

SIXTH SEMESTER (CUCBCSS—UG) DEGREE EXAMINATION, MARCH 2022

Chemistry

CHE 6B 13 (E3)—MEDICINAL AND ENVIRONMENTAL CHEMISTRY

(2014 to 2018 Admissions)

Time : Three Hours

Maximum : 80 Marks

Section A (One Word)*Answer all questions.**Each question carries 1 mark.*

1. Name any *two* methods for sterilizing surgical instruments.
2. Write two examples of non-prescription drugs.
3. Give an example for a prodrug.
4. Give the names of any two drugs that can be used for the treatment of measles.
5. Which parts of the body are affected by arsenic poisoning.
6. Give the names of a two atmospheric gases which cause acid rain.
7. Mention any two sources of CO.
8. What is the use of a fabric filter ?
9. Name two industrial water contaminants.
10. Name the technique used to determine the total solid content in sewage analysis.

(10 × 1 = 10 marks)

Section B (Short Answers)*Answer any ten questions.**Each question carries 2 marks.*

11. Define Health.
12. What is meant by LD₅₀ and ED₅₀.

Turn over

13. Explain communicable and non-communicable diseases with examples.
14. What are the symptoms of anthrax ?
15. What are the factors responsible for kidney stone ?
16. Why are pesticides toxic to the ecosystem ?
17. What are the toxicological effects of asbestos ?
18. What is meant by cold trapping ?
19. How does a catalytic converter works ?
20. What is the principle behind ion exchange method of water purification ?
21. What is the importance of rainwater harvesting ?
22. What are the important steps involved in UASB process ?

(10 × 2 = 20 marks)

Section C (Paragraph)

Answer any five questions.

Each question carries 6 marks

23. What is meant by blood typing and matching ? How are they performed ?
24. Write a short note on drug abuse.
25. Differentiate between the symptoms of cholera and dysentery. How are they treated ?
26. How do heavy metals affect the environment ? Explain with the help of any two examples.
27. Explain the principle and working of gravitational settling chamber and electrostatic precipitator.
28. Explain the methods which can be used to minimise air pollution at source.
29. Differentiate between COD and BOD in water quality.
30. Explain the activated sludge process.

(5 × 6 = 30 marks)

Section D (Essays)

Answer any two questions.

Each question carries 10 marks.

31. (a) Write briefly on the biochemical analysis of urine.
(b) Write the application of any five medicinal plants of Indian origin.
32. (a) Explain the causes, symptoms and treatment of lung cancer. (8 marks)
(b) Define threshold limiting value. (2 marks)
33. Explain the following :
- (a) Colorimetric method for the determination of NO_x . (3 marks)
(b) Gas chromatography technique for the determination of hydrocarbon. (4 marks)
(c) Zoning. (3 marks)
34. Explain in detail about primary and secondary waste water treatment.

[2 × 10 = 20 marks]

**SIXTH SEMESTER (CUCBCSS—UG) DEGREE EXAMINATION
MARCH 2022**

Chemistry

CHE 6B 13 (E2)—POLYMER CHEMISTRY

(2014 to 2018 Admissions)

Time : Three Hours

Maximum : 80 Marks

Section A (One word)

Answer all questions.

Each question carries 1 mark.

1. Give an example for a copolymer.
2. Natural rubber is basically a polymer of _____.
3. The weight average and number average molecular mass of a polymer are respectively 40,000 and 30,000. The polydispersity index of the polymer will be _____ ?
4. Give an example for thermosetting plastic.
5. _____ is an example for inorganic polymer.
6. Mention one conductive polymer.
7. The glass transition temperature of natural rubber is _____.
8. Which polymer is sold under the trade name 'Saran'.
9. Hollow plastic articles are generally produced by _____ moulding technique.
10. What is super glue ?

(10 × 1 = 10 marks)

Section B (Short answer)

Answer any ten questions.

Each question carries 2 marks.

11. What are the different steps in chain polymerisation ?
12. How are polymers classified according to their intermolecular forces present in it ?
13. Write short note on 'Glyptal'.
14. Give any two applications of poly methyl methacrylate in medical field.

Turn over

15. What is the significance of polydispersity index.
16. Comment on the oxidative degradation of polymers.
17. What is the monomer of neoprene ?
18. Give two examples for fire resistant polymers.
19. What is 'melmac' ?
20. Give two examples for fibre forming polymers.
21. Mention the advantages of solution polymerisation.
22. What is interfacial polycondensation ?

(10 × 2 = 20 marks)

Section C (Paragraph)

Answer any **five** questions.

Each question carries 6 marks.

23. What is condensation polymerisation? How is Nylon 6,6 prepared ?
24. Explain coordination polymerisation and its mechanism.
25. Briefly explain the preparation, structure and properties of carbon fibres.
26. Write short note on thermoforming.
27. Discuss plastic identification codes.
28. Write short note on Polyurethanes.
29. Mention important fire-resistant polymers. Discuss their applications.
30. Briefly explain the classification of polymers based on synthesis.

(5 × 6 = 30 marks)

Section D (Essay)

Answer any **two** questions.

Each question carries 10 marks.

31. Briefly discuss the following polymer processing techniques : (a) Compression moulding ; (b) Injection moulding.
32. Explain the structure, properties and applications of : (a) PP ; (b) PVC ; (c) PMMA and (d) Teflon.
33. Write short note on : (a) Glass transition temperature ; (b) Applications of polymers in medical field.
34. Discuss the classification of polymers based on : (a) Synthesis ; (b) Structure ; and (c) intermolecular forces.

