A. reactants are favored **B.** a small amount of reactants converted into products
C. products are favored **D.** both (A and B) are correct.
- 48.** Which of the following types of molecular representations **cannot** be used to show differences between isomers?
A. molecular formula **B.** three-dimensional drawing or model
C. structural formula **D.** both (B and C) are correct
- 49.** In a reaction, $\Delta G^\circ = 142.0 \text{ kJ/mol}$ and $\Delta H^\circ = 206.1 \text{ kJ/mol}$, at room temperature which of the following is correct?
A. the entropy of the reactants is greater **B.** the entropy of the products is greater
C. the entropy of reactants and the products is equal **D.** none of them
- 50.** In the adjacent energy diagram after using catalyst the value of E_a :-



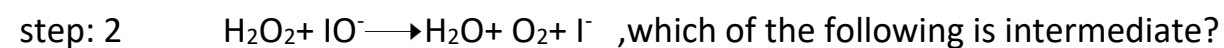
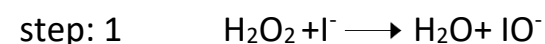
- A.** is equal to 100 kJ/mol
B. is greater than 100 kJ/mol
C. is less than 100 kJ/mol
D. cannot be determined



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

- One of the following **cannot** be isomer for C_3H_8O :-
 A. 2-propanol B. 1-propanol C. ethyl methyl ether D. 2-propanon
 - In a titration experiment, by using phenolphthalein indicator (pH=8.0-10.0), 0.5mol of which of the following acids neutralizes 0.5mol of NaOH? A. H_3PO_4 B. HF C. HCl D. both (A and B)
 - Used in biology laboratories as a preservative for dead animals:-
 A. methanol B. acetic acid C. methanal D. methyl amine
 - In the aqueous solution of KCN, the water reacts with:-
 A. K^+ and produces strong base B. K^+ and produces weak base
 C. CN^- and produces strong acid D. CN^- and produces weak acid
 - The anion of the acid that stomach produces:-
 A. is a strong conjugate base B. it acts as amphoteric
 C. is a weak conjugate acid D. it has a little tendency to attract a proton
 - This reaction: $CH_2=CH-CH_3 + HCl \longrightarrow$ 2-chloro propane, is called:-
 A. substitution B. addition C. condensation D. elimination
 - By using the information in the adjacent table, 55g of which of the following element absorbed 3.562 kJ of energy if it was heated from $22.4^\circ C$ to $94.6^\circ C$?
 A. Ca B. Al C. Fe D. Au
- | Element | Ca | Al | Fe | Au |
|-----------------------|-------|-------|-------|-------|
| Specific heat J/(g.K) | 0.647 | 0.897 | 0.449 | 0.129 |
- The equilibrium self-ionization equation of water at $25^\circ C$ is: $2H_2O(l) + \text{energy} \rightleftharpoons H_3O^+(aq) + OH^-(aq)$, by decreasing the temperature which of the following is incorrect?
 A. the pH value increases B. the pOH value decreases
 C. the K_w value decreases D. none of them
 - The molal boiling-point constant (K_b) depends on the:-
 A. nature of solute B. number of solvent moles C. nature of solvent D. solute concentration
 - The rate law for a reaction is found to be: $R=k[X][Y]^2$, by what factor does the rate increase if [Y] tripled?
 A. 3 B. 6 C. 27 D. 9
 - When the ammonia molecule reacts with the hydrogen ion (proton) :-
 A. ammonia molecule is an electron-pair acceptor B. ammonia acts as Arrhenius base
 C. proton acts as Lewis acid D. both (A and C) are correct
 - In the second ionization stage of phosphoric acid in its aqueous solution.....are produced.
 A. HPO_4^{2-} and H_3O^+ B. $H_2PO_4^-$ and H_3O^+ C. PO_4^{3-} and H_3O^+ D. all of them

13. This reaction: $2H_2O_2 \longrightarrow 2H_2O + O_2$, by using catalyst has the following proposed mechanism:-



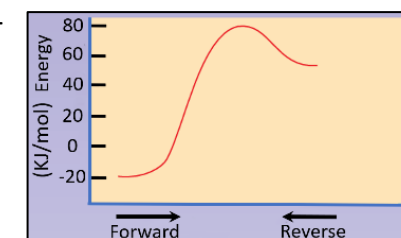
- A. I^- B. H_2O C. IO^- D. both (A and C) are correct

14. Changing the temperature affects the rate of reaction because it affects:-

- A. the energy of activated complex B. the enthalpy of reaction
 C. the number of effective collision D. the properties of reactants

15. In the adjacent energy diagram after using catalyst the value of E_a :-

- A. is equal to 100 kJ/mol
 B. is greater than 100 kJ/mol
 C. is less than 100 kJ/mol
 D. cannot be determined



16. In the titration acid and base process the equivalence point is determined by :-

- A. suitable indicator B. pH meter C. transition interval D. both (A and B) are correct

17. The correct name for this compound: (1-ethyl-3-methyl propane) according to IUPAC system is:

- A. hexane B. 2-methyl pentane C. 3-methyl pentane D. 2,3-dimethyl butane

18. A hydrocarbon that contains delocalized electrons:-

- A. graphite B. benzene C. cyclohexane D. both (A and B) are correct

19. Which of the following can have geometric isomers?

- A. CH_2Cl_2 B. $C_2H_4Cl_2$ C. $C_2H_2Cl_2$ D. none of them

20. In this reaction: $2H_2(g) + O_2(g) \longrightarrow 2H_2O(l) + 571.6 \text{ kJ}$, which of the following is correct?

- A. ΔH_f° of water = -285.8 kJ/mol B. ΔH_f° of water = +285.8 kJ/mol
 C. ΔH° of reverse reaction = +571.6 kJ/mol D. both (A and C) are correct

21. In the reaction NO_2^- ions with water, which of the following is conjugate acid –base pair?

- A. H_2O and H_3O^+ B. HNO_2 and NO_2^- C. H_2O and OH^- D. both (B and C) are correct

22. The acidity of which of the following aqueous solutions at $25^\circ C$ is highest?

- A. pOH=13 B. $[H_3O^+]=1.0 \times 10^{-7} M$ C. $[OH^-]=1.0 \times 10^{-4} M$ D. pH=12

23. Suppose that 15mL of 0.025M H_2SO_4 is required to neutralize 10mL of KOH solution, what is the molarity of the base?

- A. 0.025 B. 0.0125 C. 0.075 D. 0.0075

24. Which of the following solutions with the same concentration has the highest vapor- pressure?

- A. $AlCl_3$ B. $NaNO_3$ C. $C_6H_{12}O_6$ D. $CaCl_2$

25. When one gram of iron is heated to $100.0^\circ C$ and cooled to $50.0^\circ C$ in a calorimeter transfers 22.5 J of energy to the surrounding water. But one gram of silver transfers 11.8 J of energy under the same conditions, the difference of the value of transfer energy depends on the:-

- A. mass of the material B. temperature change C. nature of the material D. all of them

26. Which of the following reactions represent the hydrolysis reaction?

- A. $H_2CO_3(aq) + H_2O(l) \rightleftharpoons HCO_3^-(aq) + H_3O^+(aq)$ B. $CH_3NH_2(aq) + H_2O(l) \rightleftharpoons CH_3NH_3^+(aq) + OH^-(aq)$
 C. $NH_4^+(aq) + H_2O(l) \rightleftharpoons NH_3(aq) + H_3O^+(aq)$ D. all of them are correct

- 27.** If the $[\text{H}_3\text{O}^+]$ of aqueous solution of $\text{Ca}(\text{OH})_2$ is equal to $1.0 \times 10^{-8} \text{M}$, what is the molarity of $\text{Ca}(\text{OH})_2$?
 A. 1.0×10^{-6} B. 5.0×10^{-7} C. 1.0×10^{-8} D. 2.0×10^{-6}
- 28.** Which of the following two conditions will favor a spontaneous reaction?
 A. $\Delta H < 0$ and $\Delta S > 0$ B. $\Delta H > 0$ and $\Delta S > 0$ C. $\Delta H > 0$ and $\Delta S < 0$ D. $\Delta H < 0$ and $\Delta S < 0$
- 29.** In this reaction: $\text{Al}(\text{s}) + \text{H}_2\text{SO}_4(\text{aq}) \longrightarrow$, which of the following is the net ionic equation?
 A. $\text{H}_3\text{O}^+(\text{aq}) + \text{OH}^-(\text{aq}) \longrightarrow 2\text{H}_2\text{O}(\text{l})$ B. $2\text{Al}(\text{s}) + 6\text{H}_3\text{O}^+(\text{aq}) \longrightarrow 2\text{Al}^{3+}(\text{aq}) + 9\text{H}_2(\text{g})$
 C. $2\text{Al}(\text{s}) + 6\text{H}_3\text{O}^+(\text{aq}) \longrightarrow 2\text{Al}^{3+}(\text{aq}) + 6\text{H}_2\text{O}(\text{l}) + 3\text{H}_2(\text{g})$ D. none of them
- 30.** If a small amounts of HCl added to a solution of HNO_2 and KNO_2 , which of the following decreases?
 A. pH B. ionization of HNO_2 C. $[\text{OH}^-]$ D. all of them are Correct
- 31.** When comparing the expected and actual freezing point of an aqueous solution of MgI_2 with 1.0 m concentration, which of the following is correct? If the actual freezing point is equal to -4.78°C and K_f of water = $-1.86^\circ\text{C}/m$.
 A. the expected freezing point is equal to the actual freezing point.
 B. the expected freezing point is lower than the actual freezing point
 C. the expected freezing point is higher than the actual freezing point
 D. none of them
- 32.** How many moles of nitrate ions are produced by dissolving 0.15 mol of zinc nitrate in water?
 A. 0.30 B. 0.15 C. 0.45 D. 2.0
- 33.** In the following hypothetical reaction: $\text{A} + \text{B} \longrightarrow \text{C} + \text{D}$ $\Delta H > 0$, which of the following is correct?
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 C. the reaction is an exothermic D. none of them
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 D. the molecular formula of methyl benzene is C_6H_8 .
- 35.** An aqueous solution of hydrogen fluoride weakly conducts an electric current because :-
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 C. the hydrogen- fluorine bond is weak D. both (A and B) are correct
- 36.** Which of the following compounds formed hydrogen bond with water?
 A. ethers B. benzene C. alcohols D. both (A and C) are correct
- 37.** In a reaction, $\Delta G^\circ = 142.0 \text{ kJ/mol}$ and $\Delta H^\circ = 206.1 \text{ kJ/mol}$, at room temperature which of the following is correct?
 A. the entropy of the reactants is greater B. the entropy of the products is greater
 C. the entropy of reactants and the products is equal D. none of them
- 38.** In a saturated solution the concentration.....
 A. is always high B. is always low
 C. may be high or low, depending on the solubility of the solute D. cannot be determined

- 39.** In this reaction: $\text{H}_2(\text{g}) + \text{I}_2(\text{g}) \rightleftharpoons 2\text{HI}(\text{g})$, at 425°C is found at equilibrium:
 $[\text{H}_2] = 1.83 \times 10^{-3} \text{M}$, $[\text{I}_2] = 3.13 \times 10^{-3} \text{M}$ and $[\text{HI}] = 1.77 \times 10^{-2} \text{M}$, which of the following is correct?
 A. reactants are favored B. a small amount of reactants converted into products
 C. products are favored D. both (A and B) are correct.
- 40.** Which of the following exhibits properties of an Arrhenius acid?
 A. hydrogen chloride that is dissolved in water B. the pure hydrogen chloride gas
 C. hydrogen chloride that is dissolved in nonpolar solvent D. all of them
- 41.** Determine the concentration of fluoride ions in a saturated solution of CaF_2 , If the K_{sp} of CaF_2 is 5.3×10^{-9} . A. $2.2 \times 10^{-3} \text{M}$ B. $1.1 \times 10^{-3} \text{M}$ C. $1.325 \times 10^{-5} \text{M}$ D. $1.1 \times 10^{-4} \text{M}$
- 42.** Which of the following compounds **cannot** be monomer for the addition polymer?
 A. C_2H_4 B. CH_3COOH C. C_2F_4 D. $\text{CH}_2=\text{CH}-\text{CH}_3$
- 43.** The calcium sulfate salt is produce by the reaction between the:-
 A. Ca and H_2SO_4 B. $\text{Ca}(\text{OH})_2$ and H_2SO_4 C. $\text{Ca}(\text{OH})_2$ and H_2SO_3 D. both (A and B) are correct
- 44.** If the value of equilibrium constant for gaseous reaction is equal to 300 at given temperature, what is the value of equilibrium constant for the reaction by doubling the volume of reaction vessel, at the same temperature? A. 300 B. 600 C. 900 D. 150
- 45.** All of the following are affect the rate of reaction between hydrogen gas and chlorine gas **EXCEPT**:-
 A. surface area B. temperature C. presence catalyst D. concentration
- 46.** Which of the following pairs of solutions produce a precipitate when combined?
 A. NH_4Cl and NaOH B. KCl and Na_2SO_4 C. $\text{Fe}(\text{NO}_3)_3$ and KCl D. NH_4Cl and AgNO_3
- 47.** Which of the following types of molecular representations **cannot** be used to show differences between isomers?
 A. molecular formula B. three-dimensional drawing or model
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- 48.** This hypothetical reaction: $\text{A} + \text{B} \longrightarrow 2\text{C}$, is occur in one step-mechanism, what is the value of the specific rate constant for reverse reaction when $[\text{C}] = 0.015 \text{M}$ and the rate of reaction is equal to $1.1 \times 10^{-3} \text{M/s}$? A. $4.9 \text{ M}^{-1}\text{s}^{-1}$ B. 4.9 s^{-1} C. $0.2 \text{ M}^{-1}\text{s}^{-1}$ D. 0.2 s^{-1}
- 49.** All of the following may be alkene and cycloalkane **EXCEPT**:-
 A. C_3H_6 B. C_2H_4 C. C_5H_{10} D. C_4H_8
- 50.** The general formula for esters is:-
 A. $\text{R}-\text{CO}-\text{R}$ B. $\text{R}-\text{COO}-\text{R}$ C. $\text{R}-\text{COOH}$ D. $\text{R}-\text{O}-\text{R}$



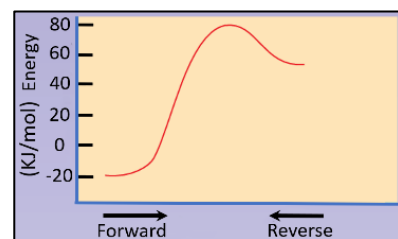
Answer the following questions: (two marks for each correct choice)

