

QUESTION BANK
ON
ENGINEERING CHEMISTRY
Th - 2 (b)

FOR 1ST AND 2ND SEMESTER
COMMON TO ALL BRANCHES

*Prepared BY: G Badhei
Lect. Chemistry
SKDAV GP,
Rourkela*

2 MARKS QUESTIONS

I- PHYSICAL CHEMISTRY: [2 Marks]

Atomic structure[2 Marks]

1. What are fundamental sub-atomic particle?
2. Write any two drawbacks of Rutherford's atomic model.
3. What are the results of Rutherford's gold foil experiment?
4. What do you mean by quantization of energy?
5. What do you mean by the stationary states of atoms?
6. How electronic transition occurs according to Bohr's atomic model?
7. What is the origin of spectral lines according to Bohr's atomic model?
8. Which circular orbits are allowed for the electrons to revolve?
9. Arrange the following in the increasing order of their energy content: 4f, 5p, 6s, 4p, 3d.
10. Write down the electronic configurations of Cr and Cu.
11. Write down the electronic configurations of Ca^{2+} and O^{2-} .
12. Write down the electronic configurations of Mg^{2+} and N^{3-} .
13. Write down the electronic configurations of Mn^{2+} and Cu.
14. Write down the electronic configurations of Cr^{3+} and Fe^{2+} ions.
15. Define mass number. How many protons, electrons and neutrons are present in an ion of N^{3-} ?
16. Define isotope with suitable example.
17. Define isotope. What are the isotopes of chlorine?
18. Define isobar with a suitable example.
19. Define isotone with a suitable example.

Chemical Bonding[2 Marks]

1. Define chemical bonding.
2. Define electrovalent bonding.
3. Define covalent bonding.
4. Define co-ordinate bonding.
5. What is Lattice energy? How is it related with the strength of an ionic bond?
6. Mention the conditions for formation of electrovalent bonding.
7. Mention the conditions for formation of co-ordinate bonding.
8. Define ionization potential. What should be the value of it for the metals to form ionic bond?
9. Define electron affinity. What should be the value of it for the metals to form ionic bond?
10. Which types of chemical bondings exist in MgCl_2 and NH_3 ?
11. Which types of chemical bondings exist in MgCl_2 and H_2O ?

Acid – Base Theories/Salts [2 Marks]

1. Define Arrhenius theory of acids and bases.
2. Define Bronsted-Lowery theory of acids and bases.
3. Define Lewis theory of acids and bases.
4. Justify that all Arrhenius acids are Bronsted-Lowery acids.
5. Explain how BF_3 is a Lewis acid.
6. Explain how SiCl_4 is a Lewis acid.

7. Explain how BF_3 is a Lewis acid.
8. Explain how AlCl_3 is a Lewis acid.
9. Explain how SO_2 is a Lewis acid.
10. Explain how NH_3 is both a Bronsted-Lowery base and a Lewis base.
11. Write down the conjugate acids and conjugate bases of H_2O & NH_3 .
12. What do you mean by conjugate acid-base pair? Explain with a suitable example.
13. CH_3COOH is a weak acid while CH_3COO^- is a strong base. Explain.
14. What is neutralization reaction? Give an example of it.
15. Define salt. How does an acidic salt formed?
16. Define salt. How does a basic salt formed?
17. What is double salt? Give an example.
18. What is co-ordination salt? Give an example.
19. What is mixed salt? Give an example.
20. Explain how bleaching powder is a mixed salt.
21. Explain how potash alum is a double salt.

Solution [2 Marks]