(2 × 10 = 20 marks)

SIXTH SEMESTER (CUCBCSS—UG) DEGREE EXAMINATION, MARCH 2022

Chemistry

CHE 6B 12—ADVANCED AND APPLIED CHEMISTRY

(2014 to 2018 Admissions)

Time : Three Hours

Maximum : 80 Marks

Section A (One word)*Answer all questions.**Each question carries 1 mark.*

1. Monomer of teflon is _____.
2. An example for a thermoplastic is _____.
3. FACT is located at _____.
4. The percentage by volume of iso-octane in the iso-octane-heptane mixture that matches the fuel being tested in a standard test engine is called _____.
5. Give an example for an anti-knocking compound.
6. An example for a prodrug is _____.
7. Give an example for a tranquilizer.
8. Draw the structure of BHC.
9. Write an example for an insecticide.
10. _____ is an example for an auxochrome.

(10 × 1 = 10 marks)

Section B (Short Answer)*Answer any ten questions.**Each question carries 2 marks.*

11. Explain the significance of quantum dots.
12. What are fullerenes ?
13. What is green chemistry ?
14. Write notes on self assembly.
15. Explain the term combinatorial chemistry.

Turn over

16. What is a computer programme ? Give an example.
17. Explain condensation polymerization using a suitable example.
18. What is PLA ?
19. Write the composition of talcum powder.
20. What are Antiseptics ? Give one example.
21. What are rodenticides ? Give one example.
22. Based on the concept of chromophore - auxochrome theory, arrange the following compounds in the increasing order of colour intensity. naphthalene, nitro-naphthol and nitro naphthalene.

(10 × 2 = 20 marks)

Section C (Paragraph)

Answer any five questions.

Each question carries 6 marks.

23. Explain different carbon nanostructures.
24. Write a note on green organic synthesis using Diel's-Alder reaction as example.
25. Discuss different types of non-covalent interactions in supramolecular chemistry.
26. Give an account of combinatorial synthesis.
27. Explain the synthesis and applications of bakelite.
28. What are biodegradable polymers ? Give examples
29. Discuss the classification of drugs based on their mode of action using suitable examples.
30. Discuss the preparation and use of indigo.

(5 × 6 = 30 marks)

Section D (Essay)

Answer any two questions.

Each question carries 10 marks.

31. Give an account of the applications of nanomaterials in various fields.
32. Explain the twelve principles of green chemistry.
33. a) Discuss the classification of soaps.
b) Explain the cleansing action of soap.
34. Explain the classification of dyes based on their structure and mode of application using suitable examples.

(2 × 10 = 20 marks)

SIXTH SEMESTER (CUCBCSS-UG) DEGREE EXAMINATION, MARCH 2022

Chemistry

CHE 6B 11—PHYSICAL CHEMISTRY—III

(2014 to 2018 Admissions)

Time : Three Hours

Maximum : 80 Marks

Section A (One word)

*Answer all questions.**Each question carries 1 mark.*

1. One gram equivalent of a substance is deposited by _____.
2. The ratio of λ / λ_0 gives _____.
3. A device which converts chemical energy into electrical energy is called _____.
4. The potential difference between a metal electrode and the solution containing its ions surrounding the electrode is called _____.
5. In a galvanic cell the positive electrode is _____.
6. HCO_3^- and water are capable of donating and accepting the proton and they are called as _____ substances.
7. The solubility product of silver chloride (AgCl) is 1.6×10^{-10} at 25°C . Its solubility at 25°C is _____.
8. An example of ideal solution is _____.
9. The number of Bravais lattice in orthorhombic crystal system is _____.
10. The angle between any *two* faces of a crystal is called an _____.

(10 × 1 = 10 marks)

Turn over

Section B (Short Answer)

*Answer any ten questions.
Each question carries 2 marks.*

11. The specific conductance of an electrolyte decreases and equivalent conductance increases with dilution. Give reason.
12. Define liquid junction potential. How it can be eliminated ?
13. State and explain the Nernst equation for EMF of a cell.
14. What is a calomel electrode ? Give the reaction taking place at the calomel electrode.
15. What is meant by buffer action ? Explain with an example.
16. Calculate the pH of a solution obtained by mixing 800 ml of 0.05M HCl and 200 ml of 0.1M NaOH.
17. State Raoult's Law of ideal solutions.
18. What is azeotropic mixture ?
19. What are miller indices ? Sketch 110 plane.
20. State Steno's law of constancy of interfacial angles.
21. Distinguish between extrinsic and intrinsic semi-conductors.
22. What is meant by colour centres ? Give an example.

(10 × 2 = 20 marks)

Section C (Paragraph)

*Answer any five questions.
Each question carries 6 marks.*

23. Explain Debye Falkenhagen and Wien effects.
24. Derive an expression for the emf of a concentration cell with transference.
25. What are fuel cells ? Describe H₂-O₂ fuel cell and its cell reactions.
26. Explain the electro-chemical theory of rusting of iron. What are the methods to prevent corrosion ?
27. Discuss the application of common ion effect and solubility product in inorganic qualitative analysis.
28. A buffer solution contains 0.2 mole of NH₄OH and 0.5 mole of NH₄Cl per litre. Calculate the pH of the solution. The dissociation constant of NH₄OH is 1.8×10^{-5} .

29. Write a short note on CaF_2 structure.
30. Write a note on non-stoichiometric defects in crystals.

(5 × 6 = 30 marks)

Section D (Essay)

Answer any two questions.

Each question carries 10 marks.

31. (a) What is meant by transport number of ions? Describe the Hittorf's method for the determination of transport number of silver ions.
- (b) Explain the theory of a redox titration carried out potentiometrically.
32. What is freezing point depression? Derive an expression to calculate the molecular mass of solute from depression in freezing point.
33. What is hydrolysis of salts? Discuss the hydrolysis of NH_4Cl . Derive the relation between the hydrolysis constant and degree of hydrolysis.
34. (a) Briefly describe the powder method for determination of crystal structure.
- (b) Briefly discuss liquid crystals and its classification with applications.

(2 × 10 = 20 marks)

**SIXTH SEMESTER (CUCBCSS—UG) DEGREE EXAMINATION
MARCH 2022**

Chemistry

CHE 6B 10—ORGANIC CHEMISTRY—III

(2014 to 2018 Admissions)

Time : Three Hours

Maximum : 80 Marks

Section A (one word)

Answer all questions.

