

## GENERAL CHEMISTRY II

### UNIT I-(Chemical bonding)

1. What is an ionic bond?
2. How ionic bond is formed?
3. What are the properties of ionic compounds?
4. State and explain radius ratio rule.
5. What are the limitations of radius ratio rule?
6. Define hydration energy.
7. Define the hydration energy of ions.
8. What are the applications of hydration energy?
9. Define lattice energy.
10. How lattice energy can be calculated?
11. Explain Born-Haber cycle.
12. What are the applications of lattice energy?
13. What is polarization?
14. State and explain Fajan's rule.
15. Explain the partial ionic character of a covalent bond.
16. How will you calculate the percentage of ionic character of a covalent bond?
17. What are effects of polarization?
18. Explain the valence bond theory.
19. State and explain VSEPR theory.
20. Explain the shapes  $\text{H}_2\text{O}$ ,  $\text{NH}_3$  and  $\text{IF}_7$  molecules on the basis of VSEPR theory.
21. Describe the molecular orbital theory.
22. What are bonding and antibonding orbitals?
23. What is bond order?
24. Explain the molecular orbital picture of  $\text{H}_2$ ,  $\text{Ne}_2$  and  $\text{O}_2$ .
25. Describe the comparison of VB and MO theory.

## UNIT II

(Chemistry of s-block elements & zero group elements and metallurgy)

1. Discuss the position of hydrogen in the periodic table.
2. Write short notes on atomic hydrogen.
3. Write short notes on nascent hydrogen.
4. Write short notes on occluded hydrogen.
5. What are the uses of hydrogen?
6. Explain the diagonal relationship between lithium and magnesium.
7. How will you prepare lithium?
8. What are the uses of sodium hydroxide and sodium carbonate?
9. Explain the diagonal relationship between beryllium and aluminium.
10. What are noble gases? Give the names of any three gases.
11. Name the elements of zero groups. Write their electronic configuration and explain their inertness.
12. Which is the most abundant rare gas in the atmosphere?
13. Xenon forms a number of fluorides, oxides and oxy fluoride. Explain.
14. Outline the properties and structure of any one compound of xenon.
15. Mention the important xenon fluorides. Describe the method of preparation of fluorides of xenon.
16. How are different fluorides of xenon prepared? Give at least one chemical property for each one of them.
17. How is  $\text{XeF}_4$  prepared in the laboratory? Give its important chemical reaction.
18. How is  $\text{XeF}_6$  prepared in the laboratory? Give its important chemical reaction.
19. How is  $\text{XeOF}_4$  prepared in the laboratory? Give its important chemical reaction.
20. Give the structure of  $\text{XeF}_4$ ,  $\text{XeF}_6$  and  $\text{XeOF}_4$ .
21. Write down the products of hydrolysis of  $\text{XeF}_6$ .
22. How does  $\text{XeF}_6$  react with HF,  $\text{H}_2$  and  $\text{H}_2\text{O}$ ?
23. Complete the following equation.  
$$\text{XeF}_4 + \text{H}_2\text{O} =$$
$$\text{XeF}_6 + \text{H}_2\text{O} =$$
$$\text{XeF}_6 + \text{SiO}_2 =$$
24. Xenon forms the most stable hydrate. Explain
25. Mention at least two important uses of rare gases.
26. Mention two important uses of helium.
27. Mention the uses of helium and neon.
28. Mention the important uses of argon.
29. Why is argon better than nitrogen for filling light bulbs?
30. Explain the noble gases in the periodic table.
31. Write notes on clathrate compounds of xenon.

### UNIT III-(Chemistry of benzene and benzenoid compounds)

1. What are alkynes? Give example.
2. Discuss the preparation of alkynes.
3. Explain the acidic property of acetylene.
4. How acetylene reacts with sodium and silver?
5. How acetylene reacts with water in presence of mercuric sulphate?
6. How is acetic acid obtained from acetylene?
7. Explain markonikoff's rule with example.
8. Explain peroxide effect with example.
9. How is acetone obtained from propylene?
10. How ozone react with acetylene and propylene?
11. Explain ozonolysis with two examples.
12. What is hydroboration? Give an example.
13. Discuss the uses of ozonolysis in structure elucidation with suitable example.
14. Write short notes on Hukel's rule of Aromaticity / aromatic character with suitable examples.
15. How can Hukel's rule be used to justify the aromatic nature of benzene, naphthalene and anthracene?
16. Explain Hukel's rule to predict Aromaticity.
17. Which is aromatic in character? How?
18. Explain with examples: electrophilic substitution reactions.
19. What is electrophile? Give an example. Why is it called so? Explain.
20. Write detailed notes on: electrophilic substitution reaction.
21. Explain the mechanism of electrophilic substitution in benzene with an example.
22. Show that a substituent group in benzene affects both the reactivity and orientation in electrophilic aromatic substitution.
23. Electron releasing groups when attached to benzene ring activate the ring while electron withdrawing groups deactivate the ring. Account for.
24. Write detailed notes on: polar effects and their role in substitutions.
25. Describe the effect of substituents in the nitration of mono substituted benzene with regard to activation, deactivation and directive influence.
26. Explain why ortho and para substitution reactions are faster than Meta substitution reaction.
27. Give an account of the theory of orientation in mono substituted benzene derivatives.
28. Predict in which position electrophilic substitution will occur in chloro benzene state the reason.
29. Explain the method of preparing naphthalene on a large scale.