- Changing the temperature affects the rate of reaction because it affects:-
 A. the energy of activated complex B. the enthalpy of reaction
 C. the number of effective collision D. the properties of reactants
 - All of the following are affect the rate of reaction between hydrogen gas and chlorine gas **EXCEPT**:-
 A. surface area B. temperature C. presence catalyst D. concentration
 - One of the following **cannot** be isomer for C_3H_8O :-
 A. 2-propanol B. 1-propanol C. ethyl methyl ether D. 2-propanon
 - Determine the concentration of fluoride ions in a saturated solution of CaF_2 , If the K_{sp} of CaF_2 is 5.3×10^{-9} .
 A. $2.2 \times 10^{-3}M$ B. $1.1 \times 10^{-3}M$ C. $1.325 \times 10^{-5}M$ D. $1.1 \times 10^{-4}M$
 - In this reaction: $H_2(g) + I_2(g) \rightleftharpoons 2HI(g)$, at $425^\circ C$ is found at equilibrium:
 $[H_2] = 1.83 \times 10^{-3}M$, $[I_2] = 3.13 \times 10^{-3}M$ and $[HI] = 1.77 \times 10^{-2}M$, which of the following is correct?
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 C. the entropy of reactants and the products is equal D. none of them
 - By using the information in the adjacent table, 55g of which of the following element absorbed 3.562 kJ of energy if it was heated from $22.4^\circ C$ to $94.6^\circ C$?
 A. Ca B. Al
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- | Element | Ca | Al | Fe | Au |
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| Specific heat J/(g.K) | 0.647 | 0.897 | 0.449 | 0.129 |
- In a saturated solution the concentration.....
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 - In the aqueous solution of KCN, the water reacts with:-
 A. K^+ and produces strong base B. K^+ and produces weak base
 C. CN^- and produces strong acid D. CN^- and produces weak acid
 - How many moles of nitrate ions are produced by dissolving 0.15 mol of zinc nitrate in water?
 A. 0.30 B. 0.15 C. 0.45 D. 2.0
 - If a small amounts of HCl added to a solution of HNO_2 and KNO_2 , which of the following decreases?
 A. pH B. ionization of HNO_2 C. $[OH^-]$ D. all of them are Correct

- The acidity of which of the following aqueous solutions at $25^\circ C$ is highest?
 A. $pOH=13$ B. $[H_3O^+]=1.0 \times 10^{-7}M$ C. $[OH^-]=1.0 \times 10^{-4}M$ D. $pH=12$
- In the second ionization stage of phosphoric acid in its aqueous solution.....are produced.
 A. HPO_4^{2-} and H_3O^+ B. $H_2PO_4^-$ and H_3O^+ C. PO_4^{3-} and H_3O^+ D. all of them
- The general formula for esters is:-
 A. $R-CO-R$ B. $R-COO-R$ C. $R-COOH$ D. $R-O-R$
- Which of the following compounds **cannot** be monomer for the addition polymer?
 A. C_2H_4 B. CH_3COOH C. C_2F_4 D. $CH_2=CH-CH_3$
- The equilibrium self-ionization equation of water at $25^\circ C$ is: $2H_2O(l) + \text{energy} \rightleftharpoons H_3O^+(aq) + OH^-(aq)$, by decreasing the temperature which of the following is incorrect?
 A. the pH value increases B. the pOH value decreases
 C. the K_w value decreases D. none of them
- In the reaction NO_2^- ions with water, which of the following is conjugate acid –base pair?
 A. H_2O and H_3O^+ B. HNO_2 and NO_2^- C. H_2O and OH^- D. both (B and C) are correct
- The calcium sulfate salt is produce by the reaction between the:-
 A. Ca and H_2SO_4 B. $Ca(OH)_2$ and H_2SO_4 C. $Ca(OH)_2$ and H_2SO_3 D. both (A and B) are correct
- The correct name for this compound: (1-ethyl-3-methyl propane) according to IUPAC system is:
 A. hexane B. 2-methyl pentane C. 3-methyl pentane D. 2,3-dimethyl butane
- In the titration acid and base process the equivalence point is determined by :-
 A. suitable indicator B. pH meter C. transition interval D. both (A and B) are correct
- The molal boiling-point constant (K_b) depends on the:-
 A. nature of solute B. number of solvent moles C. nature of solvent D. solute concentration
- This hypothetical reaction: $A + B \longrightarrow 2C$, is occur in one step-mechanism, what is the value of the specific rate constant for reverse reaction when $[C] = 0.015M$ and the rate of reaction is equal to $1.1 \times 10^{-3}M/s$?
 A. $4.9 M^{-1}s^{-1}$ B. $4.9 s^{-1}$ C. $0.2 M^{-1}s^{-1}$ D. $0.2 s^{-1}$
- In a titration experiment, by using phenolphthalein indicator ($pH=8.0-10.0$), 0.5mol of which of the following acids neutralizes 0.5mol of NaOH?
 A. H_3PO_4 B. HF C. HCl D. both (A and B)
- When one gram of iron is heated to $100.0^\circ C$ and cooled to $50.0^\circ C$ in a calorimeter transfers 22.5 J of energy to the surrounding water. But one gram of silver transfers 11.8 J of energy under the same conditions, the difference of the value of transfer energy depends on the:-
 A. mass of the material B. temperature change C. nature of the material D. all of them
- In this reaction: $Al(s) + H_2SO_4(aq) \longrightarrow$, which of the following is the net ionic equation?
 A. $H_3O^+(aq) + OH^-(aq) \longrightarrow 2H_2O(l)$ B. $2Al(s) + 6H_3O^+(aq) \longrightarrow 2Al^{3+}(aq) + 9H_2(g)$
 C. $2Al(s) + 6H_3O^+(aq) \longrightarrow 2Al^{3+}(aq) + 6H_2O(l) + 3H_2(g)$ D. none of them
- Which of the following exhibits properties of an Arrhenius acid?
 A. hydrogen chloride that is dissolved in water B. the pure hydrogen chloride gas
 C. hydrogen chloride that is dissolved in nonpolar solvent D. all of them

28. In the adjacent energy diagram after using catalyst the value of E_a :-

- A. is equal to 100 kJ/mol
- B. is greater than 100 kJ/mol
- C. is less than 100 kJ/mol
- D. cannot be determined



29. Which of the following compounds formed hydrogen bond with water?

- A. ethers
- B. benzene
- C. alcohols
- D. both (A and C) are correct

30. Used in biology laboratories as a preservative for dead animals:-

- A. methanol
- B. acetic acid
- C. methanal
- D. methyl amine

31. In the following hypothetical reaction: $A+B \longrightarrow C+D$ $\Delta H > 0$, which of the following is correct?

- A. the products are more stable
- B. the reactants are more stable
- C. the reaction is an exothermic
- D. none of them

32. All of the following may be alkene and cycloalkane **EXCEPT**:-

- A. C_3H_6
- B. C_2H_4
- C. C_5H_{10}
- D. C_4H_8

33. Which of the following types of molecular representations **cannot** be used to show differences between isomers?

- A. molecular formula
- B. three-dimensional drawing or model
- C. structural formula
- D. both (B and C) are correct

34. Which of the following can have geometric isomers?

- A. CH_2Cl_2
- B. $C_2H_4Cl_2$
- C. $C_2H_2Cl_2$
- D. none of them

35. Which of the following reactions represent the hydrolysis reaction?

- A. $H_2CO_3(aq) + H_2O(l) \rightleftharpoons HCO_3^-(aq) + H_3O^+(aq)$
- B. $CH_3NH_2(aq) + H_2O(l) \rightleftharpoons CH_3NH_3^+(aq) + OH^-(aq)$
- C. $NH_4^+(aq) + H_2O(l) \rightleftharpoons NH_3(aq) + H_3O^+(aq)$
- D. all of them are correct

36. The anion of the acid that stomach produces:-

- A. is a strong conjugate base
- B. it acts as amphoteric
- C. is a weak conjugate acid
- D. it has a little tendency to attract a proton

37. Suppose that 15mL of 0.025M H_2SO_4 is required to neutralize 10mL of KOH solution, what is the molarity of the base?

- A. 0.025
- B. 0.0125
- C. 0.075
- D. 0.0075

38. Which of the following solutions with the same concentration has the highest vapor- pressure?

- A. $AlCl_3$
- B. $NaNO_3$
- C. $C_6H_{12}O_6$
- D. $CaCl_2$

39. In this reaction: $2H_2(g) + O_2(g) \longrightarrow 2H_2O(l) + 571.6 \text{ kJ}$, which of the following is correct?

- A. ΔH_f° of water = -285.8 kJ/mol
- B. ΔH_f° of water = +285.8 kJ/mol
- C. ΔH° of reverse reaction = +571.6 kJ/mol
- D. both (A and C) are correct

40. An aqueous solution of hydrogen fluoride weakly conducts an electric current because :-

- A. it is ionized partially
- B. the hydrogen- fluorine bond is strong
- C. the hydrogen- fluorine bond is weak
- D. both (A and B) are correct

41. A hydrocarbon that contains delocalized electrons:-

- A. graphite
- B. benzene
- C. cyclohexane
- D. both (A and B) are correct

42. Which of the following is correct?

- A. the boiling point of pentane greater than 2-methyl butane.
- B. the carbon atom hybridization type of C_2H_2 is sp^2 .
- C. the graphite is a good conductor of heat.
- D. the molecular formula of methyl benzene is C_6H_8 .

43. Which of the following pairs of solutions produce a precipitate when combined?

- A. NH_4Cl and $NaOH$
- B. KCl and Na_2SO_4
- C. $Fe(NO_3)_3$ and KCl
- D. NH_4Cl and $AgNO_3$

44. The rate law for a reaction is found to be: $R = k[X][Y]^2$, by what factor does the rate increase if $[Y]$ tripled?

- A. 3
- B. 6
- C. 27
- D. 9

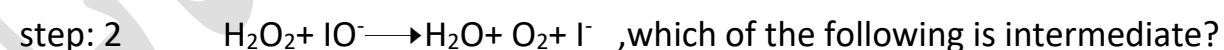
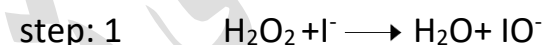
45. This reaction: $CH_2=CH-CH_3 + HCl \longrightarrow$ 2-chloro propane, is called:-

- A. substitution
- B. addition
- C. condensation
- D. elimination

46. If the value of equilibrium constant for gaseous reaction is equal to 300 at given temperature, what is the value of equilibrium constant for the reaction by doubling the volume of reaction vessel, at the same temperature?

- A. 300
- B. 600
- C. 900
- D. 150

47. This reaction: $2H_2O_2 \longrightarrow 2H_2O + O_2$, by using catalyst has the following proposed mechanism:-



- A. I^-
- B. H_2O
- C. IO^-
- D. both (A and C) are correct

48. When comparing the expected and actual freezing point of an aqueous solution of MgI_2 with 1.0 m concentration, which of the following is correct? If the actual freezing point is equal to $-4.78^\circ C$ and K_f of water = $-1.86^\circ C/m$.

- A. the expected freezing point is equal to the actual freezing point.
- B. the expected freezing point is lower than the actual freezing point
- C. the expected freezing point is higher than the actual freezing point
- D. none of them

49. If the $[H_3O^+]$ of aqueous solution of $Ca(OH)_2$ is equal to $1.0 \times 10^{-8} M$, what is the molarity of $Ca(OH)_2$?

- A. 1.0×10^{-6}
- B. 5.0×10^{-7}
- C. 1.0×10^{-8}
- D. 2.0×10^{-6}

50. Which of the following two conditions will favor a spontaneous reaction?

- A. $\Delta H < 0$ and $\Delta S > 0$
- B. $\Delta H > 0$ and $\Delta S > 0$
- C. $\Delta H > 0$ and $\Delta S < 0$
- D. $\Delta H < 0$ and $\Delta S < 0$



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

- This hypothetical reaction: $A+B \rightarrow 2C$, is occur in one step-mechanism, what is the value of the specific rate constant for reverse reaction when $[C]=0.015M$ and the rate of reaction is equal to $1.1 \times 10^{-3} M/s$?
 A. $4.9 M^{-1}s^{-1}$ B. $4.9 s^{-1}$ C. $0.2 M^{-1}s^{-1}$ D. $0.2 s^{-1}$
- The calcium sulfate salt is produce by the reaction between the:-
 A. Ca and H_2SO_4 B. $Ca(OH)_2$ and H_2SO_4 C. $Ca(OH)_2$ and H_2SO_3 D. both (A and B) are correct
- All of the following are affect the rate of reaction between hydrogen gas and chlorine gas **EXCEPT**:-
 A. surface area B. temperature C. presence catalyst D. concentration
- The general formula for esters is:-
 A. $R-CO-R$ B. $R-COO-R$ C. $R-COOH$ D. $R-O-R$
- In this reaction: $2H_2(g)+O_2(g) \rightarrow 2H_2O(l)+571.6 kJ$, which of the following is correct?
 A. ΔH_f° of water= $-285.8 kJ/mol$ B. ΔH_f° of water= $+285.8 kJ/mol$
 C. ΔH° of reverse reaction= $+571.6 kJ/mol$ D. both (A and C) are correct
- The correct name for this compound: (1-ethyl-3-methyl propane) according to IUPAC system is:
 A. hexane B. 2-methyl pentane C. 3-methyl pentane D. 2,3-dimethyl butane
- A hydrocarbon that contains delocalized electrons:-
 A. graphite B. benzene C. cyclohexane D. both (A and B) are correct
- In the aqueous solution of KCN, the water reacts with:-
 A. K^+ and produces strong base B. K^+ and produces weak base
 C. CN^- and produces strong acid D. CN^- and produces weak acid
- Which of the following types of molecular representations **cannot** be used to show differences between isomers?
 A. molecular formula B. three-dimensional drawing or model
 C. structural formula D. both (B and C) are correct
- The acidity of which of the following aqueous solutions at $25^\circ C$ is highest?
 A. $pOH=13$ B. $[H_3O^+]=1.0 \times 10^{-7} M$ C. $[OH^-]=1.0 \times 10^{-4} M$ D. $pH=12$
- In the second ionization stage of phosphoric acid in its aqueous solution.....are produced.
 A. HPO_4^{2-} and H_3O^+ B. $H_2PO_4^-$ and H_3O^+ C. PO_4^{3-} and H_3O^+ D. all of them
- This reaction: $2H_2O_2 \rightarrow 2H_2O+O_2$, by using catalyst has the following proposed mechanism:-
 step: 1 $H_2O_2 + I^- \rightarrow H_2O + IO^-$
 step: 2 $H_2O_2 + IO^- \rightarrow H_2O + O_2 + I^-$, which of the following is intermediate?
 A. I^- B. H_2O C. IO^- D. both (A and C) are correct