Each question carries 1 mark.

1. Finger print region in ir spectrum is _____.
2. Among ethane, 1, 3-butadiene and 1, 3, 5-hexatriene, which will have highest λ_{\max} ?
3. α -D-glucopyranose and β -D-glucopyranose are _____.
4. A disaccharide which does not exhibit mutarotation is _____.
5. An example for carbohydrate with β -glycosodic linkage is _____.
6. Write an example of a non chiral amino acid.
7. Name of an acidic amino acid.
8. Waxes are chemically _____.
9. Give any *one* source of vitamin C.
10. Write the name of a peptide hormone.

(10 × 1 = 10 marks)

Section B (Short Answer)

Answer any ten questions.

Each question carries 2 marks.

11. What is red shift ?
12. How will you distinguish acetone and ethanol by ir spectroscopy ?

Turn over

13. What are epimers ? Give example.
14. Draw the structure of phenyl alanine and lysine.
15. Write a test to distinguish proteins.
16. How vitamins are classified ?
17. Why LDL is termed as bad lipid ?
18. Draw the structure of lecithin.
19. Why adenine pair up with thymine and guanine with cytosine ?
20. Give any *two* uses of lemon grass oil.
21. What are nucleotides ?
22. Draw the molecular orbitals of butadiene.

(10 × 2 = 20 marks)

Section C (Paragraph)

Answer any five questions.

Each question carries 6 marks.

23. How will you distinguish ethanol and dimethyl ether by ^1H NMR spectra ?
24. Describe Killiani-Fischer synthesis.
25. How glucose reacts with phenyl hydrazine ?
26. Explain Solid Phase Peptide Synthesis. (SPPS)
27. Write the differences between DNA and RNA.
28. Show that the thermal electrocyclic ring closure of butadiene is con rotatory.
29. Draw the structure and write uses of citral and menthol.
30. Explain replication.

(5 × 6 = 30 marks)

Section D (Essay)

Answer any two questions.

Each question carries 10 marks.

31. Discuss DNA finger printing.
32. Write any *two* methods each for the synthesis of amino acids and peptides.
33. How are lipids classified ? Give an account of each type.
34. Identify the compound :

Molecular formula : C_8H_{10} , UV λ_{max} : 266 nm

IR spectra : 3028, 2967, 1496, 1453 cm^{-1} .

1H NMR spectra : δ (ppm) 1.22 (3H) triplet, 2.63 (2H) quartet, 7.10 – 7.45 (5H) multiplet

(2 × 10 = 20 marks)

**SIXTH SEMESTER (CUCBCSS—UG) DEGREE EXAMINATION
MARCH 2022**

Chemistry

CHE 6B 09—INORGANIC CHEMISTRY—IV

(2014 to 2018 Admissions)

Time : Three Hours

Maximum : 80 Marks

Section A (One Words)

Answer all questions.

Each question carries 1 mark.

1. The constituents of German silver are _____.
2. Actinides are characterized by filling up of _____ orbitals.
3. The element with highest density is _____.
4. Titanium is purified by _____ method.
5. The geometry of $[\text{Ni}(\text{CO})_4]$ is _____.
6. Give an example of tridentate ligand.
7. The complex $[\text{Co}(\text{NH}_3)_6]^{3+}$ is a _____ spin complex.
8. Give an example for a trace metal in biological system.
9. What is Wilkinson's catalyst?
10. Give the structure of cisplatin.

(10 × 1 = 10 marks)

Section B (Short Answers)

Answer any ten questions.

Each question carries 2 marks.

11. Explain Van Arkel method.
12. Give the uses of alloy steels.

Turn over

13. How do you account for closeness of atomic radii of zirconium and hafnium ?
14. The compounds of *s* and *p* block element are generally colourless, whereas that of transition elements are coloured. Explain.
15. Briefly describe ionization isomerism in co-ordination compounds.
16. Give the structure and significance of carboplatin.
17. Differentiate inert and labile complexes.
18. Briefly describe the structure of $[\text{Co}_2(\text{CO})_8]$.
19. Explain Chelate effect.
20. Explain the toxicity of mercury.
21. Briefly describe Ellingham diagram for metal oxides.
22. Why is a solution of copper(II)sulphate blue ?

(10 × 2 = 20 marks)

Section C (Paragraph)

Answer any five questions.

Each question carries 6 marks.

23. Give a comparison of lanthanides and actinides.
24. Write a note on spectrochemical series.
25. Briefly describe Mond's process.
26. Describe the structure of ferrocene.
27. Explain the biochemistry of calcium.
28. Discuss the factors influencing the extent of crystal field splitting.
29. Describe the open-hearth process.
30. Briefly describe the toxicity of lead and arsenic.

(5 × 6 = 30 marks)

Section D (Essay)

Answer any two questions.

Each question carries 10 questions.

31. Write a note on isomerism in co-ordination compounds.
32. (a) Describe the isolation of lanthanides from monazite.
(b) Explain the separation of lanthanides using ion-exchange resin.
33. Describe the metallurgy of iron.
34. (a) Discuss the mechanism of sodium-potassium pump.
(b) Biochemistry of zinc.

(2 × 10 = 20 marks)

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SIXTH SEMESTER U.G. DEGREE EXAMINATION, MARCH 2022

(CBCSS-UG)

Chemistry

CHE 6B 13 (E3)—MEDICINAL AND ENVIRONMENTAL CHEMISTRY

(2019 Admissions)

Time : Two Hours

Maximum : 60 Marks

Section A*Answer atleast eight questions.**Each question carries 3 marks.**All questions can be attended.**Overall ceiling 24.*

1. What is WHO definition of health ?
2. What is Rh factor ?
3. Define pro drug.
4. Write *four* examples of communicable diseases.
5. Name *four* water borne diseases.
6. What are the toxic effects of hydrogen sulphide and chlorine ?
7. Name *four* persistent organic pollutants.
8. How will you determine CO content in air ?
9. Explain fabric filter to vontrol air pollution.
10. How will you determine hydrogen sulphide content ?
11. What are the different types of industrialwaste water ?
12. Name any *six* methods of industrial waste waterpurification.