1. Define atomic weight.
2. Define molecular weight. What is the molecular weight of sulphuric acid?
3. Define equivalent weight. What is the equivalent weight of H_3PO_4 ?
4. Find the molecular weights of $\text{Al}_2(\text{SO}_4)_3$ and CuCO_3 .
5. Find the equivalent weights of H_3PO_4 and H_3PO_3 .
6. Find the equivalent weights of $\text{Ca}(\text{HCO}_3)_2$ and H_3BO_3 .
7. Find the equivalent weights of acetic acid and calcium hydroxide.
8. Derive a relationship between atomic weight, equivalent weight and valency.
9. Define variable equivalent weights. Give suitable examples.
10. Why do the equivalent weights of FeO and Fe_2O_3 vary?
11. 1 gm of a metal on heating with air produces 1.5 g of its oxide. Calculate the equivalent weight of the metal.
12. An oxide of metal contains 60% oxygen. Find the equivalent weight of the metal.
13. Find the equivalent weights of $\text{Ca}(\text{OH})_2$ and CH_3COOH .
14. Define molarity. Mention its unit.
15. How many grams of NaCl are required to prepare 2 liters of its solution having molarity 1M?
16. Define normality.
17. 4 grams of NaOH are present 2 lit of its solution. Find its normality.
18. Define molality.
19. 5.6 gram of KOH are present in 200 gram of water. Find molality of the solution.
20. Find the equivalent weights of calcium chloride and nitric acid.
21. 8 gram of NaOH are present in 108 gram of its solution. Find molality of the solution.
22. Define normality. Mention its unit.
23. What do you mean by decimolar solution?
24. How many gms of Na_2CO_3 are required to prepare one litre of its decimolar solution?
25. Obtain a relationship between molarity and normality.
26. Convert 0.01 M H_2SO_4 in to normality.
27. Convert 10^{-2} N H_2SO_4 in to molarity.
28. Define P^{H} and P^{OH} .
29. The P^{H} of a basic solution is 12. What is its hydroxyl ion concentration in moles/lit?
30. Define ionic product of water. What is its value at 25°C ?

31. What is the importance of P^H in sugar industry?
32. Write down the importance of P^H in textile industries.
33. Find the P^H value of 0.001 M HCl solution.
34. Find the P^H value of 0.01 M NaOH solution.
35. Find the P^H value of 0.01 M H_2SO_4 solution.

Electrochemistry[2 Marks]

1. Define electrolyte. Give an example of it.
2. Define strong and weak electrolytes with examples.
3. What are non-electrolytes? Give examples.
4. Define electrolysis. Which gas is evolved at the cathode during electrolysis of acidulated water?
5. Define Faraday's 1st law of electrolysis.
6. Define Faraday's 2nd law of electrolysis.
7. Define electrochemical equivalent. Mention its unit.
8. Find the electrochemical equivalent of calcium.
9. Find the electrochemical equivalent of aluminium.
10. How many coulombs of charge are required to get 10 grams of calcium from molten calcium chloride?
11. Define electroplating.
12. What is Galvanisation?
13. What is the relationship between the masses of the substances and their equivalent weights, when the same quantity of electricity is passed through different electrolytes?
14. What is the difference between electrolytes and non-electrolytes?
15. What do you mean by corrosion?
16. What is atmospheric corrosion?
17. What is water-line corrosion?
18. How corrosion is prevented by the alloy durrion?
19. How the rate of rusting of iron is accelerated in presence of CO_2 in moisture?

II-INORGANIC CHEMISTRY[2 Marks]

Metallurgy/Alloys: [2 Marks]

1. What do you mean by gangue?
2. Mention the basic steps involved in the metallurgical operation.
3. What do you mean by concentration of ore?
4. What happens during oxidation step of metallurgical operation?
5. What happens during reduction step of metallurgical operation?
6. Why only sulphide ores are concentrated by froth floatation method?
7. Which types of ores are concentrated by magnetic separation?
8. Which types of ores are concentrated by gravity separation method?
9. What is leaching?
10. What is the purpose of adding charcoal or coke during smelting?
11. What do you mean by smelting?
12. Define calcinations and roasting.
13. What is slag?
14. What is the principle of distillation method of refining of crude metals?
15. What is alloy? Give an example of non-ferrous alloy.
16. What is amalgam? How is it formed?
17. What is the composition and uses of Brass?
18. What is the composition and uses of Bronze?

19. What is electrometallurgy?
20. What is the purpose of addition of flux during smelting?

III-ORGANIC CHEMISTRY[2 Marks]

1. To which class of compound C_4H_{10} belongs and how?
2. To which class of compound C_5H_{10} belongs and how?
3. To which class of compound C_6H_{10} belongs and how?
4. What are saturated hydrocarbons?
5. What are unsaturated hydrocarbons?
6. How C_4H_8 is unsaturated?
7. What are aliphatic hydrocarbons? Give any two examples of it.
8. What is the IUPAC name of isopropyl alcohol?
9. What is the IUPAC name of tertiary butyl alcohol?
10. What is the IUPAC name of isobutyl chloride?
11. Give the structural formula of 4-Chloro-5-methylpent-2-en-2-ol.
12. Define Huckel's rule for aromaticity.
13. How benzene is aromatic?
14. What is tertiary alkyl halide? Give an example of it.
15. What is the general formula of monohydric alcohols? Give a suitable example of it.