- The equilibrium self-ionization equation of water at $25^\circ C$ is: $2H_2O(l)+energy \rightleftharpoons H_3O^+(aq)+OH^-(aq)$, by decreasing the temperature which of the following is incorrect?
 A. the pH value increases B. the pOH value decreases
 C. the K_w value decreases D. none of them
- The molal boiling-point constant (K_b) depends on the:-
 A. nature of solute B. number of solvent moles C. nature of solvent D. solute concentration
- The anion of the acid that stomach produces:-
 A. is a strong conjugate base B. it acts as amphoteric
 C. is a weak conjugate acid D. it has a little tendency to attract a proton
- Determine the concentration of fluoride ions in a saturated solution of CaF_2 , If the K_{sp} of CaF_2 is 5.3×10^{-9} .
 A. $2.2 \times 10^{-3} M$ B. $1.1 \times 10^{-3} M$ C. $1.325 \times 10^{-5} M$ D. $1.1 \times 10^{-4} M$
- In the following hypothetical reaction: $A+B \rightarrow C+D$ $\Delta H > 0$, which of the following is correct?
 A. the products are more stable B. the reactants are more stable
 C. the reaction is an exothermic D. none of them
- In a reaction, $\Delta G^\circ=142.0 kJ/mol$ and $\Delta H^\circ=206.1 kJ/mol$, at room temperature which of the following is correct?
 A. the entropy of the reactants is greater B. the entropy of the products is greater
 C. the entropy of reactants and the products is equal D. none of them
- If the $[H_3O^+]$ of aqueous solution of $Ca(OH)_2$ is equal to $1.0 \times 10^{-8} M$, what is the molarity of $Ca(OH)_2$?
 A. 1.0×10^{-6} B. 5.0×10^{-7} C. 1.0×10^{-8} D. 2.0×10^{-6}
- Which of the following solutions with the same concentration has the highest vapor- pressure?
 A. $AlCl_3$ B. $NaNO_3$ C. $C_6H_{12}O_6$ D. $CaCl_2$
- Which of the following pairs of solutions produce a precipitate when combined?
 A. NH_4Cl and $NaOH$ B. KCl and Na_2SO_4 C. $Fe(NO_3)_3$ and KCl D. NH_4Cl and $AgNO_3$
- One of the following **cannot** be isomer for C_3H_8O :-
 A. 2-propanol B. 1-propanol C. ethyl methyl ether D. 2-propanon
- Suppose that 15mL of 0.025M H_2SO_4 is required to neutralize 10mL of KOH solution, what is the molarity of the base?
 A. 0.025 B. 0.0125 C. 0.075 D. 0.0075
- Which of the following two conditions will favor a spontaneous reaction?
 A. $\Delta H < 0$ and $\Delta S > 0$ B. $\Delta H > 0$ and $\Delta S > 0$ C. $\Delta H > 0$ and $\Delta S < 0$ D. $\Delta H < 0$ and $\Delta S < 0$
- All of the following may be alkene and cycloalkane **EXCEPT**:-
 A. C_3H_6 B. C_2H_4 C. C_5H_{10} D. C_4H_8
- In this reaction: $Al(s)+H_2SO_4(aq) \rightarrow$, which of the following is the net ionic equation?
 A. $H_3O^+(aq)+OH^-(aq) \rightarrow 2H_2O(l)$ B. $2Al(s)+6H_3O^+(aq) \rightarrow 2Al^{3+}(aq)+9H_2(g)$
 C. $2Al(s)+6H_3O^+(aq) \rightarrow 2Al^{3+}(aq)+6H_2O(l)+3H_2(g)$ D. none of them
- The rate law for a reaction is found to be: $R=k[X][Y]^2$, by what factor does the rate increase if $[Y]$ tripled?
 A. 3 B. 6 C. 27 D. 9

28. Which of the following compounds formed hydrogen bond with water?
 A. ethers B. benzene C. alcohols D. both (A and C) are correct

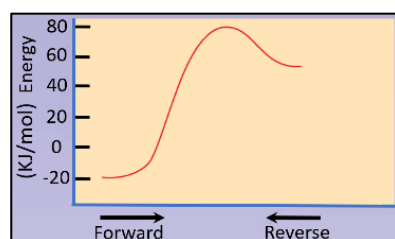
29. An aqueous solution of hydrogen fluoride weakly conducts an electric current because :-
 A. it is ionized partially B. the hydrogen- fluorine bond is strong
 C. the hydrogen- fluorine bond is weak D. both (A and B) are correct

30. Changing the temperature affects the rate of reaction because it affects:-
 A. the energy of activated complex B. the enthalpy of reaction
 C. the number of effective collision D. the properties of reactants

31. How many moles of nitrate ions are produced by dissolving 0.15 mol of zinc nitrate in water?
 A. 0.30 B. 0.15 C. 0.45 D. 2.0

32. Used in biology laboratories as a preservative for dead animals:-
 A. methanol B. acetic acid C. methanal D. methyl amine

33. In the adjacent energy diagram after using catalyst the value of E_a :-
 A. is equal to 100 kJ/mol
 B. is greater than 100 kJ/mol
 C. is less than 100 kJ/mol
 D. cannot be determined



34. By using the information in the adjacent table, 55g of which of the following element absorbed 3.562 kJ of energy if it was heated from 22.4°C to 94.6°C?

- A. Ca B. Al
 C. Fe D. Au

Element	Ca	Al	Fe	Au
Specific heat J/(g.K)	0.647	0.897	0.449	0.129

35. In a saturated solution the concentration.....
 A. is always high B. is always low
 C. may be high or low, depending on the solubility of the solute D. cannot be determined

36. In the reaction NO_2^- ions with water, which of the following is conjugate acid –base pair?
 A. H_2O and H_3O^+ B. HNO_2 and NO_2^- C. H_2O and OH^- D. both (B and C) are correct

37. This reaction: $\text{CH}_2=\text{CH}-\text{CH}_3 + \text{HCl} \longrightarrow$ 2-chloro propane, is called:-
 A. substitution B. addition C. condensation D. elimination

38. When the ammonia molecule reacts with the hydrogen ion (proton) :-
 A. ammonia molecule is an electron-pair acceptor B. ammonia acts as Arrhenius base
 C. proton acts as Lewis acid D. both (A and C) are correct

39. Which of the following compounds **cannot** be monomer for the addition polymer?
 A. C_2H_4 B. CH_3COOH C. C_2F_4 D. $\text{CH}_2=\text{CH}-\text{CH}_3$

40. If a small amounts of HCl added to a solution of HNO_2 and KNO_2 , which of the following decreases?
 A. pH B. ionization of HNO_2 C. $[\text{OH}^-]$ D. all of them are Correct

41. When comparing the expected and actual freezing point of an aqueous solution of MgI_2 with 1.0 *m* concentration, which of the following is correct? If the actual freezing point is equal to -4.78°C and K_f of water = $-1.86^\circ\text{C}/m$.

- A. the expected freezing point is equal to the actual freezing point.
 B. the expected freezing point is lower than the actual freezing point
 C. the expected freezing point is higher than the actual freezing point
 D. none of them

42. Which of the following reactions represent the hydrolysis reaction?
 A. $\text{H}_2\text{CO}_3(\text{aq}) + \text{H}_2\text{O}(\text{l}) \rightleftharpoons \text{HCO}_3^-(\text{aq}) + \text{H}_3\text{O}^+(\text{aq})$ B. $\text{CH}_3\text{NH}_2(\text{aq}) + \text{H}_2\text{O}(\text{l}) \rightleftharpoons \text{CH}_3\text{NH}_3^+(\text{aq}) + \text{OH}^-(\text{aq})$
 C. $\text{NH}_4^+(\text{aq}) + \text{H}_2\text{O}(\text{l}) \rightleftharpoons \text{NH}_3(\text{aq}) + \text{H}_3\text{O}^+(\text{aq})$ D. all of them are correct

43. In a titration experiment, by using phenolphthalein indicator ($\text{pH}=8.0-10.0$), 0.5mol of which of the following acids neutralizes 0.5mol of NaOH? A. H_3PO_4 B. HF C. HCl D. both (A and B)

44. When one gram of iron is heated to 100.0°C and cooled to 50.0°C in a calorimeter transfers 22.5 J of energy to the surrounding water. But one gram of silver transfers 11.8 J of energy under the same conditions, the difference of the value of transfer energy depends on the:-
 A. mass of the material B. temperature change C. nature of the material D. all of them

45. In the titration acid and base process the equivalence point is determined by :-
 A. suitable indicator B. pH meter C. transition interval D. both (A and B) are correct

46. If the value of equilibrium constant for gaseous reaction is equal to 300 at given temperature, what is the value of equilibrium constant for the reaction by doubling the volume of reaction vessel, at the same temperature? A. 300 B. 600 C. 900 D. 150

47. Which of the following can have geometric isomers?
 A. CH_2Cl_2 B. $\text{C}_2\text{H}_4\text{Cl}_2$ C. $\text{C}_2\text{H}_2\text{Cl}_2$ D. none of them

48. Which of the following is correct?
 A. the boiling point of pentane greater than 2-methyl butane.
 B. the carbon atom hybridization type of C_2H_2 is sp^2 .
 C. the graphite is a good conductor of heat.
 D. the molecular formula of methyl benzene is C_6H_8 .

49. Which of the following exhibits properties of an Arrhenius acid?
 A. hydrogen chloride that is dissolved in water B. the pure hydrogen chloride gas
 C. hydrogen chloride that is dissolved in nonpolar solvent D. all of them

50. In this reaction: $\text{H}_2(\text{g}) + \text{I}_2(\text{g}) \rightleftharpoons 2\text{HI}(\text{g})$, at 425°C is found at equilibrium:
 $[\text{H}_2] = 1.83 \times 10^{-3}\text{M}$, $[\text{I}_2] = 3.13 \times 10^{-3}\text{M}$ and $[\text{HI}] = 1.77 \times 10^{-2}\text{M}$, which of the following is correct?
 A. reactants are favored B. a small amount of reactants converted into products
 C. products are favored D. both (A and B) are correct.



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

- In a titration experiment, by using phenolphthalein indicator (pH=8.0-10.0), 0.5mol of which of the following acids neutralizes 0.5mol of NaOH? A. H_3PO_4 B. HF C. HCl D. both (A and B)
- This reaction: $CH_2=CH-CH_3 + HCl \longrightarrow$ 2-chloro propane, is called:-
A. substitution B. addition C. condensation D. elimination
- The general formula for esters is:-
A. R-CO-R B. R-COO-R C. R-COOH D. R-O-R
- In the following hypothetical reaction: $A+B \longrightarrow C+D$ $\Delta H > 0$, which of the following is correct?
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- Which of the following compounds **cannot** be monomer for the addition polymer?
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- A hydrocarbon that contains delocalized electrons:-
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- The calcium sulfate salt is produce by the reaction between the:-
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- This reaction: $2H_2O_2 \longrightarrow 2H_2O + O_2$, by using catalyst has the following proposed mechanism:-
step: 1 $H_2O_2 + I^- \longrightarrow H_2O + IO^-$
step: 2 $H_2O_2 + IO^- \longrightarrow H_2O + O_2 + I^-$, which of the following is intermediate?
A. I^- B. H_2O C. IO^- D. both (A and C) are correct
- The correct name for this compound: (1-ethyl-3-methyl propane) according to IUPAC system is:
A. hexane B. 2-methyl pentane C. 3-methyl pentane D. 2,3-dimethyl butane
- Which of the following can have geometric isomers?
A. CH_2Cl_2 B. $C_2H_4Cl_2$ C. $C_2H_2Cl_2$ D. none of them

14. Which of the following types of molecular representations **cannot** be used to show differences between isomers?

- A. molecular formula B. three-dimensional drawing or model
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15. Which of the following solutions with the same concentration has the highest vapor- pressure?

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16. Which of the following pairs of solutions produce a precipitate when combined?

- A. NH_4Cl and NaOH B. KCl and Na_2SO_4 C. $Fe(NO_3)_3$ and KCl D. NH_4Cl and $AgNO_3$

17. By using the information in the adjacent table, 55g of which of the following element absorbed 3.562 kJ of energy if it was heated from $22.4^\circ C$ to $94.6^\circ C$?

- A. Ca B. Al
C. Fe D. Au

Element	Ca	Al	Fe	Au
Specific heat J/(g.K)	0.647	0.897	0.449	0.129

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- A. $H_3O^+(aq) + OH^-(aq) \longrightarrow 2H_2O(l)$ B. $2Al(s) + 6H_3O^+(aq) \longrightarrow 2Al^{3+}(aq) + 9H_2(g)$
C. $2Al(s) + 6H_3O^+(aq) \longrightarrow 2Al^{3+}(aq) + 6H_2O(l) + 3H_2(g)$ D. none of them

21. In the second ionization stage of phosphoric acid in its aqueous solution.....are produced.

- A. HPO_4^{2-} and H_3O^+ B. $H_2PO_4^-$ and H_3O^+ C. PO_4^{3-} and H_3O^+ D. all of them

22. How many moles of nitrate ions are produced by dissolving 0.15 mol of zinc nitrate in water?

- A. 0.30 B. 0.15 C. 0.45 D. 2.0

23. Which of the following two conditions will favor a spontaneous reaction?

- A. $\Delta H < 0$ and $\Delta S > 0$ B. $\Delta H > 0$ and $\Delta S > 0$ C. $\Delta H > 0$ and $\Delta S < 0$ D. $\Delta H < 0$ and $\Delta S < 0$

24. When comparing the expected and actual freezing point of an aqueous solution of MgI_2 with 1.0 m concentration, which of the following is correct? If the actual freezing point is equal to $-4.78^\circ C$ and K_f of water = $-1.86^\circ C/m$.