(8 × 3 = 24 marks)

Section B*Answer atleast five questions.**Each question carries 5 marks.**All questions can be attended.**Overall ceiling 25.*

13. Explain the causes of lung cancer and its symptoms.
14. Explain LD₅₀ and ED₅₀.

Turn over

15. Write a short note on causes and symptoms of anthrax, chicken pox and tuberculosis.
16. Explain the sources and toxicological effects of chlorine and asbestos.
17. Write a note on food borne diseases.
18. What are the toxicological effects of carbaryl and DDT ?
19. Write a note on endosulfan disaster.

(5 × 5 = 25 marks)

Section C

*Answer any **one** questions.
Each question carries 11 marks.*

20. Write an essay on air pollution control measures.
21. Explain waste water treatment processes.

(1 × 11 = 11 marks)

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SIXTH SEMESTER U.G. DEGREE EXAMINATION, MARCH 2022

(CBCSS—UG)

Chemistry

CHE 6B 13 (E2)—POLYMER CHEMISTRY

(2019 Admissions)

Time : Two Hours

Maximum : 60 Marks

Section A (Short Answers)*Answer at least **eight** questions.**Each question carries 3 marks.**All questions can be attended.**Overall Ceiling 24.*

1. Differentiate between thermoplastic and thermosetting polymers. Give one example each.
2. What are Polymers ? How they are classified ?
3. Define the term 'chain growth' in polymerization. What are inhibitors. Give an example of an inhibitor.
4. Briefly explain on what is group transfer polymerization.
5. Explain the concept of ring opening in polymerisation.
6. Briefly explain the phenomenon why a rubber ball becomes like glass below -70°C .
7. Briefly explain bulk polymerization? What is its major disadvantage.
8. What is HDPE ? Explain one method on how it is produced.
9. Explain why the melting point of polyurethane is much less than that of corresponding polyamide.
10. What is Teflon ? Mention its two applications
11. What is PVC ? Give one method for industrial polymerization of vinyl chloride.
12. What is EPDM rubber ? Give any *one* of its properties.

(8 × 3 = 24 marks)

Turn over

Section B (Paragraph)

*Answer at least **five** questions.*

Each question carries 5 marks.

All questions can be attended.

Overall Ceiling 25.

13. Explain how an ionic mechanism of chain polymerization takes place ?
14. Briefly explain the Zeigler Natta polymerization.
15. Briefly explain what is meant by molecular weight of a polymer and explain how degree of polymerization is expressed in terms of molecular weight.
16. Bring out any two key features of solution polymerization and suspension polymerization.
17. Write short note on interfacial condensation.
18. Briefly explain how phenol-formaldehyde resins are formed.
19. What are conducting polymers ? What is Dopping ?

(5 × 5 = 25 marks)

Section C (Essays)

*Answer any **one** question.*

The question carries 11 marks.

20. Write notes on thermal, photo and oxidative degradations of polymers.
21. Write notes on any *four* polymer processing techniques.

(1 × 11 = 11 marks)

SIXTH SEMESTER U.G. DEGREE EXAMINATION, MARCH 2022

(CBCSS-UG)

Chemistry

CHE 6B 12—ADVANCED AND APPLIED CHEMISTRY

(2019 Admissions)

Time : Two Hours

Maximum : 60 Marks

Section A*Answer at least **eight** questions.**Each question carries 3 marks.**All questions can be attended.**Overall ceiling 24.*

1. What is zeta potential ?
2. Explain the uses of nano-materials.
3. Why melting point of nano-material decrease when particle size decrease ?
4. What is the principle of green chemistry ?
5. Explain the importance of combinatorial synthesis.
6. Explain the term global minimum in computational chemistry.
7. Name one Nitrogenous and Potash fertilizer.
8. What are Propellants ?
9. Describe the term prodrugs with example.
10. Define octane number.
11. What are BHA and BHT ? Mention their important applications.
12. How will you synthesize Rosaniline ?

(8 × 3 = 24 marks)

Turn over

Section B

*Answer atleast **five** questions.*

Each question carries 5 marks.

All questions can be attended.

Overall ceiling 25.

13. Give an account of the stability of colloids.
14. Explain different host-guest interaction in supra molecules.
15. What are the software used in computational chemistry ?
16. Explain the term PHBV and PGA. Discuss its significance and applications.
17. Explain the strengthening of glass.
18. What are the major fractions in petroleum refining ?
19. Explain the theory of colour and constitution.

(5 × 5 = 25 marks)

Section C

*Answer any **one** questions.*

The question carries 11 marks.

20. Write short notes on :
 - (a) Applications of combinatorial synthesis.
 - (b) Computational chemistry as a tool and its scope.
 - (c) Ziegler-Natta catalyst.
21. Write short notes on :
 - (a) Travancore Cochin Chemicals Ltd.
 - (b) Preparations of paracetamol and aspirin.
 - (c) Artificial ripening of fruits.

(1 × 11 = 11 marks)

SIXTH SEMESTER U.G. DEGREE EXAMINATION, MARCH 2022

(CBCSS—UG)

Chemistry

CHE 6B 11—PHYSICAL CHEMISTRY—III

(2019 Admissions)

Time : Two Hours

Maximum : 60 Marks

Section A (Short Answers)*Answer at least eight questions.**Each question carries 3 marks.**All questions can be attended.**Overall Ceiling 24.*

1. The specific conductance decreases with dilution while the molar conductance increases to certain extent. Why ?
2. Using suitable example write the importance of solubility product in qualitative analysis.
3. Write the advantages of conductometric titration over titrations using indicators.
4. What happen when nitrogen gas is bubbled through ammonia solution ?
5. Calculate the osmotic pressure of a 0.1 M aqueous solution of an organic solute at 17°C. ($R = 0.0821 \text{ L atm K}^{-1} \text{ mol}^{-1}$).
6. Hydrogen chloride gas is passed through common salt for its purification process. What is the principle involved ?
7. What do you understand by space lattice and unit cell ?
8. Calculate the Miller indices of a crystal plane which passes through the crystal axes at 2a, 3b, c.
9. What is Frenkel defect ? How it affect the density of the crystal ?
10. What do you mean by intrinsic conductors ? Write two examples.
11. What is salt bridge why it is used ?
12. Write the oxidation reduction process involved in the hydrogen oxygen fuel cell.