IV-INDUSTRIAL CHEMISTRY[2 Marks]

Water Treatment: [2 Marks]

1. Define soft water and hard water.
2. Name the chemical substances which are responsible for temporary hardness of water.
3. Name the chemical substances which are responsible for permanent hardness of water.
4. What do you mean by hardness of water? What are the different types of hardness?
5. How the temporary hardness of water can be eliminated by boiling?
6. How the temporary hardness of water can be eliminated by the treatment of lime?
7. Why coagulant is required during removal of hardness of water by cold Lime Soda process?
8. Mention any four advantages of hot Lime Soda process over the Cold Lime Soda process.
9. What are ion exchange resins?
10. What are cation exchange resins?
11. What are anion exchange resins?
12. How the ion exchange resins can be regenerated after they are exhausted?
13. What is effect of use of excess lime on hard water?

Lubricants[2 Marks]

1. Define lubricant. Give one example of liquid and one example of solid lubricants.
2. Under what conditions solid lubricants are preferred?
3. Under what conditions semi-solid lubricants are preferred?
4. Mention any four functions of lubrication?
5. Which types of lubricant are preferred when there is a chance of jerk and why?

Fuel[2 Marks]

1. Define calorific value of fuel. How is it related with the quality of fuels?
2. Define calorific value of fuel. Mention any two units of it.

3. What should be the characteristics of good fuel with respect to moisture and calorific value?
4. Mention any four important characteristics of good fuel.
5. What is the composition and uses of anthracite coal?
6. What are the conditions of formation of coal?
7. What do you mean by fractional distillation method?
8. What is CNG?

Polymers[2 Marks]

1. Define polymerization.
2. Define monomer and polymer.
3. Define homo polymer and co-polymer.
4. Define condensation polymer and addition polymer.
5. Name the monomers of Bakelite. Write the structure of Bakelite.
6. What is degree of polymerization?
7. What is the monomer of natural rubber?
8. What is the chemical composition of natural rubber?
9. What is vulcanization of natural rubber?

Chemicals in Agriculture [2 Marks]

1. Define pesticide with a suitable example.
2. Classify pesticides into different types.
3. Define insecticide with a suitable example.
4. Define herbicide with a suitable example.
5. Define fungicide with a suitable example.
6. What are bio-fertilizers?

5 MARKS QUESTIONS

I- PHYSICAL CHEMISTRY:[5 Marks]

Atomic structure[5 Marks]

1. Explain the Discovery of atomic nuclei.
2. Explain Rutherford's atomic model.
3. Explain the failures of Rutherford's atomic model.
4. Write down the postulates of Bohr-Bury Scheme.
5. Define and explain Aufbau principle. Write down the electronic configuration of manganese.
6. How did Bohr overcome Rutherford's atomic model?
7. Define and explain Hund's rule of maximum multiplicity.
8. Explain electronic transition according to Bohr's atomic theory.
9. Explain the origin of atomic spectral lines.

Chemical Bonding[5 Marks]

1. Define and explain electrovalent bonding with a suitable example.
2. Define and explain covalent bonding with a suitable example.
3. Define and explain co-ordinate bonding with a suitable example.
4. Explain the formation of NH_3 and NH_4^+ .
5. Explain the conditions of formation of electrovalent bond.
6. Explain the conditions of formation of co-ordinate bond.

7. Define covalent bond. Explain the formation of CH_4 molecule.
8. Define covalent bond. Explain the formation of H_2O molecule.
9. Define covalent bond. Explain the formation of O_2 molecule.
10. Define covalent bond. Explain the formation of N_2 molecule.
11. Define covalent bond. Explain the formation of NH_3 molecule.
12. Define electrovalent bonding. Explain the formation of MgCl_2 molecule.
13. Define and explain co-ordinate bonding and explain the formation of NH_4^+ ion.
14. Define and explain co-ordinate bonding and explain the formation of SO_2 molecule.
15. Write down at least ten properties of ionic compounds.
16. Write down at least ten properties of covalent compounds.