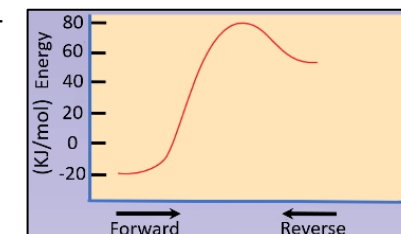
- A. the expected freezing point is equal to the actual freezing point.
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25. When the ammonia molecule reacts with the hydrogen ion (proton) :-

- A. ammonia molecule is an electron-pair acceptor B. ammonia acts as Arrhenius base
C. proton acts as Lewis acid D. both (A and C) are correct

26. In this reaction: $2\text{H}_2(\text{g}) + \text{O}_2(\text{g}) \longrightarrow 2\text{H}_2\text{O}(\text{l}) + 571.6 \text{ kJ}$, which of the following is correct?
 A. ΔH_f° of water = -285.8 kJ/mol
 B. ΔH_f° of water = +285.8 kJ/mol
 C. ΔH° of reverse reaction = +571.6 kJ/mol
 D. both (A and C) are correct
27. Changing the temperature affects the rate of reaction because it affects:-
 A. the energy of activated complex
 B. the enthalpy of reaction
 C. the number of effective collision
 D. the properties of reactants
28. The molal boiling-point constant (K_b) depends on the:-
 A. nature of solute
 B. number of solvent moles
 C. nature of solvent
 D. solute concentration
29. The acidity of which of the following aqueous solutions at 25°C is highest?
 A. $\text{pOH}=13$
 B. $[\text{H}_3\text{O}^+]=1.0 \times 10^{-7} \text{ M}$
 C. $[\text{OH}^-]=1.0 \times 10^{-4} \text{ M}$
 D. $\text{pH}=12$
30. If the value of equilibrium constant for gaseous reaction is equal to 300 at given temperature, what is the value of equilibrium constant for the reaction by doubling the volume of reaction vessel, at the same temperature?
 A. 300
 B. 600
 C. 900
 D. 150
31. In the reaction NO_2^- ions with water, which of the following is conjugate acid-base pair?
 A. H_2O and H_3O^+
 B. HNO_2 and NO_2^-
 C. H_2O and OH^-
 D. both (B and C) are correct
32. Which of the following reactions represent the hydrolysis reaction?
 A. $\text{H}_2\text{CO}_3(\text{aq}) + \text{H}_2\text{O}(\text{l}) \rightleftharpoons \text{HCO}_3^-(\text{aq}) + \text{H}_3\text{O}^+(\text{aq})$
 B. $\text{CH}_3\text{NH}_2(\text{aq}) + \text{H}_2\text{O}(\text{l}) \rightleftharpoons \text{CH}_3\text{NH}_3^+(\text{aq}) + \text{OH}^-(\text{aq})$
 C. $\text{NH}_4^+(\text{aq}) + \text{H}_2\text{O}(\text{l}) \rightleftharpoons \text{NH}_3(\text{aq}) + \text{H}_3\text{O}^+(\text{aq})$
 D. all of them are correct
33. If the $[\text{H}_3\text{O}^+]$ of aqueous solution of $\text{Ca}(\text{OH})_2$ is equal to $1.0 \times 10^{-8} \text{ M}$, what is the molarity of $\text{Ca}(\text{OH})_2$?
 A. 1.0×10^{-6}
 B. 5.0×10^{-7}
 C. 1.0×10^{-8}
 D. 2.0×10^{-6}
34. All of the following are affect the rate of reaction between hydrogen gas and chlorine gas **EXCEPT**:-
 A. surface area
 B. temperature
 C. presence catalyst
 D. concentration
35. If a small amounts of HCl added to a solution of HNO_2 and KNO_2 , which of the following decreases?
 A. pH
 B. ionization of HNO_2
 C. $[\text{OH}^-]$
 D. all of them are Correct
36. This hypothetical reaction: $\text{A} + \text{B} \longrightarrow 2\text{C}$, is occur in one step-mechanism, what is the value of the specific rate constant for reverse reaction when $[\text{C}] = 0.015 \text{ M}$ and the rate of reaction is equal to $1.1 \times 10^{-3} \text{ M/s}$?
 A. $4.9 \text{ M}^{-1} \text{ s}^{-1}$
 B. 4.9 s^{-1}
 C. $0.2 \text{ M}^{-1} \text{ s}^{-1}$
 D. 0.2 s^{-1}
37. One of the following **cannot** be isomer for $\text{C}_3\text{H}_8\text{O}$:-
 A. 2-propanol
 B. 1-propanol
 C. ethyl methyl ether
 D. 2-propanon
38. Used in biology laboratories as a preservative for dead animals:-
 A. methanol
 B. acetic acid
 C. methanal
 D. methyl amine
39. Suppose that 15mL of 0.025M H_2SO_4 is required to neutralize 10mL of KOH solution, what is the molarity of the base?
 A. 0.025
 B. 0.0125
 C. 0.075
 D. 0.0075
40. Which of the following exhibits properties of an Arrhenius acid?
 A. hydrogen chloride that is dissolved in water
 B. the pure hydrogen chloride gas
 C. hydrogen chloride that is dissolved in nonpolar solvent
 D. all of them

41. In a reaction, $\Delta G^\circ = 142.0 \text{ kJ/mol}$ and $\Delta H^\circ = 206.1 \text{ kJ/mol}$, at room temperature which of the following is correct?
 A. the entropy of the reactants is greater
 B. the entropy of the products is greater
 C. the entropy of reactants and the products is equal
 D. none of them
42. All of the following may be alkene and cycloalkane **EXCEPT**:-
 A. C_3H_6
 B. C_2H_4
 C. C_5H_{10}
 D. C_4H_8
43. In the titration acid and base process the equivalence point is determined by :-
 A. suitable indicator
 B. pH meter
 C. transition interval
 D. both (A and B) are correct
44. In the adjacent energy diagram after using catalyst the value of E_a :-
 A. is equal to 100 kJ/mol
 B. is greater than 100 kJ/mol
 C. is less than 100 kJ/mol
 D. cannot be determined
45. In the aqueous solution of KCN , the water reacts with:-
 A. K^+ and produces strong base
 B. K^+ and produces weak base
 C. CN^- and produces strong acid
 D. CN^- and produces weak acid
46. Which of the following compounds formed hydrogen bond with water?
 A. ethers
 B. benzene
 C. alcohols
 D. both (A and C) are correct
47. Determine the concentration of fluoride ions in a saturated solution of CaF_2 , If the K_{sp} of CaF_2 is 5.3×10^{-9} .
 A. $2.2 \times 10^{-3} \text{ M}$
 B. $1.1 \times 10^{-3} \text{ M}$
 C. $1.325 \times 10^{-5} \text{ M}$
 D. $1.1 \times 10^{-4} \text{ M}$
48. The equilibrium self-ionization equation of water at 25°C is: $2\text{H}_2\text{O}(\text{l}) + \text{energy} \rightleftharpoons \text{H}_3\text{O}^+(\text{aq}) + \text{OH}^-(\text{aq})$, by decreasing the temperature which of the following is incorrect?
 A. the pH value increases
 B. the pOH value decreases
 C. the K_w value decreases
 D. none of them
49. In this reaction: $\text{H}_2(\text{g}) + \text{I}_2(\text{g}) \rightleftharpoons 2\text{HI}(\text{g})$, at 425°C is found at equilibrium:
 $[\text{H}_2] = 1.83 \times 10^{-3} \text{ M}$, $[\text{I}_2] = 3.13 \times 10^{-3} \text{ M}$ and $[\text{HI}] = 1.77 \times 10^{-2} \text{ M}$, which of the following is correct?
 A. reactants are favored
 B. a small amount of reactants converted into products
 C. products are favored
 D. both (A and B) are correct.
50. When one gram of iron is heated to 100.0°C and cooled to 50.0°C in a calorimeter transfers 22.5 J of energy to the surrounding water. But one gram of silver transfers 11.8 J of energy under the same conditions, the difference of the value of transfer energy depends on the:-
 A. mass of the material
 B. temperature change
 C. nature of the material
 D. all of them

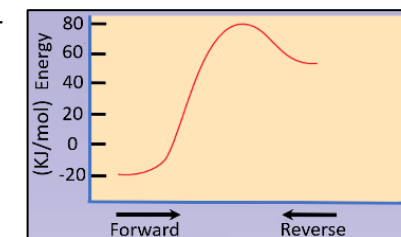




Answer the following questions: (two marks for each correct choice)

- If the $[H_3O^+]$ of aqueous solution of $Ca(OH)_2$ is equal to $1.0 \times 10^{-8} M$, what is the molarity of $Ca(OH)_2$?
 A. 1.0×10^{-6} B. 5.0×10^{-7} C. 1.0×10^{-8} D. 2.0×10^{-6}
- Which of the following is correct?
 A. the boiling point of pentane greater than 2-methyl butane.
 B. the carbon atom hybridization type of C_2H_2 is sp^2 .
 C. the graphite is a good conductor of heat.
 D. the molecular formula of methyl benzene is C_6H_8 .
- If a small amounts of HCl added to a solution of HNO_2 and KNO_2 , which of the following decreases?
 A. pH B. ionization of HNO_2 C. $[OH^-]$ D. all of them are Correct
- Which of the following reactions represent the hydrolysis reaction?
 A. $H_2CO_3(aq) + H_2O(l) \rightleftharpoons HCO_3^-(aq) + H_3O^+(aq)$ B. $CH_3NH_2(aq) + H_2O(l) \rightleftharpoons CH_3NH_3^+(aq) + OH^-(aq)$
 C. $NH_4^+(aq) + H_2O(l) \rightleftharpoons NH_3(aq) + H_3O^+(aq)$ D. all of them are correct
- In the aqueous solution of KCN, the water reacts with:-
 A. K^+ and produces strong base B. K^+ and produces weak base
 C. CN^- and produces strong acid D. CN^- and produces weak acid
- Which of the following types of molecular representations **cannot** be used to show differences between isomers?
 A. molecular formula B. three-dimensional drawing or model
 C. structural formula D. both (B and C) are correct
- This hypothetical reaction: $A + B \rightarrow 2C$, is occur in one step-mechanism, what is the value of the specific rate constant for reverse reaction when $[C] = 0.015 M$ and the rate of reaction is equal to $1.1 \times 10^{-3} M/s$?
 A. $4.9 M^{-1}s^{-1}$ B. $4.9 s^{-1}$ C. $0.2 M^{-1}s^{-1}$ D. $0.2 s^{-1}$
- When comparing the expected and actual freezing point of an aqueous solution of MgI_2 with $1.0 m$ concentration, which of the following is correct? If the actual freezing point is equal to $-4.78^\circ C$ and K_f of water = $-1.86^\circ C/m$.
 A. the expected freezing point is equal to the actual freezing point.
 B. the expected freezing point is lower than the actual freezing point
 C. the expected freezing point is higher than the actual freezing point
 D. none of them
- This reaction: $CH_2=CH-CH_3 + HCl \rightarrow$ 2-chloro propane, is called:-
 A. substitution B. addition C. condensation D. elimination
- An aqueous solution of hydrogen fluoride weakly conducts an electric current because :-
 A. it is ionized partially B. the hydrogen- fluorine bond is strong
 C. the hydrogen- fluorine bond is weak D. both (A and B) are correct

- Which of the following compounds formed hydrogen bond with water?
 A. ethers B. benzene C. alcohols D. both (A and C) are correct
- Which of the following can have geometric isomers?
 A. CH_2Cl_2 B. $C_2H_4Cl_2$ C. $C_2H_2Cl_2$ D. none of them
- In this reaction: $H_2(g) + I_2(g) \rightleftharpoons 2HI(g)$, at $425^\circ C$ is found at equilibrium:
 $[H_2] = 1.83 \times 10^{-3} M$, $[I_2] = 3.13 \times 10^{-3} M$ and $[HI] = 1.77 \times 10^{-2} M$, which of the following is correct?
 A. reactants are favored B. a small amount of reactants converted into products
 C. products are favored D. both (A and B) are correct.
- A hydrocarbon that contains delocalized electrons:-
 A. graphite B. benzene C. cyclohexane D. both (A and B) are correct
- Suppose that 15mL of 0.025M H_2SO_4 is required to neutralize 10mL of KOH solution, what is the molarity of the base?
 A. 0.025 B. 0.0125 C. 0.075 D. 0.0075
- Which of the following two conditions will favor a spontaneous reaction?
 A. $\Delta H < 0$ and $\Delta S > 0$ B. $\Delta H > 0$ and $\Delta S > 0$ C. $\Delta H > 0$ and $\Delta S < 0$ D. $\Delta H < 0$ and $\Delta S < 0$
- Which of the following exhibits properties of an Arrhenius acid?
 A. hydrogen chloride that is dissolved in water B. the pure hydrogen chloride gas
 C. hydrogen chloride that is dissolved in nonpolar solvent D. all of them
- In the adjacent energy diagram after using catalyst the value of E_a :-
 A. is equal to 100 kJ/mol
 B. is greater than 100 kJ/mol
 C. is less than 100 kJ/mol
 D. cannot be determined
- The calcium sulfate salt is produce by the reaction between the:-
 A. Ca and H_2SO_4 B. $Ca(OH)_2$ and H_2SO_4 C. $Ca(OH)_2$ and H_2SO_3 D. both (A and B) are correct
- If the value of equilibrium constant for gaseous reaction is equal to 300 at given temperature, what is the value of equilibrium constant for the reaction by doubling the volume of reaction vessel, at the same temperature?
 A. 300 B. 600 C. 900 D. 150
- In a saturated solution the concentration.....
 A. is always high B. is always low
 C. may be high or low, depending on the solubility of the solute D. cannot be determined
- The molal boiling-point constant (K_b) depends on the:-
 A. nature of solute B. number of solvent moles C. nature of solvent D. solute concentration
- The anion of the acid that stomach produces:-
 A. is a strong conjugate base B. it acts as amphoteric
 C. is a weak conjugate acid D. it has a little tendency to attract a proton
- In a titration experiment, by using phenolphthalein indicator ($pH = 8.0-10.0$), 0.5mol of which of the following acids neutralizes 0.5mol of NaOH?
 A. H_3PO_4 B. HF C. HCl D. both (A and B)
- In the titration acid and base process the equivalence point is determined by :-
 A. suitable indicator B. pH meter C. transition interval D. both (A and B) are correct