30. Account for the Aromaticity of naphthalene.
31. Explain why nitration of naphthalene occurs in 1-position.
32. Naphthalene is more easily oxidized than benzene. Why? Explain.
33. State the properties of naphthalene.
34. What happens when naphthalene undergoes reduction?
35. Explain the following reaction: naphthalene is reduced with sodium and alcohol.
36. Starting from naphthalene how will you prepare tetralin?
37. What is decalin? How it is prepared? Specify the reagents and reaction conditions if any starting from naphthalene how many decalin be prepared?
38. How does naphthalene react with various oxidizing agents?
39. Explain what happens when naphthalene vapor is passed over silica gel in the presence of vanadium pent oxide.
40. Starting from naphthalene how phthalic acid may be prepared?
41. How does naphthalene react with: chromic acid – acetic anhydride mixture?
42. How does naphthalene react with nitrating mixture?
43. How does naphthalene react with concentrated sulphuric acid? What happens when naphthalene is sulphonated name and formulate the products, stating the conditions of the reactions.
44. How is the following conversion effect? Specify the reagents and reaction conditions if any: naphthalene to 1-chloromethyl naphthalene.
45. Starting from naphthalene how will you prepare 1-naphthyl amine?
46. How would you prepare the following? 1-naphthol from naphthalene.
47. Write / discuss the Haworth's synthesis of naphthalene.
48. Discuss the structure of naphthalene.
49. How would you prove that there are two fused benzene rings in naphthalene?
50. Write down the resonance structures of naphthalene.
51. State the uses of naphthalene.
52. Explain how phenanthrene is obtained.
53. The 9, 10 position in phenanthrene is olefin in nature. Explain.
54. What happens when phenanthrene is warmed with per acetic acid?
55. Explain the following reaction: phenanthrene is treated with ozone and the product the oxidized.
56. Diphenic acid is the oxidation product of a) benzene b) naphthalene c) phenanthrene.
57. Phenanthrene on oxidation gives which acid?
58. How is the following conversion brought about? Give the preparation of diphenic acid.
59. Give at least four reactions of phenanthrene.
60. What happens when naphthalene is treated with succinic anhydride in the presence of anhydrous chloride in nitro benzene?

61. Which of the following do you consider not as aromatic? Why?

Benzene and phenanthrene.

#### UNIT IV-(Alkyl and aryl halogens)

1. Explain the reaction intermediates with suitable examples.
2. Discuss the method of formation of reaction intermediates.
3. Detect the formation of reaction intermediate by any one technique.
4. What is carbocation? How it is formed?
5. What is carbanions? How it is formed?
6. Explain the addition reactions of carboanions.
7. Explain the substitution reactions of carbanions.
8. Discuss the stability of carbanions.
9. Explain the free radical chlorination reaction of methane.
10. Explain with examples: electrophilic substitution.
11. Write detailed notes on: electrophilic substitution reactions.
12. What is electrophile? Give an example. Why it is called so. Explain.
13. Explain the mechanism of electrophilic substitution in benzene with an example.
14. Show that a substituent group in benzene affects both the reactivity and orientation in electrophilic aromatic substitution.
15. Electron releasing group when attached to benzene ring activate the ring while electron withdrawing groups deactivate the ring. Account for.
16. Write detailed notes on: polar effects and their role in substitutions.

#### UNIT V-(Atomic structure and basic quantum mechanics)

1. What are the fundamental particles of a matter?
2. Describe the Rutherford's atom model. What are the limitations?
3. Discuss Bohr's postulates of atomic structure.
4. How does Bohr's theory explain structure of atomic spectra of hydrogen?
5. Describe Bohr's model of atom? Discuss its success and limitations.
6. Write an essay on Sommerfield's atom model and its limitations.
7. Write short notes on: a) black body radiation b) photo-electric effect c) Compton effect.
8. Derive De-Broglie equation.
9. State and explain Heisenberg's uncertainty principle.
10. What are quantum numbers?
11. Write short notes on: a) principle quantum number b) azimuthal quantum number.
12. Write short notes on: a) magnetic quantum number b) spin quantum number.

13. What will be the values of other quantum numbers of an element when the principle quantum number is 2?
14. State the relationship between “n”, “l” and “m” quantum numbers by giving all the values of “l” and “m” when “n” = 3.
15. What are the “n”, “l” and “m” values for  $2p_x$  and  $3p_y$  electron?
16. Write Schrodinger wave equation and give the significance of each term involved in it.
17. Describe the significance of  $\psi$  and  $\psi^2$ .