(8 × 3 = 24 marks)

Turn over

Section B (Paragraph)

*Answer at least **five** questions.*

Each question carries 5 marks.

All questions can be attended.

Overall Ceiling 25.

13. Briefly discuss the band theory of metals.
14. Briefly discuss the hcp and ccp arrangements in crystal.
15. How will you determine the molecular mass of a non-ionic solid by elevation in boiling point method ?
16. How will you determine viscosity of a liquid using Ostwald Viscometer ?
17. Briefly discuss the mechanism of buffer action in a mixture of weak base and its salt and derive the Henderson equation.
18. How will you determine pH of a solution using quinhydrone electrode.
19. How e.m.f. measurements help for the calculation of the thermodynamic parameters, ΔH , ΔS and ΔG .

(5 × 5 = 25 marks)

Section C (Essay)

*Answer any **one** question.*

The question carries 11 marks.

20. Derive Bragg's equation. Explain how you will determine the crystal structure of NaCl by rotating crystal method. Predict the difference that can be observed in the interplanar distance of KCl and NaCl even though both have same type unit cell.
21. Briefly discuss the Debye-Huckel theory for strong electrolytes. Write Debye-Huckel-Onsager equation and explain the terms involved. Briefly explain the effect of high AC frequencies and High potential gradients in the conductivity of strong electrolytes.

(1 × 11 = 11 marks)

SIXTH SEMESTER U.G. DEGREE EXAMINATION, MARCH 2022

(CBCSS—UG)

Chemistry

CHE 6B 10—ORGANIC CHEMISTRY—III

(2019 Admissions)

Time : Two Hours

Maximum : 60 Marks

Section A*Answer at least eight questions.**Each question carries 3 marks.**All questions can be attended.**Overall Ceiling 24.*

1. What is a chromophore ? Give an example.
2. Write the fingerprint region in IR spectroscopy. What is its significance?
3. Give one example each for mobile phase and stationary phase in column chromatography.
4. Represent the ^1H nmr spectrum of $\text{CH}_3\text{CH}_2\text{Br}$.
5. Draw the Fischer projection of D(+) Glucose.
6. What are osazones ?
7. What are polysaccharides? Give two examples.
8. Write the hydrolysis product of sucrose.
9. Define isoelectric point.
10. What is biuret test ?
11. Name the bases present in nucleic acids.
12. Draw the structure of Vitamin C.

(8 × 3 = 24 marks)

Turn over

Section B

*Answer at least **five** questions.*

Each question carries 5 marks.

All questions can be attended.

Overall Ceiling 25.

13. How is IR spectroscopy useful for distinguishing inter and intramolecular H -bonding in alcohols ?
14. Write notes on electronic transitions in organic molecules giving suitable examples.
15. Give an account on structure of starch and glycogen.
16. Draw the structure of cholesterol. Give any two biological functions of cholesterol.
17. Discuss conrotation and disrotation in electrocyclic reactions.
18. Explain the Woodward-Hoffmann selection rules for sigmatropic reactions.
19. Write the mechanism of Claisen rearrangement.

(5 × 5 = 25 marks)

Section C

*Answer any **one** question.*

The question carries 11 marks.

20. Describe the structure of nucleic acids and their role in heredity and protein biosynthesis.
21. (a) Give an account on structure of natural rubber.
(b) Write notes on vulcanization of rubber and show the substitution at allylic carbon and addition across double bond.

(1 × 11 = 11 marks)

SIXTH SEMESTER U.G. DEGREE EXAMINATION, MARCH 2022

(CBCSS-UG)

Chemistry

CHE 6B 09—INORGANIC CHEMISTRY—IV

(2019 Admissions)

Time : Two Hours

Maximum : 60 Marks

Section A*Answer atleast eight questions.**Each question carries 3 marks.**All questions can be attended.**Overall ceiling 30.*

1. What is AAS ?
2. Discuss the principle of FES.
3. $\text{La}(\text{OH})_3$ is more basic than $\text{Lu}(\text{OH})_3$. Why ?
4. Copper is a transition element. Predict its four important properties.
5. What are d block elements ? Give their electronic configuration.
6. What is meant by stability constant ?
7. What is spectrochemical series ?
8. While $\text{Co}[(\text{H}_2\text{O})_6]^{2+}$ is pink in colour, $\text{Co}(\text{Cl})_4]^{2-}$ is blue in colour. Why ?
9. What is Zeise's salt ? Write its structure.
10. What is Wilkinson's catalyst ? Write its structure.
11. How does Haemoglobin differ from myoglobin ?
12. Why Arsenic is considered as a toxic metal?

(8 × 3 = 24 marks)

Turn over

Section B

Answer atleast five questions.

Each question carries 5 marks.

All questions can be attended.

Overall ceiling 25.

13. What are the factors affecting DTA curves ?
14. What are actinides ? Why are they so called ?
15. Discuss the paramagnetic behaviour of *d* and *f* block elements.
16. What is lanthanide contraction ? What are its consequences ?
17. Cobalt (III) easily forms low spin complexes whereas Cobalt (II) does not. Explain.
18. Discuss any *five* factors influencing the stability of complexes.
19. Give an account of the bio-chemistry and significance of Zinc in living systems.

(5 × 5 = 25 marks)

Section C

Answer any one questions.

Each question carries 11 marks.