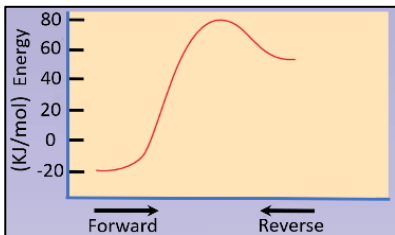


- 26.** The equilibrium self-ionization equation of water at 25°C is: $2\text{H}_2\text{O}(l) + \text{energy} \rightleftharpoons \text{H}_3\text{O}^+(\text{aq}) + \text{OH}^-(\text{aq})$, by decreasing the temperature which of the following is incorrect?
- A. the pH value increases
B. the pOH value decreases
C. the K_w value decreases
D. none of them
- 27.** Changing the temperature affects the rate of reaction because it affects:-
- A. the energy of activated complex
B. the enthalpy of reaction
C. the number of effective collision
D. the properties of reactants
- 28.** In a reaction, $\Delta G^0 = 142.0 \text{ kJ/mol}$ and $\Delta H^0 = 206.1 \text{ kJ/mol}$, at room temperature which of the following is correct?
- A. the entropy of the reactants is greater
B. the entropy of the products is greater
C. the entropy of reactants and the products is equal
D. none of them
- 29.** All of the following are affect the rate of reaction between hydrogen gas and chlorine gas **EXCEPT**:-
- A. surface area
B. temperature
C. presence catalyst
D. concentration
- 30.** The correct name for this compound: (1-ethyl-3-methyl propane) according to IUPAC system is:
- A. hexane
B. 2-methyl pentane
C. 3-methyl pentane
D. 2,3-dimethyl butane
- 31.** Determine the concentration of fluoride ions in a saturated solution of CaF_2 , If the K_{sp} of CaF_2 is 5.3×10^{-9} .
- A. $2.2 \times 10^{-3} \text{ M}$
B. $1.1 \times 10^{-3} \text{ M}$
C. $1.325 \times 10^{-5} \text{ M}$
D. $1.1 \times 10^{-4} \text{ M}$
- 32.** Which of the following solutions with the same concentration has the highest vapor- pressure?
- A. AlCl_3
B. NaNO_3
C. $\text{C}_6\text{H}_{12}\text{O}_6$
D. CaCl_2
- 33.** In this reaction: $\text{Al}(\text{s}) + \text{H}_2\text{SO}_4(\text{aq}) \longrightarrow$, which of the following is the net ionic equation?
- A. $\text{H}_3\text{O}^+(\text{aq}) + \text{OH}^-(\text{aq}) \longrightarrow 2\text{H}_2\text{O}(\text{l})$
B. $2\text{Al}(\text{s}) + 6\text{H}_3\text{O}^+(\text{aq}) \longrightarrow 2\text{Al}^{3+}(\text{aq}) + 9\text{H}_2(\text{g})$
C. $2\text{Al}(\text{s}) + 6\text{H}_3\text{O}^+(\text{aq}) \longrightarrow 2\text{Al}^{3+}(\text{aq}) + 6\text{H}_2\text{O}(\text{l}) + 3\text{H}_2(\text{g})$
D. none of them
- 34.** When one gram of iron is heated to 100.0°C and cooled to 50.0°C in a calorimeter transfers 22.5 J of energy to the surrounding water. But one gram of silver transfers 11.8 J of energy under the same conditions, the difference of the value of transfer energy depends on the:-
- A. mass of the material
B. temperature change
C. nature of the material
D. all of them
- 35.** Which of the following pairs of solutions produce a precipitate when combined?
- A. NH_4Cl and NaOH
B. KCl and Na_2SO_4
C. $\text{Fe}(\text{NO}_3)_3$ and KCl
D. NH_4Cl and AgNO_3
- 36.** In the reaction NO_2^- ions with water, which of the following is conjugate acid –base pair?
- A. H_2O and H_3O^+
B. HNO_2 and NO_2^-
C. H_2O and OH^-
D. both (B and C) are correct
- 37.** When the ammonia molecule reacts with the hydrogen ion (proton) :-
- A. ammonia molecule is an electron-pair acceptor
B. ammonia acts as Arrhenius base
C. proton acts as Lewis acid
D. both (A and C) are correct
- 38.** The rate law for a reaction is found to be: $R = k[\text{X}][\text{Y}]^2$, by what factor does the rate increase if [Y] tripled?
- A. 3
B. 6
C. 27
D. 9
- 39.** One of the following **cannot** be isomer for $\text{C}_3\text{H}_8\text{O}$:-
- A. 2-propanol
B. 1-propanol
C. ethyl methyl ether
D. 2-propanon

- 40.** Used in biology laboratories as a preservative for dead animals:-
- A. methanol
B. acetic acid
C. methanal
D. methyl amine
- 41.** How many moles of nitrate ions are produced by dissolving 0.15 mol of zinc nitrate in water?
- A. 0.30
B. 0.15
C. 0.45
D. 2.0
- 42.** In the second ionization stage of phosphoric acid in its aqueous solution.....are produced.
- A. HPO_4^{2-} and H_3O^+
B. H_2PO_4^- and H_3O^+
C. PO_4^{3-} and H_3O^+
D. all of them
- 43.** This reaction: $2\text{H}_2\text{O}_2 \longrightarrow 2\text{H}_2\text{O} + \text{O}_2$, by using catalyst has the following proposed mechanism:-
- step: 1 $\text{H}_2\text{O}_2 + \text{I}^- \longrightarrow \text{H}_2\text{O} + \text{IO}^-$
step: 2 $\text{H}_2\text{O}_2 + \text{IO}^- \longrightarrow \text{H}_2\text{O} + \text{O}_2 + \text{I}^-$, which of the following is intermediate?
- A. I^-
B. H_2O
C. IO^-
D. both (A and C) are correct
- 44.** All of the following may be alkene and cycloalkane **EXCEPT**:-
- A. C_3H_6
B. C_2H_4
C. C_5H_{10}
D. C_4H_8
- 45.** The general formula for esters is:-
- A. $\text{R}-\text{CO}-\text{R}$
B. $\text{R}-\text{COO}-\text{R}$
C. $\text{R}-\text{COOH}$
D. $\text{R}-\text{O}-\text{R}$
- 46.** By using the information in the adjacent table, 55g of which of the following element absorbed 3.562 kJ of energy if it was heated from 22.4°C to 94.6°C?
- | Element | Ca | Al | Fe | Au |
|-----------------------|-------|-------|-------|-------|
| Specific heat J/(g.K) | 0.647 | 0.897 | 0.449 | 0.129 |
- A. Ca
B. Al
C. Fe
D. Au
- 47.** In the following hypothetical reaction: $\text{A} + \text{B} \longrightarrow \text{C} + \text{D}$ $\Delta H > 0$, which of the following is correct?
- A. the products are more stable
B. the reactants are more stable
C. the reaction is an exothermic
D. none of them
- 48.** The acidity of which of the following aqueous solutions at 25°C is highest?
- A. $\text{pOH} = 13$
B. $[\text{H}_3\text{O}^+] = 1.0 \times 10^{-7} \text{ M}$
C. $[\text{OH}^-] = 1.0 \times 10^{-4} \text{ M}$
D. $\text{pH} = 12$
- 49.** In this reaction: $2\text{H}_2(\text{g}) + \text{O}_2(\text{g}) \longrightarrow 2\text{H}_2\text{O}(\text{l}) + 571.6 \text{ kJ}$, which of the following is correct?
- A. ΔH_f^0 of water = -285.8 kJ/mol
B. ΔH_f^0 of water = +285.8 kJ/mol
C. ΔH^0 of reverse reaction = +571.6 kJ/mol
D. both (A and C) are correct
- 50.** Which of the following compounds **cannot** be monomer for the addition polymer?
- A. C_2H_4
B. CH_3COOH
C. C_2F_4
D. $\text{CH}_2=\text{CH}-\text{CH}_3$



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

- The acidity of which of the following aqueous solutions at 25°C is highest?
 A. pOH=13 B. $[H_3O^+]=1.0 \times 10^{-7} M$ C. $[OH^-]=1.0 \times 10^{-4} M$ D. pH=12
 - In the aqueous solution of KCN, the water reacts with:-
 A. K^+ and produces strong base B. K^+ and produces weak base
 C. CN^- and produces strong acid D. CN^- and produces weak acid
 - In the titration acid and base process the equivalence point is determined by :-
 A. suitable indicator B. pH meter C. transition interval D. both (A and B) are correct
 - In the adjacent energy diagram after using catalyst the value of E_a :-
 A. is equal to 100 kJ/mol
 B. is greater than 100 kJ/mol
 C. is less than 100 kJ/mol
 D. cannot be determined
- 
- When the ammonia molecule reacts with the hydrogen ion (proton) :-
 A. ammonia molecule is an electron-pair accepter B. ammonia acts as Arrhenius base
 C. proton acts as Lewis acid D. both (A and C) are correct
 - Which of the following reactions represent the hydrolysis reaction?
 A. $H_2CO_3(aq) + H_2O(l) \rightleftharpoons HCO_3^-(aq) + H_3O^+(aq)$ B. $CH_3NH_2(aq) + H_2O(l) \rightleftharpoons CH_3NH_3^+(aq) + OH^-(aq)$
 C. $NH_4^+(aq) + H_2O(l) \rightleftharpoons NH_3(aq) + H_3O^+(aq)$ D. all of them are correct
 - Which of the following pairs of solutions produce a precipitate when combined?
 A. NH_4Cl and $NaOH$ B. KCl and Na_2SO_4 C. $Fe(NO_3)_3$ and KCl D. NH_4Cl and $AgNO_3$
 - In the second ionization stage of phosphoric acid in its aqueous solution.....are produced.
 A. HPO_4^{2-} and H_3O^+ B. $H_2PO_4^-$ and H_3O^+ C. PO_4^{3-} and H_3O^+ D. all of them
 - In the reaction NO_2^- ions with water, which of the following is conjugate acid –base pair?
 A. H_2O and H_3O^+ B. HNO_2 and NO_2^- C. H_2O and OH^- D. both (B and C) are correct
 - By using the information in the adjacent table, 55g of which of the following element absorbed 3.562 kJ of energy if it was heated from 22.4°C to 94.6°C?
- | Element | Ca | Al | Fe | Au |
|-----------------------|-------|-------|-------|-------|
| Specific heat J/(g.K) | 0.647 | 0.897 | 0.449 | 0.129 |
- The equilibrium self-ionization equation of water at 25°C is: $2H_2O(l) + \text{energy} \rightleftharpoons H_3O^+(aq) + OH^-(aq)$, by decreasing the temperature which of the following is incorrect?
 A. the pH value increases B. the pOH value decreases
 C. the K_w value decreases D. none of them
 - If a small amounts of HCl added to a solution of HNO_2 and KNO_2 , which of the following decreases?
 A. pH B. ionization of HNO_2 C. $[OH^-]$ D. all of them are Correct

- Which of the following exhibits properties of an Arrhenius acid?
 A. hydrogen chloride that is dissolved in water B. the pure hydrogen chloride gas
 C. hydrogen chloride that is dissolved in nonpolar solvent D. all of them
- Which of the following types of molecular representations **cannot** be used to show differences between isomers?
 A. molecular formula B. three-dimensional drawing or model
 C. structural formula D. both (B and C) are correct
- In a reaction, $\Delta G^0 = 142.0 \text{ kJ/mol}$ and $\Delta H^0 = 206.1 \text{ kJ/mol}$, at room temperature which of the following is correct?
 A. the entropy of the reactants is greater B. the entropy of the products is greater
 C. the entropy of reactants and the products is equal D. none of them
- Which of the following two conditions will favor a spontaneous reaction?
 A. $\Delta H < 0$ and $\Delta S > 0$ B. $\Delta H > 0$ and $\Delta S > 0$ C. $\Delta H > 0$ and $\Delta S < 0$ D. $\Delta H < 0$ and $\Delta S < 0$
- All of the following are affect the rate of reaction between hydrogen gas and chlorine gas **EXCEPT**:-
 A. surface area B. temperature C. presence catalyst D. concentration
- Suppose that 15mL of 0.025M H_2SO_4 is required to neutralize 10mL of KOH solution, what is the molarity of the base?
 A. 0.025 B. 0.0125 C. 0.075 D. 0.0075
- The general formula for esters is:-
 A. $R-CO-R$ B. $R-COO-R$ C. $R-COOH$ D. $R-O-R$
- How many moles of nitrate ions are produced by dissolving 0.15 mol of zinc nitrate in water?
 A. 0.30 B. 0.15 C. 0.45 D. 2.0
- The rate law for a reaction is found to be: $R = k[X][Y]^2$, by what factor does the rate increase if [Y] tripled?
 A. 3 B. 6 C. 27 D. 9
- Which of the following compounds **cannot** be monomer for the addition polymer?
 A. C_2H_4 B. CH_3COOH C. C_2F_4 D. $CH_2=CH-CH_3$
- The anion of the acid that stomach produces:-
 A. is a strong conjugate base B. it acts as amphoteric
 C. is a weak conjugate acid D. it has a little tendency to attract a proton
- If the value of equilibrium constant for gaseous reaction is equal to 300 at given temperature, what is the value of equilibrium constant for the reaction by doubling the volume of reaction vessel, at the same temperature?
 A. 300 B. 600 C. 900 D. 150
- This hypothetical reaction: $A + B \rightarrow 2C$, is occur in one step-mechanism, what is the value of the specific rate constant for reverse reaction when $[C] = 0.015 M$ and the rate of reaction is equal to $1.1 \times 10^{-3} M/s$?
 A. $4.9 M^{-1}s^{-1}$ B. $4.9 s^{-1}$ C. $0.2 M^{-1}s^{-1}$ D. $0.2 s^{-1}$
- In this reaction: $Al(s) + H_2SO_4(aq) \rightarrow$, which of the following is the net ionic equation?
 A. $H_3O^+(aq) + OH^-(aq) \rightarrow 2H_2O(l)$ B. $2Al(s) + 6H_3O^+(aq) \rightarrow 2Al^{3+}(aq) + 9H_2(g)$
 C. $2Al(s) + 6H_3O^+(aq) \rightarrow 2Al^{3+}(aq) + 6H_2O(l) + 3H_2(g)$ D. none of them

- 27.** In a titration experiment, by using phenolphthalein indicator (pH=8.0-10.0), 0.5mol of which of the following acids neutralizes 0.5mol of NaOH? **A.** H_3PO_4 **B.** HF **C.** HCl **D.** both (A and B)
- 28.** In this reaction: $2\text{H}_2(\text{g}) + \text{O}_2(\text{g}) \longrightarrow 2\text{H}_2\text{O}(\text{l}) + 571.6 \text{ kJ}$, which of the following is correct?
A. ΔH_f° of water = -285.8 kJ/mol **B.** ΔH_f° of water = +285.8 kJ/mol
C. ΔH° of reverse reaction = +571.6 kJ/mol **D.** both (A and C) are correct
- 29.** When one gram of iron is heated to 100.0°C and cooled to 50.0°C in a calorimeter transfers 22.5 J of energy to the surrounding water. But one gram of silver transfers 11.8 J of energy under the same conditions, the difference of the value of transfer energy depends on the:-
A. mass of the material **B.** temperature change **C.** nature of the material **D.** all of them
- 30.** The molal boiling-point constant (K_b) depends on the:-
A. nature of solute **B.** number of solvent moles **C.** nature of solvent **D.** solute concentration
- 31.** Changing the temperature affects the rate of reaction because it affects:-
A. the energy of activated complex **B.** the enthalpy of reaction
C. the number of effective collision **D.** the properties of reactants
- 32.** When comparing the expected and actual freezing point of an aqueous solution of MgI_2 with 1.0 *m* concentration, which of the following is correct? If the actual freezing point is equal to -4.78°C and K_f of water = $-1.86^\circ\text{C}/m$.
A. the expected freezing point is equal to the actual freezing point.
B. the expected freezing point is lower than the actual freezing point
C. the expected freezing point is higher than the actual freezing point
D. none of them
- 33.** Which of the following solutions with the same concentration has the highest vapor- pressure?
A. AlCl_3 **B.** NaNO_3 **C.** $\text{C}_6\text{H}_{12}\text{O}_6$ **D.** CaCl_2
- 34.** An aqueous solution of hydrogen fluoride weakly conducts an electric current because :-
A. it is ionized partially **B.** the hydrogen- fluorine bond is strong
C. the hydrogen- fluorine bond is weak **D.** both (A and B) are correct
- 35.** Which of the following is correct?
A. the boiling point of pentane greater than 2-methyl butane.
B. the carbon atom hybridization type of C_2H_2 is sp^2 .
C. the graphite is a good conductor of heat.
D. the molecular formula of methyl benzene is C_6H_8 .
- 36.** Which of the following compounds formed hydrogen bond with water?
A. ethers **B.** benzene **C.** alcohols **D.** both (A and C) are correct
- 37.** If the $[\text{H}_3\text{O}^+]$ of aqueous solution of $\text{Ca}(\text{OH})_2$ is equal to $1.0 \times 10^{-8}\text{M}$, what is the molarity of $\text{Ca}(\text{OH})_2$?
A. 1.0×10^{-6} **B.** 5.0×10^{-7} **C.** 1.0×10^{-8} **D.** 2.0×10^{-6}
- 38.** In the following hypothetical reaction: $\text{A} + \text{B} \longrightarrow \text{C} + \text{D}$ $\Delta H > 0$, which of the following is correct?
A. the products are more stable **B.** the reactants are more stable
C. the reaction is an exothermic **D.** none of them