Theories of Acid-Base /Salts [5 Marks]

1. Define and explain Arrhenius theory of acids and bases.
2. Define and explain Bronsted-Lowery theory of acids and bases.
3. Define and explain Lewis theory of acids and bases.
4. Explain the limitations of Arrhenius theory.
5. Explain the limitations of Bronsted-Lowery theory.
6. Explain the limitations of Lewis theory.
7. Justify that all Arrhenius acids are Bronsted-Lowery acids, but all Arrhenius bases are not Bronsted – Lowery bases.
8. Explain how SiCl_4 and BF_3 are acids.
9. Explain why SiCl_4 is an acid but CCl_4 is not.
10. Define and explain conjugate acid-base pair with a suitable example.
11. Justify your answer that H_2O is amphoteric.
12. How many grams of KOH are required to get 2 lit of its solution having P^{H} 10?
13. Explain how potash alum is a double salt while, $\text{K}_3[\text{Fe}(\text{CN})_6]$ is a complex salt.
14. 14.7 grams of H_2SO_4 are present in 2 liters of its solution. Find morality and normality of the solution.
15. How many grams of calcium hydroxide are required to prepare 10^{-2} M and 10^{-2} N solutions?
16. How many grams of decahydrated sodium carbonate of 80% purity are required to prepare 2.5 lit. of its decinormal solution?

Electrochemistry[5 Marks]

1. Define electrolyte and electrolysis. What are strong and weak electrolytes? Give examples.
2. Define electrolysis. Explain the process of electrolysis of molten NaCl .
3. Define Faraday's 1st law of electrolysis. How many grams of calcium will be deposited at the cathode by passing 15 ampere of currents through molten CaCl_2 for 30 minutes?
4. Define electrochemical equivalent. Find the ECE of Ca and Al .
5. Define and explain Faraday's 2nd law of electrolysis.
6. Explain the process of applying a coating of zinc over an iron article by the process of electrolysis.
7. Explain the electro refining process of a crude copper bar.
8. Define and explain electrometallurgy.
9. Explain the electrolysis of acidulated water.
10. Define and explain Galvanisation.
11. Define and explain atmospheric corrosion.
12. Define corrosion. Explain waterline corrosion.
13. Explain the alloying process of protection of corrosion.
14. Define Faraday's 1st law of electrolysis. How many coulombs of charges are required to get 36 grams of magnesium from molten magnesium chloride?

II-INORGANIC CHEMISTRY[5 Marks]

Metallurgy/Alloys: [5 Marks]

1. Explain the gravity separation method of concentration of ores.
2. Explain the froth floatation method of concentration of ores.
3. Explain the magnetic separation method of concentration of ores.
4. Explain the gravity leaching process of concentration of ores.
5. Define calcinations. Write down its functions.
6. Define roasting. Write down its function.
7. Define and explain smelting.
8. Explain the electrolytic method of purification of impure copper.
9. Define alloy. Write down the composition and uses of Brass and Bronze.
10. Define alloy. Classify alloys in to different types with examples.
11. Define alloy. What do you mean by amalgam? Write the important uses of amalgams.

III-ORGANIC CHEMISTRY[5 Marks]

1. What are saturated and unsaturated hydrocarbons? Is benzene saturated? Justify your answer.
2. Define and explain Huckel's rule of aromaticity with suitable examples.
3. What are aliphatic hydrocarbons? How can you classify them?
4. Define with example: Prefix, word root, primary suffix and secondary suffix.
5. What are the conditions of aromaticity?
6. Mention any two uses of benzene and toluene.
7. Mention any two uses of toluene and phenol
8. Mention any two uses of toluene naphthalene.
9. Mention any two uses of benzene and Anthracene
10. Mention any two uses of benzene and BHC.

IV-INDUSTRIAL CHEMISTRY[5 Marks]

Water Treatment: [5 Marks]

1. What do you mean by hardness of water? Explain different types of hardness with their causes.
2. Explain how the temporary hardness of water can be eliminated?
3. Explain cold Lime –Soda process of removing hardness with a neat and labeled diagram.
4. Explain hot Lime –Soda process of removing hardness with a neat and labeled diagram.
5. Explain the advantages of hot L – S process over the cold L – S process.
6. Explain the regeneration of ion exchange resins after they are exhausted.
7. Explain the basic principle underlying the ion exchange process of removing hardness of water.

Lubricants[5 Marks]

1. Explain the purpose of lubrication.
2. What is lubricant? Classify with examples different types of lubricants.

Fuel[5 Marks]

1. Define fuel. What is calorific value of fuel? Write any four important characteristics of good fuel.
2. Write a short note on water gas.