20. (a) Describe the ion exchange method for the separation of lanthanides from monazite.
(b) Comment on the industrial importance of Lanthanides.
21. Write an account on the Molecular orbital theory of octahedral complexes containing only sigma bonds.

(1 × 11 = 11 marks)

SIXTH SEMESTER (CUCBCSS—UG) DEGREE [SPECIAL] EXAMINATION
MARCH 2021

Chemistry

CHE 6B 13(E3)—MEDICINAL AND ENVIRONMENTAL CHEMISTRY

Time : Three Hours

Maximum : 80 Marks

Section A (One word)

*Answer all questions.
Each question carries 1 mark.*

1. Two examples of water borne diseases are _____.
2. Major chemical constituent of Brahmi is _____.
3. What is meant by LD₅₀ Therapeutic index ?
4. TCOD is chemically _____.
5. What do you mean by myocardial infarction ?
6. Draw the structure of DDT.
7. Example of a persistent organic pollutant is _____.
8. Mention *two* medicinal uses of Hibiscus.
9. Define Hypercholesterolemia.
10. Mention *three* symptoms of Measles.

(10 × 1 = 10 marks)

Section B (Short Answers)

*Answer at least five questions.
Each question carries 4 marks.
All questions can be attended.
Overall Ceiling 20.*

11. Discuss the source and toxicological effects of asbestos.
12. Write S.N. on overdose and drug toxicity.

13. Write S.N. on Bio-chemical analysis of serum.
14. Discuss the various sampling methods available for gases and vapours.
15. Write S.N. on USAB process.
16. Explain desalination process.
17. Write S.N. on BOD and COD.
18. Write S.N. on sterilization of surgical instruments.
19. Discuss briefly Cottrell electrostatic precipitator.
20. Discuss the symptoms and drugs used for Bronchial Asthma.
21. Discuss the causes and symptoms of Lung Cancer.
22. Write S.N. on major chemical constituents and medicinal uses of Neem and Aloe Vera.

(5 × 4 = 20 marks)

Section C (Short Answers)

Answer at least four questions.

Each question carries 7 marks.

All questions can be attended.

Overall Ceiling 28.

23. Write S.N. on aerobic and anaerobic oxidation .
24. Write S.N. on toxicological effects of CCl₄ and Phenol.
25. Discuss the treatment for specific poisons such as Arsenic and Lead.
26. Write S.N. on deep well injection and USAB process.
27. Write S.N. on green belt. What is its purpose ?
28. Write S.N. on Blood grouping and Blood transfusion.
29. Discuss in detail the causes and symptoms for Typhoid fever and Hepatitis A.
30. Write S.N. on Drug abuse.

(4 × 7 = 28 marks)

Section D (Essays)

Answer any two questions.

Each question carries 11 marks.

31. Discuss the analytical methods for determination of H₂S, hydrocarbons and particulate matter.
32. Discuss the types and characteristics of industrial waste water in detail. Also discuss the measures for protection of surface waters from pollution with industrial sewage.
33. Discuss the History of drugs. What are the different routes of drug administration ?
34. Discuss the drugs used in treatment for systemic hypertension, and hypercholesterolemia. Also discuss the drugs used for treatment of diabetes.

(2 × 11 = 22 marks)

**SIXTH SEMESTER (CUCBCSS—UG) DEGREE (SPECIAL) EXAMINATION
MARCH 2021**

Chemistry

CHE 6B 13 (E2)—POLYMER CHEMISTRY

Time : Three Hours

Maximum : 80 Marks

Section A (One word / Sentence)

Answer all questions.

Each question carries 1 mark.

1. What is the monomer of Neoprene ?
2. Nylon -6 is prepared by _____ polymerization.
3. If A is a monomer, a linear polymer of A is represented as _____.
4. What is PMMA ?
5. Name a catalyst used in stereo regular polymerization.
6. What are copolymers ?
7. Example for condensation polymer is _____.
8. Monomer of PVC is _____.
9. What is UF resin ?
10. Name a conducting polymer.

(10 × 1 = 10 marks)

Section B (Short Answers)

Answer at least five questions.

Each question carries 4 marks.

All questions can be attended.

Overall Ceiling 20.

11. What is stereoregularity ?
12. How is Teflon prepared ? What are its uses ?

Turn over

13. Write a note on condensation polymerization.
14. What is meant by recycling of plastics ?
15. How is polypropylene prepared ? What are its uses ?
16. Explain vulcanization in polymers.
17. What is Kevlar ? How is it prepared ?
18. Write the structural formula of NR. What is its monomer ?
19. Explain Viscosity average molecular weight.
20. Write a short note on carbon fibres.
21. What is photo degradation of polymers ?
22. Compare between HDPE and LDPE.

(5 × 4 = 20 marks)

Section C (Paragraphs)

*Answer at least **four** questions.*

Each question carries 7 marks.

All questions can be attended.

Overall Ceiling 28.

23. Discuss the relationship between PDI and molecular weight.
24. Explain number average and weight average molecular weights.
25. Write a note on the three types of polymer degradation.
26. Briefly explain bulk and suspension polymerisations.
27. How are lexan and melmac prepared? What are their uses ?
28. What is ring opening polymerization ? Explain with an example.
29. Write a note on pollution due to plastics.
30. What are interfacial polycondensation reactions ? Explain with an example.

(4 × 7 = 28 marks)

Section D (Essays)

Answer any two questions.

Each question carries 11 marks.

31. Describe compression, injection and blow moulding processes.
32. Explain Ziegler-Natta Catalysis with mechanism. What is its significance ?
33. What is Tg ? Discuss the various factors influencing Tg.
34. How are the following polymers prepared ? What are their uses ?
 - (i) Urea-Formaldehyde resin.
 - (ii) Silicone rubber.
 - (iii) Nitrile rubber.