- 39.** The calcium sulfate salt is produce by the reaction between the:-
A. Ca and H_2SO_4 **B.** $\text{Ca}(\text{OH})_2$ and H_2SO_4 **C.** $\text{Ca}(\text{OH})_2$ and H_2SO_3 **D.** both (A and B) are correct
- 40.** In a saturated solution the concentration.....
A. is always high **B.** is always low
C. may be high or low, depending on the solubility of the solute **D.** cannot be determined
- 41.** All of the following may be alkene and cycloalkane **EXCEPT**:-
A. C_3H_6 **B.** C_2H_4 **C.** C_5H_{10} **D.** C_4H_8
- 42.** Determine the concentration of fluoride ions in a saturated solution of CaF_2 , If the K_{sp} of CaF_2 is 5.3×10^{-9} . **A.** $2.2 \times 10^{-3}\text{M}$ **B.** $1.1 \times 10^{-3}\text{M}$ **C.** $1.325 \times 10^{-5}\text{M}$ **D.** $1.1 \times 10^{-4}\text{M}$
- 43.** This reaction: $2\text{H}_2\text{O}_2 \longrightarrow 2\text{H}_2\text{O} + \text{O}_2$, by using catalyst has the following proposed mechanism:-
step: 1 $\text{H}_2\text{O}_2 + \text{I}^- \longrightarrow \text{H}_2\text{O} + \text{IO}^-$
step: 2 $\text{H}_2\text{O}_2 + \text{IO}^- \longrightarrow \text{H}_2\text{O} + \text{O}_2 + \text{I}^-$, which of the following is intermediate?
A. I^- **B.** H_2O **C.** IO^- **D.** both (A and C) are correct
- 44.** The correct name for this compound: (1-ethyl-3-methyl propane) according to IUPAC system is:
A. hexane **B.** 2-methyl pentane **C.** 3-methyl pentane **D.** 2,3-dimethyl butane
- 45.** Used in biology laboratories as a preservative for dead animals:-
A. methanol **B.** acetic acid **C.** methanal **D.** methyl amine
- 46.** Which of the following can have geometric isomers?
A. CH_2Cl_2 **B.** $\text{C}_2\text{H}_4\text{Cl}_2$ **C.** $\text{C}_2\text{H}_2\text{Cl}_2$ **D.** none of them
- 47.** In this reaction: $\text{H}_2(\text{g}) + \text{I}_2(\text{g}) \rightleftharpoons 2\text{HI}(\text{g})$, at 425°C is found at equilibrium:
 $[\text{H}_2] = 1.83 \times 10^{-3}\text{M}$, $[\text{I}_2] = 3.13 \times 10^{-3}\text{M}$ and $[\text{HI}] = 1.77 \times 10^{-2}\text{M}$, which of the following is correct?
A. reactants are favored **B.** a small amount of reactants converted into products
C. products are favored **D.** both (A and B) are correct.
- 48.** A hydrocarbon that contains delocalized electrons:-
A. graphite **B.** benzene **C.** cyclohexane **D.** both (A and B) are correct
- 49.** One of the following **cannot** be isomer for $\text{C}_3\text{H}_8\text{O}$:-
A. 2-propanol **B.** 1-propanol **C.** ethyl methyl ether **D.** 2-propanon
- 50.** This reaction: $\text{CH}_2=\text{CH}-\text{CH}_3 + \text{HCl} \longrightarrow 2\text{-chloro propane}$, is called:-
A. substitution **B.** addition **C.** condensation **D.** elimination



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

- The acidity of which of the following aqueous solutions at 25°C is highest?
 A. $\text{pOH}=13$ B. $[\text{H}_3\text{O}^+]=1.0 \times 10^{-7}\text{M}$ C. $[\text{OH}^-]=1.0 \times 10^{-4}\text{M}$ D. $\text{pH}=12$
- The rate law for a reaction is found to be: $R=k[\text{X}][\text{Y}]^2$, by what factor does the rate increase if $[\text{Y}]$ tripled?
 A. 3 B. 6 C. 27 D. 9
- Which of the following two conditions will favor a spontaneous reaction?
 A. $\Delta H < 0$ and $\Delta S > 0$ B. $\Delta H > 0$ and $\Delta S > 0$ C. $\Delta H > 0$ and $\Delta S < 0$ D. $\Delta H < 0$ and $\Delta S < 0$
- If a small amounts of HCl added to a solution of HNO_2 and KNO_2 , which of the following decreases?
 A. pH B. ionization of HNO_2 C. $[\text{OH}^-]$ D. all of them are Correct
- When comparing the expected and actual freezing point of an aqueous solution of MgI_2 with 1.0 m concentration, which of the following is correct? If the actual freezing point is equal to -4.78°C and K_f of water = $-1.86^\circ\text{C}/m$.
 A. the expected freezing point is equal to the actual freezing point.
 B. the expected freezing point is lower than the actual freezing point
 C. the expected freezing point is higher than the actual freezing point
 D. none of them
- The calcium sulfate salt is produce by the reaction between the:-
 A. Ca and H_2SO_4 B. $\text{Ca}(\text{OH})_2$ and H_2SO_4 C. $\text{Ca}(\text{OH})_2$ and H_2SO_3 D. both (A and B) are correct
- This reaction: $2\text{H}_2\text{O}_2 \longrightarrow 2\text{H}_2\text{O} + \text{O}_2$, by using catalyst has the following proposed mechanism:-
 step: 1 $\text{H}_2\text{O}_2 + \text{I}^- \longrightarrow \text{H}_2\text{O} + \text{IO}^-$
 step: 2 $\text{H}_2\text{O}_2 + \text{IO}^- \longrightarrow \text{H}_2\text{O} + \text{O}_2 + \text{I}^-$, which of the following is intermediate?
 A. I^- B. H_2O C. IO^- D. both (A and C) are correct
- Which of the following compounds formed hydrogen bond with water?
 A. ethers B. benzene C. alcohols D. both (A and C) are correct
- An aqueous solution of hydrogen fluoride weakly conducts an electric current because :-
 A. it is ionized partially B. the hydrogen- fluorine bond is strong
 C. the hydrogen- fluorine bond is weak D. both (A and B) are correct
- Which of the following pairs of solutions produce a precipitate when combined?
 A. NH_4Cl and NaOH B. KCl and Na_2SO_4 C. $\text{Fe}(\text{NO}_3)_3$ and KCl D. NH_4Cl and AgNO_3
- This hypothetical reaction: $\text{A} + \text{B} \longrightarrow 2\text{C}$, is occur in one step-mechanism, what is the value of the specific rate constant for reverse reaction when $[\text{C}] = 0.015\text{M}$ and the rate of reaction is equal to $1.1 \times 10^{-3}\text{M/s}$?
 A. $4.9 \text{ M}^{-1}\text{s}^{-1}$ B. 4.9 s^{-1} C. $0.2 \text{ M}^{-1}\text{s}^{-1}$ D. 0.2 s^{-1}
- In this reaction: $2\text{H}_2(\text{g}) + \text{O}_2(\text{g}) \longrightarrow 2\text{H}_2\text{O}(\text{l}) + 571.6 \text{ kJ}$, which of the following is correct?
 A. ΔH_f° of water = -285.8 kJ/mol B. ΔH_f° of water = $+285.8 \text{ kJ/mol}$
 C. ΔH° of reverse reaction = $+571.6 \text{ kJ/mol}$ D. both (A and C) are correct

- This reaction: $\text{CH}_2=\text{CH}-\text{CH}_3 + \text{HCl} \longrightarrow 2\text{-chloro propane}$, is called:-
 A. substitution B. addition C. condensation D. elimination
- In the following hypothetical reaction: $\text{A} + \text{B} \longrightarrow \text{C} + \text{D}$ $\Delta H > 0$, which of the following is correct?
 A. the products are more stable B. the reactants are more stable
 C. the reaction is an exothermic D. none of them
- The correct name for this compound: (1-ethyl-3-methyl propane) according to IUPAC system is:
 A. hexane B. 2-methyl pentane C. 3-methyl pentane D. 2,3-dimethyl butane
- How many moles of nitrate ions are produced by dissolving 0.15 mol of zinc nitrate in water?
 A. 0.30 B. 0.15 C. 0.45 D. 2.0
- One of the following **cannot** be isomer for $\text{C}_3\text{H}_8\text{O}$:-
 A. 2-propanol B. 1-propanol C. ethyl methyl ether D. 2-propanon
- In a saturated solution the concentration.....
 A. is always high B. is always low
 C. may be high or low, depending on the solubility of the solute D. cannot be determined
- The molal boiling-point constant (K_b) depends on the:-
 A. nature of solute B. number of solvent moles C. nature of solvent D. solute concentration
- Determine the concentration of fluoride ions in a saturated solution of CaF_2 , If the K_{sp} of CaF_2 is 5.3×10^{-9} .
 A. $2.2 \times 10^{-3}\text{M}$ B. $1.1 \times 10^{-3}\text{M}$ C. $1.325 \times 10^{-5}\text{M}$ D. $1.1 \times 10^{-4}\text{M}$
- In this reaction: $\text{H}_2(\text{g}) + \text{I}_2(\text{g}) \rightleftharpoons 2\text{HI}(\text{g})$, at 425°C is found at equilibrium:
 $[\text{H}_2] = 1.83 \times 10^{-3}\text{M}$, $[\text{I}_2] = 3.13 \times 10^{-3}\text{M}$ and $[\text{HI}] = 1.77 \times 10^{-2}\text{M}$, which of the following is correct?
 A. reactants are favored B. a small amount of reactants converted into products
 C. products are favored D. both (A and B) are correct.
- In a reaction, $\Delta G^\circ = 142.0 \text{ kJ/mol}$ and $\Delta H^\circ = 206.1 \text{ kJ/mol}$, at room temperature which of the following is correct?
 A. the entropy of the reactants is greater B. the entropy of the products is greater
 C. the entropy of reactants and the products is equal D. none of them
- A hydrocarbon that contains delocalized electrons:-
 A. graphite B. benzene C. cyclohexane D. both (A and B) are correct
- Which of the following reactions represent the hydrolysis reaction?
 A. $\text{H}_2\text{CO}_3(\text{aq}) + \text{H}_2\text{O}(\text{l}) \rightleftharpoons \text{HCO}_3^-(\text{aq}) + \text{H}_3\text{O}^+(\text{aq})$ B. $\text{CH}_3\text{NH}_2(\text{aq}) + \text{H}_2\text{O}(\text{l}) \rightleftharpoons \text{CH}_3\text{NH}_3^+(\text{aq}) + \text{OH}^-(\text{aq})$
 C. $\text{NH}_4^+(\text{aq}) + \text{H}_2\text{O}(\text{l}) \rightleftharpoons \text{NH}_3(\text{aq}) + \text{H}_3\text{O}^+(\text{aq})$ D. all of them are correct
- If the $[\text{H}_3\text{O}^+]$ of aqueous solution of $\text{Ca}(\text{OH})_2$ is equal to $1.0 \times 10^{-8}\text{M}$, what is the molarity of $\text{Ca}(\text{OH})_2$?
 A. 1.0×10^{-6} B. 5.0×10^{-7} C. 1.0×10^{-8} D. 2.0×10^{-6}
- The general formula for esters is:-
 A. $\text{R}-\text{CO}-\text{R}$ B. $\text{R}-\text{COO}-\text{R}$ C. $\text{R}-\text{COOH}$ D. $\text{R}-\text{O}-\text{R}$
- In a titration experiment, by using phenolphthalein indicator ($\text{pH}=8.0-10.0$), 0.5mol of which of the following acids neutralizes 0.5mol of NaOH ?
 A. H_3PO_4 B. HF C. HCl D. both (A and B)

28. Which of the following exhibits properties of an Arrhenius acid?

- A. hydrogen chloride that is dissolved in water
B. the pure hydrogen chloride gas
C. hydrogen chloride that is dissolved in nonpolar solvent
D. all of them

29. By using the information in the adjacent table, 55g of which of the following element absorbed 3.562 kJ of energy if it was heated from 22.4°C to 94.6°C?

- A. Ca
B. Al
C. Fe
D. Au

Element	Ca	Al	Fe	Au
Specific heat J/(g.K)	0.647	0.897	0.449	0.129

30. In the aqueous solution of KCN, the water reacts with:-

- A. K^+ and produces strong base
B. K^+ and produces weak base
C. CN^- and produces strong acid
D. CN^- and produces weak acid

31. Which of the following is correct?

- A. the boiling point of pentane greater than 2-methyl butane.
B. the carbon atom hybridization type of C_2H_2 is sp^2 .
C. the graphite is a good conductor of heat.
D. the molecular formula of methyl benzene is C_6H_8 .

32. In the second ionization stage of phosphoric acid in its aqueous solution.....are produced.

- A. HPO_4^{2-} and H_3O^+
B. $H_2PO_4^-$ and H_3O^+
C. PO_4^{3-} and H_3O^+
D. all of them

33. All of the following may be alkene and cycloalkane **EXCEPT**:-

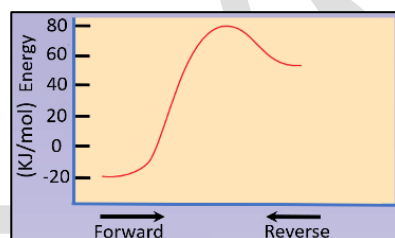
- A. C_3H_6
B. C_2H_4
C. C_5H_{10}
D. C_4H_8

34. Suppose that 15mL of 0.025M H_2SO_4 is required to neutralize 10mL of KOH solution, what is the molarity of the base?

- A. 0.025
B. 0.0125
C. 0.075
D. 0.0075

35. In the adjacent energy diagram after using catalyst the value of E_a :-

- A. is equal to 100 kJ/mol
B. is greater than 100 kJ/mol
C. is less than 100 kJ/mol
D. cannot be determined



36. If the value of equilibrium constant for gaseous reaction is equal to 300 at given temperature, what is the value of equilibrium constant for the reaction by doubling the volume of reaction vessel, at the same temperature?