3. Write a short note on producer gas.
4. Write the composition and uses of LPG and CNG.
5. What is petroleum? How is it formed and refined?
6. How coal is formed? What are the different types of coal? What is the percentage carbon content in each type of coal?

Polymers[5 Marks]

1. Define the terms monomer, polymer, degree of polymerization, homo polymer and co-polymer.
2. Write the composition and uses of PVC.
3. Write the composition and uses of Bakelite.
4. Distinguish between thermoplastics and thermosetting.
5. Explain with examples the terms: addition polymerization and condensation polymerization.
6. What are the drawbacks of natural rubber?
7. Define and explain vulcanization of raw rubber.

Chemicals in Agriculture [5 Marks]

1. Define pesticide. Classify pesticides into different types with examples.
2. Define insecticide, herbicide and fungicide with suitable examples.
3. What are bio-fertilizers? Mention its different types with examples.

I- PHYSICAL CHEMISTRY: [10 Marks]

Atomic structure[10 Marks]

1. Mention the failures of Rutherford's atomic model. Explain the postulates of Bohr's atomic model.
2. Explain how electrons are filled up in different shells as per Bohr-Bury scheme and as per Aufbau principle.

Equivalent weight/Atomic weight/Molecular weight. [10 Marks]

1. Define equivalent weight. Find the equivalent weights of H_3PO_3 , $\text{Mg}(\text{OH})_2$ and $\text{Ca}_3(\text{PO}_4)_2$.
Certain mass of a metal is heated with oxygen. The mass is found to increase by 10% due to the formation of its oxide. Find the equivalent mass of the metal.

Chemical Bonding[10 Marks]

1. Define chemical bonding. Define and explain electrovalent and covalent bandings with at least one example from each.
2. Define and explain electrovalent bonding with a suitable example. Write down the characteristics properties of ionic compounds.
3. Define and explain covalent bonding with a suitable example. Write down the characteristics properties of covalent compounds.
4. Define co-ordinate bonding. Explain the conditions of formation of this type of bond. Explain the formation of ammonium ion.

Theories of Acids & Bases/Salts [10 Marks]

1. Define and explain Arrhenius theory of acids and bases. What are the limitations of this theory?

2. Define and explain Bronsted-Lowery theory of acids and bases. What are the limitations of this theory?
3. Define and explain Lewis theory of acids and bases. What are the limitations of this theory?
4. Define salt. Classify salts in to different types with suitable examples.

Electrochemistry[10 Marks]

1. Define electrolyte. Classify electrolytes in to different types with examples. Explain the process of electrolysis of molten NaCl.
2. Define and explain Faraday's 1st and 2nd laws of electrolysis.
3. Define and explain Faraday's 1st law of electrolysis. How many grams of copper will be formed at the cathode by the passage of 20 ampere of current through acidified copper sulphate solution for 15 minutes?

II-INORGANIC CHEMISTRY[10 Marks]

Metallurgy/Alloys: [10 Marks]

1. Explain in brief the general steps of metallurgical operations.
2. Explain gravity separation and froth floatation methods of concentration of ores.
3. Define calcination and roasting. Explain their functions.
4. Explain various methods of refining of crude metals.
5. Define alloy. Classify alloys in to different types. Write down the composition of Brass and Alnico.

III-INDUSTRIAL CHEMISTRY [10 Marks]

Water Treatment: [10 Marks]

1. Define hard water and soft water. What are the causes of temporary hardness and permanent hardness?
2. Explain the ion-exchange method of softening hard water.
3. Explain hot Lime Soda process. What are the advantages of hot L-S Process over the Cold L-S process?

Lubricants [10 Marks]

1. What is lubricant? Classify with examples different types of lubricants. Explain the purpose of lubrication.

Fuel [10 Marks]

1. Explain the method of refining of crude petroleum. Write down the composition and uses of petrol, diesel and kerosene.
2. Define fuel. What is calorific value of fuel and how is it related with the quality of fuel? State any five characteristics of good fuel.

Polymers [10 Marks]

1. Define polymerization. Explain the manufacture and properties of PVC and Bakelite.
2. Define the following terms with suitable examples: Monomer, polymer, co-polymer, condensation polymer and addition polymer.
3. Define rubber. What is the monomer of natural rubber? Mention the drawbacks of natural rubber.
4. Define and explain Vulcanization and its advantages.