(2 × 11 = 22 marks)

**SIXTH SEMESTER (CUCBCSS—UG) DEGREE [SPECIAL] EXAMINATION
MARCH 2021**

Chemistry

CHE 6B 12—ADVANCED AND APPLIED CHEMISTRY

Time : Three Hours

Maximum : 80 Marks

Section A (One Word)

Answer all questions.

Each question carries 1 mark.

1. Write an example for a carbon nanostructure.
2. _____ is a green solvent.
3. Monomer of PEG is _____.
4. An example for a thermosetting plastic is _____.
5. Major chemical manufactured by Travancore Cochin Chemicals is _____.
6. _____ is an indicator of the ignition properties of diesel fuel.
7. Give an example for an anti-knocking compound.
8. Pharmacologically inactive compounds which become active after metabolism are called _____.
9. _____ is an example for a hypnotic.
10. Write an example for a fungicide.

(10 × 1 = 10 marks)

Section B (Short Answer)

Answer at least five questions.

Each question carries 4 marks.

All questions can be attended.

Overall Ceiling 20.

11. Write a note on graphenes.
12. What is supramolecular chemistry ?
13. Write two examples for food preservatives.
14. What is a computer programme ? Give an example.
15. Define Tacticity.

Turn over



16. Explain condensation polymerization using an example.
17. What are the advantages of Zeigler-Natta catalyst.
18. What is PHBV ?
19. Give the components of cement.
20. What are refractory materials ?
21. Define flash point.
22. Draw the structure of endosulfan.

(5 × 4 = 20 marks)

Section C (Paragraph)

*Answer at least four questions.
Each question carries 7 marks.
All questions can be attended.
Overall Ceiling 28.*

23. Explain the synthesis and uses of indigo.
24. Discuss the use of microwaves in green organic synthesis.
25. Write a note on combinatorial synthesis.
26. Explain the synthesis and applications of nylon 6.
27. What are biodegradable polymers ? Give examples.
28. Write a note on the classification of pesticides.
29. Explain the classification of glass.
30. Discuss the classification of dyes based on their chemical structure using examples.

(4 × 7 = 28 marks)

Section D (Essay)

*Answer any two questions.
Each question carries 11 marks.*

31. Give a detailed account of the principles of green chemistry
32. Explain the synthesis and applications of the following polymers.
a) PVC ; b) Teflon ; c) Nylon 66 ; and d) Bakelite.
33. a) Discuss the classification of drugs based on their mode of action using suitable examples.
b) Write a note on the application of nanoscience in medicine.
34. Discuss the theories of colour and constitution.

(2 × 11 = 22 marks)

SIXTH SEMESTER (CUCBCSS-UG) DEGREE [SPECIAL] EXAMINATION
MARCH 2021

Chemistry

CHE 6B 11—PHYSICAL CHEMISTRY – III

Time : Three Hours

Maximum : 80 Marks

Section A

Answer all questions.
Each question carries 1 mark.

1. The tendency of an electrode to lose electrons or to get oxidised is called _____.
2. In a galvanic cell electrons flow from _____ to _____.
3. _____ is defined as the conducting power of all the ions produced by one gram equivalent of an electrolyte in a given solution.
4. The specific conductance of an electrolyte _____ with dilution.
5. _____ is the product of concentrations of hydrogen ions and hydroxyl ions in water or any aqueous solution at a given temperature.
6. As the pK_a value increases, the acidic strength _____.
7. A solution obeying _____ is an ideal solution.
8. The measured freezing point depression for a 0.1M aqueous CH₃COOH solution is 0.19°C. The acid dissociation constant K_a at this concentration will be _____ (Given K_f the molal cryoscopic constant = 1.86K kgmol⁻¹).
9. NaCl has FCC structure. The number of Na⁺ and Cl⁻ ions in the unit cell is _____.
10. The crystal system with $a \neq b \neq c$ and $\alpha = \beta = \gamma = 90^\circ$ is _____.

(10 × 1 = 10 marks)

Section B

Answer at least **five** questions.
Each question carries 4 marks.
All questions can be attended.
Overall Ceiling 20.

11. Equivalent conductance of Cs⁺ is greater than that of Li⁺ although Cs⁺ is bigger. Give reason.
12. State Faraday's laws of electrolysis. What is one Faraday ?

Turn over

13. What is meant by liquid junction potential ? How can it be eliminated ?
14. Calculate the hydronium and hydroxyl ion concentration in (i) 0.01M HCl and (ii) 0.01M NaOH solution at 298K.
15. Define buffer index.
16. What is meant by common ion effect? Explain with an example.
17. State Henry's law and its application.
18. Define the term colligative properties. Give two examples
19. Explain the terms space lattice and unit cell. Represent diagrammatically a face centred cubic lattice.
20. What is meant by colour centres? Give an example.
21. Discuss metal deficiency defects.
22. State the law of rationality of indices.

(5 × 4 = 20 marks)

Section C

Answer at least four questions.

Each question carries 7 marks.

All questions can be attended.

Overall Ceiling 28.

23. What is quinhydrone electrode ? Explain the use of quinhydrone electrode in pH determination.
24. Describe the moving boundary method for determination of transport number.
25. Sketch and explain the conductometric titration curves for (a) strong acid-weak base titration and (b) weak acid-weak base titration.
26. What are buffer solutions ? How are they classified ? Explain the mechanism of buffer action
27. What is van't Hoff factor ? How it is related to degree of dissociation ?
28. Explain reverse osmosis. Give any one application.
29. Diffraction angle 2θ is equal to 16.8° for a crystal having interplanar distance 0.400 nm for second order diffraction. Calculate the wavelength of X-rays used.
30. What are liquid crystals ? How are they classified and mention its applications ?

(4 × 7 = 28 marks)

Section D

*Answer any two questions.
Each question carries 11 marks.*

31. Derive the relation between K_h , K_w , K_a and K_b for the hydrolysis of salt of weak acid and weak base.
32. What is fuel cell ? Explain the working of H_2-O_2 fuel cell. What are the advantages of fuel cells ?
33. Write detailed notes on any four applications of EMF measurement.
34. (a) Derive Bragg's equation for the diffraction of X-rays by crystal lattice.
(b) Describe the rotating crystal method for the determination of crystal structure. Why is rotation necessary in rotating crystal method for crystallography ?