- A. 300
B. 600
C. 900
D. 150

37. All of the following are affect the rate of reaction between hydrogen gas and chlorine gas **EXCEPT**:-

- A. surface area
B. temperature
C. presence catalyst
D. concentration

38. Used in biology laboratories as a preservative for dead animals:-

- A. methanol
B. acetic acid
C. methanal
D. methyl amine

39. In the reaction NO_2^- ions with water, which of the following is conjugate acid –base pair?

- A. H_2O and H_3O^+
B. HNO_2 and NO_2^-
C. H_2O and OH^-
D. both (B and C) are correct

40. When the ammonia molecule reacts with the hydrogen ion (proton) :-

- A. ammonia molecule is an electron-pair acceptor
B. ammonia acts as Arrhenius base
C. proton acts as Lewis acid
D. both (A and C) are correct

41. In the titration acid and base process the equivalence point is determined by :-

- A. suitable indicator
B. pH meter
C. transition interval
D. both (A and B) are correct

42. The anion of the acid that stomach produces:-

- A. is a strong conjugate base
B. it acts as amphoteric
C. is a weak conjugate acid
D. it has a little tendency to attract a proton

43. In this reaction: $Al(s) + H_2SO_4(aq) \rightarrow$, which of the following is the net ionic equation?

- A. $H_3O^+(aq) + OH^-(aq) \rightarrow 2H_2O(l)$
B. $2Al(s) + 6H_3O^+(aq) \rightarrow 2Al^{3+}(aq) + 9H_2(g)$
C. $2Al(s) + 6H_3O^+(aq) \rightarrow 2Al^{3+}(aq) + 6H_2O(l) + 3H_2(g)$
D. none of them

44. Which of the following solutions with the same concentration has the highest vapor- pressure?

- A. $AlCl_3$
B. $NaNO_3$
C. $C_6H_{12}O_6$
D. $CaCl_2$

45. Which of the following types of molecular representations **cannot** be used to show differences between isomers?

- A. molecular formula
B. three-dimensional drawing or model
C. structural formula
D. both (B and C) are correct

46. Which of the following compounds **cannot** be monomer for the addition polymer?

- A. C_2H_4
B. CH_3COOH
C. C_2F_4
D. $CH_2=CH-CH_3$

47. Which of the following can have geometric isomers?

- A. CH_2Cl_2
B. $C_2H_4Cl_2$
C. $C_2H_2Cl_2$
D. none of them

48. The equilibrium self-ionization equation of water at 25°C is: $2H_2O(l) + \text{energy} \rightleftharpoons H_3O^+(aq) + OH^-(aq)$, by decreasing the temperature which of the following is incorrect?

- A. the pH value increases
B. the pOH value decreases
C. the K_w value decreases
D. none of them

49. When one gram of iron is heated to 100.0°C and cooled to 50.0°C in a calorimeter transfers 22.5 J of energy to the surrounding water. But one gram of silver transfers 11.8 J of energy under the same conditions, the difference of the value of transfer energy depends on the:-

- A. mass of the material
B. temperature change
C. nature of the material
D. all of them

50. Changing the temperature affects the rate of reaction because it affects:-

- A. the energy of activated complex
B. the enthalpy of reaction
C. the number of effective collision
D. the properties of reactants



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

- Suppose that 15mL of 0.025M H_2SO_4 is required to neutralize 10mL of KOH solution, what is the molarity of the base?
 A. 0.025 B. 0.0125 C. 0.075 D. 0.0075
- In this reaction: $\text{H}_2(\text{g}) + \text{I}_2(\text{g}) \rightleftharpoons 2\text{HI}(\text{g})$, at 425°C is found at equilibrium:
 $[\text{H}_2] = 1.83 \times 10^{-3}\text{M}$, $[\text{I}_2] = 3.13 \times 10^{-3}\text{M}$ and $[\text{HI}] = 1.77 \times 10^{-2}\text{M}$, which of the following is correct?
 A. reactants are favored B. a small amount of reactants converted into products
 C. products are favored D. both (A and B) are correct.
- If the value of equilibrium constant for gaseous reaction is equal to 300 at given temperature, what is the value of equilibrium constant for the reaction by doubling the volume of reaction vessel, at the same temperature?
 A. 300 B. 600 C. 900 D. 150
- In the following hypothetical reaction: $\text{A} + \text{B} \rightarrow \text{C} + \text{D}$ $\Delta\text{H} > 0$, which of the following is correct?
 A. the products are more stable B. the reactants are more stable
 C. the reaction is an exothermic D. none of them
- The equilibrium self-ionization equation of water at 25°C is: $2\text{H}_2\text{O}(\text{l}) + \text{energy} \rightleftharpoons \text{H}_3\text{O}^+(\text{aq}) + \text{OH}^-(\text{aq})$, by decreasing the temperature which of the following is incorrect?
 A. the pH value increases B. the pOH value decreases
 C. the K_w value decreases D. none of them
- A hydrocarbon that contains delocalized electrons:-
 A. graphite B. benzene C. cyclohexane D. both (A and B) are correct
- Which of the following compounds **cannot** be monomer for the addition polymer?
 A. C_2H_4 B. CH_3COOH C. C_2F_4 D. $\text{CH}_2=\text{CH}-\text{CH}_3$
- If a small amounts of HCl added to a solution of HNO_2 and KNO_2 , which of the following decreases?
 A. pH B. ionization of HNO_2 C. $[\text{OH}^-]$ D. all of them are Correct
- In a saturated solution the concentration.....
 A. is always high B. is always low
 C. may be high or low, depending on the solubility of the solute D. cannot be determined
- When one gram of iron is heated to 100.0°C and cooled to 50.0°C in a calorimeter transfers 22.5 J of energy to the surrounding water. But one gram of silver transfers 11.8 J of energy under the same conditions, the difference of the value of transfer energy depends on the:-
 A. mass of the material B. temperature change C. nature of the material D. all of them
- Which of the following is correct?
 A. the boiling point of pentane greater than 2-methyl butane.
 B. the carbon atom hybridization type of C_2H_2 is sp^2 .
 C. the graphite is a good conductor of heat.
 D. the molecular formula of methyl benzene is C_6H_8 .

12. Which of the following solutions with the same concentration has the highest vapor- pressure?

A. AlCl_3 B. NaNO_3 C. $\text{C}_6\text{H}_{12}\text{O}_6$ D. CaCl_2

13. In a titration experiment, by using phenolphthalein indicator ($\text{pH}=8.0-10.0$), 0.5mol of which of the following acids neutralizes 0.5mol of NaOH? A. H_3PO_4 B. HF C. HCl D. both (A and B)

14. By using the information in the adjacent table, 55g of which of the following element absorbed 3.562 kJ of energy if it was heated from 22.4°C to 94.6°C ?

A. Ca B. Al
 C. Fe D. Au

Element	Ca	Al	Fe	Au
Specific heat J/(g.K)	0.647	0.897	0.449	0.129

15. In this reaction: $\text{Al}(\text{s}) + \text{H}_2\text{SO}_4(\text{aq}) \rightarrow$, which of the following is the net ionic equation?

A. $\text{H}_3\text{O}^+(\text{aq}) + \text{OH}^-(\text{aq}) \rightarrow 2\text{H}_2\text{O}(\text{l})$ B. $2\text{Al}(\text{s}) + 6\text{H}_3\text{O}^+(\text{aq}) \rightarrow 2\text{Al}^{3+}(\text{aq}) + 9\text{H}_2(\text{g})$
 C. $2\text{Al}(\text{s}) + 6\text{H}_3\text{O}^+(\text{aq}) \rightarrow 2\text{Al}^{3+}(\text{aq}) + 6\text{H}_2\text{O}(\text{l}) + 3\text{H}_2(\text{g})$ D. none of them

16. Which of the following reactions represent the hydrolysis reaction?

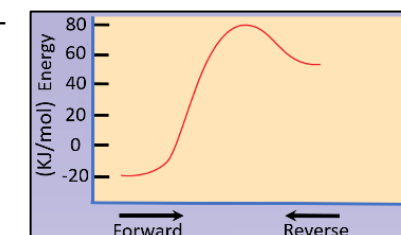
A. $\text{H}_2\text{CO}_3(\text{aq}) + \text{H}_2\text{O}(\text{l}) \rightleftharpoons \text{HCO}_3^-(\text{aq}) + \text{H}_3\text{O}^+(\text{aq})$ B. $\text{CH}_3\text{NH}_2(\text{aq}) + \text{H}_2\text{O}(\text{l}) \rightleftharpoons \text{CH}_3\text{NH}_3^+(\text{aq}) + \text{OH}^-(\text{aq})$
 C. $\text{NH}_4^+(\text{aq}) + \text{H}_2\text{O}(\text{l}) \rightleftharpoons \text{NH}_3(\text{aq}) + \text{H}_3\text{O}^+(\text{aq})$ D. all of them are correct

17. All of the following are affect the rate of reaction between hydrogen gas and chlorine gas **EXCEPT**:-

A. surface area B. temperature C. presence catalyst D. concentration

18. In the adjacent energy diagram after using catalyst the value of E_a :-

A. is equal to 100 kJ/mol
 B. is greater than 100 kJ/mol
 C. is less than 100 kJ/mol
 D. cannot be determined



19. Which of the following pairs of solutions produce a precipitate when combined?

A. NH_4Cl and NaOH B. KCl and Na_2SO_4 C. $\text{Fe}(\text{NO}_3)_3$ and KCl D. NH_4Cl and AgNO_3

20. When comparing the expected and actual freezing point of an aqueous solution of MgI_2 with 1.0 m concentration, which of the following is correct? If the actual freezing point is equal to -4.78°C and K_f of water = $-1.86^\circ\text{C}/m$.

A. the expected freezing point is equal to the actual freezing point.
 B. the expected freezing point is lower than the actual freezing point
 C. the expected freezing point is higher than the actual freezing point
 D. none of them

21. Which of the following exhibits properties of an Arrhenius acid?

A. hydrogen chloride that is dissolved in water B. the pure hydrogen chloride gas
 C. hydrogen chloride that is dissolved in nonpolar solvent D. all of them

22. Which of the following two conditions will favor a spontaneous reaction?

A. $\Delta\text{H} < 0$ and $\Delta\text{S} > 0$ B. $\Delta\text{H} > 0$ and $\Delta\text{S} > 0$ C. $\Delta\text{H} > 0$ and $\Delta\text{S} < 0$ D. $\Delta\text{H} < 0$ and $\Delta\text{S} < 0$

23. The correct name for this compound: (1-ethyl-3-methyl propane) according to IUPAC system is:

A. hexane B. 2-methyl pentane C. 3-methyl pentane D. 2,3-dimethyl butane

24. This reaction: $\text{CH}_2=\text{CH}-\text{CH}_3 + \text{HCl} \rightarrow$ 2-chloro propane, is called:-

A. substitution B. addition C. condensation D. elimination

- 25.** The molal boiling-point constant (K_b) depends on the:-
A. nature of solute **B.** number of solvent moles **C.** nature of solvent **D.** solute concentration
- 26.** How many moles of nitrate ions are produced by dissolving 0.15 mol of zinc nitrate in water?
A. 0.30 **B.** 0.15 **C.** 0.45 **D.** 2.0
- 27.** Used in biology laboratories as a preservative for dead animals:-
A. methanol **B.** acetic acid **C.** methanal **D.** methyl amine
- 28.** This hypothetical reaction: $A + B \longrightarrow 2C$, is occur in one step-mechanism, what is the value of the specific rate constant for reverse reaction when $[C] = 0.015M$ and the rate of reaction is equal to $1.1 \times 10^{-3} M/s$?
A. $4.9 M^{-1}s^{-1}$ **B.** $4.9 s^{-1}$ **C.** $0.2 M^{-1}s^{-1}$ **D.** $0.2 s^{-1}$
- 29.** The rate law for a reaction is found to be: $R = k[X][Y]^2$, by what factor does the rate increase if $[Y]$ tripled?
A. 3 **B.** 6 **C.** 27 **D.** 9
- 30.** If the $[H_3O^+]$ of aqueous solution of $Ca(OH)_2$ is equal to $1.0 \times 10^{-8} M$, what is the molarity of $Ca(OH)_2$?
A. 1.0×10^{-6} **B.** 5.0×10^{-7} **C.** 1.0×10^{-8} **D.** 2.0×10^{-6}
- 31.** Determine the concentration of fluoride ions in a saturated solution of CaF_2 , If the K_{sp} of CaF_2 is 5.3×10^{-9} .
A. $2.2 \times 10^{-3} M$ **B.** $1.1 \times 10^{-3} M$ **C.** $1.325 \times 10^{-5} M$ **D.** $1.1 \times 10^{-4} M$
- 32.** One of the following **cannot** be isomer for C_3H_8O :-
A. 2-propanol **B.** 1-propanol **C.** ethyl methyl ether **D.** 2-propanon
- 33.** Changing the temperature affects the rate of reaction because it affects:-
A. the energy of activated complex **B.** the enthalpy of reaction
C. the number of effective collision **D.** the properties of reactants
- 34.** In the aqueous solution of KCN , the water reacts with:-
A. K^+ and produces strong base **B.** K^+ and produces weak base
C. CN^- and produces strong acid **D.** CN^- and produces weak acid
- 35.** Which of the following can have geometric isomers?
A. CH_2Cl_2 **B.** $C_2H_4Cl_2$ **C.** $C_2H_2Cl_2$ **D.** none of them
- 36.** Which of the following types of molecular representations **cannot** be used to show differences between isomers?
A. molecular formula **B.** three-dimensional drawing or model
C. structural formula **D.** both (B and C) are correct
- 37.** In a reaction, $\Delta G^0 = 142.0 \text{ kJ/mol}$ and $\Delta H^0 = 206.1 \text{ kJ/mol}$, at room temperature which of the following is correct?
A. the entropy of the reactants is greater **B.** the entropy of the products is greater
C. the entropy of reactants and the products is equal **D.** none of them
- 38.** In this reaction: $2H_2(g) + O_2(g) \longrightarrow 2H_2O(l) + 571.6 \text{ kJ}$, which of the following is correct?
A. ΔH_f^0 of water = -285.8 kJ/mol **B.** ΔH_f^0 of water = $+285.8 \text{ kJ/mol}$
C. ΔH^0 of reverse reaction = $+571.6 \text{ kJ/mol}$ **D.** both (A and C) are correct
- 39.** The acidity of which of the following aqueous solutions at $25^\circ C$ is highest?
A. $pOH = 13$ **B.** $[H_3O^+] = 1.0 \times 10^{-7} M$ **C.** $[OH^-] = 1.0 \times 10^{-4} M$ **D.** $pH = 12$

- 40.** In the reaction NO_2^- ions with water, which of the following is conjugate acid –base pair?
A. H_2O and H_3O^+ **B.** HNO_2 and NO_2^- **C.** H_2O and OH^- **D.** both (B and C) are correct
- 41.** The general formula for esters is:-
A. $R-CO-R$ **B.** $R-COO-R$ **C.** $R-COOH$ **D.** $R-O-R$
- 42.** This reaction: $2H_2O_2 \longrightarrow 2H_2O + O_2$, by using catalyst has the following proposed mechanism:-
step: 1 $H_2O_2 + I^- \longrightarrow H_2O + IO^-$
step: 2 $H_2O_2 + IO^- \longrightarrow H_2O + O_2 + I^-$, which of the following is intermediate?
A. I^- **B.** H_2O **C.** IO^- **D.** both (A and C) are correct
- 43.** The anion of the acid that stomach produces:-
A. is a strong conjugate base **B.** it acts as amphoteric
C. is a weak conjugate acid **D.** it has a little tendency to attract a proton
- 44.** All of the following may be alkene and cycloalkane **EXCEPT**:-
A. C_3H_6 **B.** C_2H_4 **C.** C_5H_{10} **D.** C_4H_8
- 45.** Which of the following compounds formed hydrogen bond with water?
A. ethers **B.** benzene **C.** alcohols **D.** both (A and C) are correct
- 46.** An aqueous solution of hydrogen fluoride weakly conducts an electric current because :-
A. it is ionized partially **B.** the hydrogen- fluorine bond is strong
C. the hydrogen- fluorine bond is weak **D.** both (A and B) are correct
- 47.** When the ammonia molecule reacts with the hydrogen ion (proton) :-
A. ammonia molecule is an electron-pair acceptor **B.** ammonia acts as Arrhenius base
C. proton acts as Lewis acid **D.** both (A and C) are correct
- 48.** The calcium sulfate salt is produce by the reaction between the:-
A. Ca and H_2SO_4 **B.** $Ca(OH)_2$ and H_2SO_4 **C.** $Ca(OH)_2$ and H_2SO_3 **D.** both (A and B) are correct
- 49.** In the second ionization stage of phosphoric acid in its aqueous solution.....are produced.
A. HPO_4^{2-} and H_3O^+ **B.** $H_2PO_4^-$ and H_3O^+ **C.** PO_4^{3-} and H_3O^+ **D.** all of them
- 50.** In the titration acid and base process the equivalence point is determined by :-
A. suitable indicator **B.** pH meter **C.** transition interval **D.** both (A and B) are correct



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

- Suppose that 15mL of 0.025M H_2SO_4 is required to neutralize 10mL of KOH solution, what is the molarity of the base?
 A. 0.025 B. 0.0125 C. 0.075 D. 0.0075
 - Which of the following solutions with the same concentration has the highest vapor- pressure?
 A. AlCl_3 B. NaNO_3 C. $\text{C}_6\text{H}_{12}\text{O}_6$ D. CaCl_2
 - By using the information in the adjacent table, 55g of which of the following element absorbed 3.562 kJ of energy if it was heated from 22.4°C to 94.6°C?
 A. Ca B. Al
 C. Fe D. Au
- | Element | Ca | Al | Fe | Au |
|-----------------------|-------|-------|-------|-------|
| Specific heat J/(g.K) | 0.647 | 0.897 | 0.449 | 0.129 |
- Which of the following two conditions will favor a spontaneous reaction?
 A. $\Delta H < 0$ and $\Delta S > 0$ B. $\Delta H > 0$ and $\Delta S > 0$ C. $\Delta H > 0$ and $\Delta S < 0$ D. $\Delta H < 0$ and $\Delta S < 0$
 - The correct name for this compound: (1-ethyl-3-methyl propane) according to IUPAC system is:
 A. hexane B. 2-methyl pentane C. 3-methyl pentane D. 2,3-dimethyl butane
 - The acidity of which of the following aqueous solutions at 25°C is highest?
 A. $\text{pOH}=13$ B. $[\text{H}_3\text{O}^+]=1.0 \times 10^{-7}\text{M}$ C. $[\text{OH}^-]=1.0 \times 10^{-4}\text{M}$ D. $\text{pH}=12$
 - In the aqueous solution of KCN, the water reacts with:-
 A. K^+ and produces strong base B. K^+ and produces weak base
 C. CN^- and produces strong acid D. CN^- and produces weak acid
 - Determine the concentration of fluoride ions in a saturated solution of CaF_2 , If the K_{sp} of CaF_2 is 5.3×10^{-9} .
 A. $2.2 \times 10^{-3}\text{M}$ B. $1.1 \times 10^{-3}\text{M}$ C. $1.325 \times 10^{-5}\text{M}$ D. $1.1 \times 10^{-4}\text{M}$
 - The molal boiling-point constant (K_b) depends on the:-
 A. nature of solute B. number of solvent moles C. nature of solvent D. solute concentration
 - Which of the following pairs of solutions produce a precipitate when combined?
 A. NH_4Cl and NaOH B. KCl and Na_2SO_4 C. $\text{Fe}(\text{NO}_3)_3$ and KCl D. NH_4Cl and AgNO_3
 - In the following hypothetical reaction: $\text{A} + \text{B} \longrightarrow \text{C} + \text{D}$ $\Delta H > 0$, which of the following is correct?
 A. the products are more stable B. the reactants are more stable
 C. the reaction is an exothermic D. none of them
 - Changing the temperature affects the rate of reaction because it affects:-
 A. the energy of activated complex B. the enthalpy of reaction
 C. the number of effective collision D. the properties of reactants
 - This reaction: $\text{CH}_2=\text{CH}-\text{CH}_3 + \text{HCl} \longrightarrow 2\text{-chloro propane}$, is called:-
 A. substitution B. addition C. condensation D. elimination

- Which of the following types of molecular representations **cannot** be used to show differences between isomers?
 A. molecular formula B. three-dimensional drawing or model
 C. structural formula D. both (B and C) are correct
- How many moles of nitrate ions are produced by dissolving 0.15 mol of zinc nitrate in water?
 A. 0.30 B. 0.15 C. 0.45 D. 2.0
- In this reaction: $\text{H}_2(\text{g}) + \text{I}_2(\text{g}) \rightleftharpoons 2\text{HI}(\text{g})$, at 425°C is found at equilibrium:
 $[\text{H}_2] = 1.83 \times 10^{-3}\text{M}$, $[\text{I}_2] = 3.13 \times 10^{-3}\text{M}$ and $[\text{HI}] = 1.77 \times 10^{-2}\text{M}$, which of the following is correct?
 A. reactants are favored B. a small amount of reactants converted into products
 C. products are favored D. both (A and B) are correct.
- In the reaction NO_2^- ions with water, which of the following is conjugate acid –base pair?
 A. H_2O and H_3O^+ B. HNO_2 and NO_2^- C. H_2O and OH^- D. both (B and C) are correct
- The rate law for a reaction is found to be: $R = k[\text{X}][\text{Y}]^2$, by what factor does the rate increase if $[\text{Y}]$ tripled?
 A. 3 B. 6 C. 27 D. 9
- In this reaction: $\text{Al}(\text{s}) + \text{H}_2\text{SO}_4(\text{aq}) \longrightarrow$, which of the following is the net ionic equation?
 A. $\text{H}_3\text{O}^+(\text{aq}) + \text{OH}^-(\text{aq}) \longrightarrow 2\text{H}_2\text{O}(\text{l})$ B. $2\text{Al}(\text{s}) + 6\text{H}_3\text{O}^+(\text{aq}) \longrightarrow 2\text{Al}^{3+}(\text{aq}) + 9\text{H}_2(\text{g})$
 C. $2\text{Al}(\text{s}) + 6\text{H}_3\text{O}^+(\text{aq}) \longrightarrow 2\text{Al}^{3+}(\text{aq}) + 6\text{H}_2\text{O}(\text{l}) + 3\text{H}_2(\text{g})$ D. none of them
- When comparing the expected and actual freezing point of an aqueous solution of MgI_2 with 1.0 *m* concentration, which of the following is correct? If the actual freezing point is equal to -4.78°C and K_f of water = -1.86°C/*m*.
 A. the expected freezing point is equal to the actual freezing point.
 B. the expected freezing point is lower than the actual freezing point
 C. the expected freezing point is higher than the actual freezing point
 D. none of them
- In a titration experiment, by using phenolphthalein indicator ($\text{pH}=8.0\text{-}10.0$), 0.5mol of which of the following acids neutralizes 0.5mol of NaOH? A. H_3PO_4 B. HF C. HCl D. both (A and B)
- In a reaction, $\Delta G^0 = 142.0 \text{ kJ/mol}$ and $\Delta H^0 = 206.1 \text{ kJ/mol}$, at room temperature which of the following is correct?
 A. the entropy of the reactants is greater B. the entropy of the products is greater
 C. the entropy of reactants and the products is equal D. none of them
- This reaction: $2\text{H}_2\text{O}_2 \longrightarrow 2\text{H}_2\text{O} + \text{O}_2$, by using catalyst has the following proposed mechanism:-
 step: 1 $\text{H}_2\text{O}_2 + \text{I}^- \longrightarrow \text{H}_2\text{O} + \text{IO}^-$
 step: 2 $\text{H}_2\text{O}_2 + \text{IO}^- \longrightarrow \text{H}_2\text{O} + \text{O}_2 + \text{I}^-$, which of the following is intermediate?
 A. I^- B. H_2O C. IO^- D. both (A and C) are correct
- All of the following may be alkene and cycloalkane **EXCEPT**:-
 A. C_3H_6 B. C_2H_4 C. C_5H_{10} D. C_4H_8
- In a saturated solution the concentration.....
 A. is always high B. is always low
 C. may be high or low, depending on the solubility of the solute D. cannot be determined

26. If the $[H_3O^+]$ of aqueous solution of $Ca(OH)_2$ is equal to $1.0 \times 10^{-8} M$, what is the molarity of $Ca(OH)_2$?
 A. 1.0×10^{-6} B. 5.0×10^{-7} C. 1.0×10^{-8} D. 2.0×10^{-6}
27. The equilibrium self-ionization equation of water at $25^\circ C$ is: $2H_2O(l) + \text{energy} \rightleftharpoons H_3O^+(aq) + OH^-(aq)$, by decreasing the temperature which of the following is incorrect?
 A. the pH value increases B. the pOH value decreases
 C. the K_w value decreases D. none of them
28. Which of the following compounds **cannot** be monomer for the addition polymer?
 A. C_2H_4 B. CH_3COOH C. C_2F_4 D. $CH_2=CH-CH_3$
29. When one gram of iron is heated to $100.0^\circ C$ and cooled to $50.0^\circ C$ in a calorimeter transfers 22.5 J of energy to the surrounding water. But one gram of silver transfers 11.8 J of energy under the same conditions, the difference of the value of transfer energy depends on the:-
 A. mass of the material B. temperature change C. nature of the material D. all of them
30. The general formula for esters is:-
 A. $R-CO-R$ B. $R-COO-R$ C. $R-COOH$ D. $R-O-R$
31. One of the following **cannot** be isomer for C_3H_8O :-
 A. 2-propanol B. 1-propanol C. ethyl methyl ether D. 2-propanon
32. Which of the following is correct?
 A. the boiling point of pentane greater than 2-methyl butane.
 B. the carbon atom hybridization type of C_2H_2 is sp^2 .
 C. the graphite is a good conductor of heat.
 D. the molecular formula of methyl benzene is C_6H_8 .
33. This hypothetical reaction: $A + B \longrightarrow 2C$, is occur in one step-mechanism, what is the value of the specific rate constant for reverse reaction when $[C] = 0.015 M$ and the rate of reaction is equal to $1.1 \times 10^{-3} M/s$?
 A. $4.9 M^{-1}s^{-1}$ B. $4.9 s^{-1}$ C. $0.2 M^{-1}s^{-1}$ D. $0.2 s^{-1}$
34. Which of the following exhibits properties of an Arrhenius acid?
 A. hydrogen chloride that is dissolved in water B. the pure hydrogen chloride gas
 C. hydrogen chloride that is dissolved in nonpolar solvent D. all of them
35. A hydrocarbon that contains delocalized electrons:-
 A. graphite B. benzene C. cyclohexane D. both (A and B) are correct
36. The anion of the acid that stomach produces:-
 A. is a strong conjugate base B. it acts as amphoteric
 C. is a weak conjugate acid D. it has a little tendency to attract a proton
37. When the ammonia molecule reacts with the hydrogen ion (proton) :-
 A. ammonia molecule is an electron-pair accepter B. ammonia acts as Arrhenius base
 C. proton acts as Lewis acid D. both (A and C) are correct
38. Which of the following compounds formed hydrogen bond with water?
 A. ethers B. benzene C. alcohols D. both (A and C) are correct
39. If a small amounts of HCl added to a solution of HNO_2 and KNO_2 , which of the following decreases?
 A. pH B. ionization of HNO_2 C. $[OH^-]$ D. all of them are Correct

40. If the value of equilibrium constant for gaseous reaction is equal to 300 at given temperature, what is the value of equilibrium constant for the reaction by doubling the volume of reaction vessel, at the same temperature?
 A. 300 B. 600 C. 900 D. 150
41. An aqueous solution of hydrogen fluoride weakly conducts an electric current because :-
 A. it is ionized partially B. the hydrogen- fluorine bond is strong
 C. the hydrogen- fluorine bond is weak D. both (A and B) are correct
42. All of the following are affect the rate of reaction between hydrogen gas and chlorine gas **EXCEPT**:-
 A. surface area B. temperature C. presence catalyst D. concentration
43. Used in biology laboratories as a preservative for dead animals:-
 A. methanol B. acetic acid C. methanal D. methyl amine
44. In the titration acid and base process the equivalence point is determined by :-
 A. suitable indicator B. pH meter C. transition interval D. both (A and B) are correct
45. Which of the following reactions represent the hydrolysis reaction?
 A. $H_2CO_3(aq) + H_2O(l) \rightleftharpoons HCO_3^-(aq) + H_3O^+(aq)$ B. $CH_3NH_2(aq) + H_2O(l) \rightleftharpoons CH_3NH_3^+(aq) + OH^-(aq)$
 C. $NH_4^+(aq) + H_2O(l) \rightleftharpoons NH_3(aq) + H_3O^+(aq)$ D. all of them are correct
46. The calcium sulfate salt is produce by the reaction between the:-
 A. Ca and H_2SO_4 B. $Ca(OH)_2$ and H_2SO_4 C. $Ca(OH)_2$ and H_2SO_3 D. both (A and B) are correct
47. In the adjacent energy diagram after using catalyst the value of E_a :-
 A. is equal to 100 kJ/mol
 B. is greater than 100 kJ/mol
 C. is less than 100 kJ/mol
 D. cannot be determined
48. In this reaction: $2H_2(g) + O_2(g) \longrightarrow 2H_2O(l) + 571.6 \text{ kJ}$, which of the following is correct?
 A. ΔH_f° of water = -285.8 kJ/mol B. ΔH_f° of water = +285.8 kJ/mol
 C. ΔH° of reverse reaction = +571.6 kJ/mol D. both (A and C) are correct
49. In the second ionization stage of phosphoric acid in its aqueous solution.....are produced.
 A. HPO_4^{2-} and H_3O^+ B. $H_2PO_4^-$ and H_3O^+ C. PO_4^{3-} and H_3O^+ D. all of them
50. Which of the following can have geometric isomers?
 A. CH_2Cl_2 B. $C_2H_4Cl_2$ C. $C_2H_2Cl_2$ D. none of them