(2 × 11 = 22 marks)

**SIXTH SEMESTER (CUCBCSS—UG) DEGREE (SPECIAL) EXAMINATION
MARCH 2021**

Chemistry

CHE 6B 10—ORGANIC CHEMISTRY—III

Time : Three Hours

Maximum : 80 Marks

Section A (One Word)

Answer all questions.

Each question carries 1 mark.

1. How many absorption peaks are present in the ^1H NMR spectrum of diethyl ether ?
2. The change in specific rotation of a freshly prepared solution of glucose is known as _____.
3. Fehlings solution is a mixture of _____.
4. pH at which amino acid can migrate to cathode or anode during electrolysis is called _____.
5. Mass in grams of iodine consumed by 100 grams of oil or fat is known as _____.
6. The purine base not present in DNA is _____.
7. Which vitamin is ascorbic acid ?
8. The reaction of ethylene with butadiene to form cyclohexene is known as _____.
9. Heating natural rubber with sulphur to improve its properties is called _____.
10. The alkaloid present in tobacco is _____.

(10 × 1 = 10 marks)

Section B (Short Answers)

Answer at least five questions.

Each question carries 4 marks.

All questions can be attended.

Overall Ceiling 20.

11. Explain spin spin splitting in 1-chloro ethane.
12. Write two evidences for cyclic structure of glucose.

Turn over

13. What are the products obtained by the reduction of glucose and fructose ?
14. How will you test the presence of amino acids and proteins ?
15. What is doping ?
16. How vitamins are classified ?
17. What are essential oils ? Give an application.
18. Draw the structure of an amine hormone.
19. Why Adenine pair up with Thymine and Guanine with Cytosine in DNA double helical structure ?
20. What is sigmatropic re-arrangement ?
21. Why Cope rearrangement is a [3, 3] sigmatropic reaction ?
22. How vitamin D is formed from cholesterol.

(5 × 4 = 20 marks)

Section C (Paragraph)

*Answer at least **four** questions.*

Each question carries 7 marks.

All questions can be attended.

Overall Ceiling 28.

23. How will you convert an aldohexose to aldopentose ?
24. Explain denaturation with suitable examples.
25. Write any *four* characteristics of enzymes.
26. How lipids are classified ?
27. What are the differences between DNA and RNA ?
28. Explain replication and mention its importance.
29. What is triplet code ? Explain its role in translation and transcription.
30. Explain supra facial and antra facial overlapping with 4 + 2 and 2 + 2 cycloaddition as examples.

(4 × 7 = 28 marks)

Section D (Essays)

*Answer any two questions.
Each question carries 11 marks.*

31. Explain biosynthesis of proteins.
32. Write a note on the structure of proteins.
33. How will you establish the existence and size of glucose cyclic structure ?
34. Identify the compound and explain

Molecular formula : $C_{13}H_{10}O$,

IR spectra : 3028, 2967, 1690, 1453 cm^{-1} .

1H NMR spectra : δ (ppm) 7.40 – 7.70 10 H (multiplet).

(2 × 11 = 22 marks)

**SIXTH SEMESTER (CUCBCSS—UG) DEGREE [SPECIAL] EXAMINATION
MARCH 2021**

Chemistry

CHE 6B 09—INORGANIC CHEMISTRY—IV

Time : Three Hours

Maximum : 80 Marks

Section A

Answer all questions.

Each question carries 1 mark.

1. The sulphide ores are generally concentrated by _____ method.
2. The spin only magnetic moment of $[\text{CoF}_6]^{3-}$ is _____.
3. Pendlantite is the chief ore of _____.
4. The electronic configuration of Europium is _____.
5. Draw the structure of cisplatin.
6. Give an example of trace metal in biological system.
7. Triethylenetetramine is a _____ dentate ligand.
8. The IUPAC name of $[\text{Fe}(\text{C}_5\text{H}_5)_2]$ is _____.
9. The metal present in Wilkinson's catalyst is _____.
10. The effective atomic number of $[\text{Co}(\text{CO})_3\text{C}_6\text{H}_6]$ is _____.

(10 × 1 = 10 marks)

Section B (Short Answer)

Answer at least five questions.

Each question carries 4 marks.

All questions can be attended.

Overall Ceiling 20.

11. Comment on the oxidation state of lanthanides.
12. Explain aluminothermic process.
13. Briefly describe Ellingham diagram for metal oxides.
14. Briefly describe spin only magnetic moment.
15. Which is more stable $[\text{Co}(\text{en})_3]^{2+}$ or $[\text{Co}(\text{NH}_3)_6]^{2+}$. Explain why ?

Turn over

16. Give one example each for a high spin and low spin octahedral complexes of Iron(II) and their IUPAC name.
17. Give the structure and significance of cisplatin.
18. Comment on the bonding in dibertzenochromium.
19. Differentiate inert and labile complexes.
20. Give the structure and use of Zeigler- Natta catalyst.
21. Briefly describe the functions of hemoglobin and myoglobin.
22. Explain the toxicity of lead.

(5 × 4 = 20 marks)

Section C (Paragraph)

Answer at least four questions.

Each question carries 7 marks.

All questions can be attended.

Overall Ceiling 28.

23. Explain zone refining and vapour phase refining.
24. What is lanthanide contraction? Explain its cause and consequences.
25. Write a note on merits and demerits of crystal field theory.
26. Explain preparation and bonding in ferrocene.
27. Give a comparison of lanthanides with actinides.
28. Discuss the splitting of d orbitals in octahedral complexes.
29. Explain the biochemistry of zinc and cobalt.
30. Briefly describe Mond's process.

(4 × 7 = 28 marks)

Section D (Essay)

Answer any two questions.

Each question carries 11 marks.

31. Discuss the M.O theory of octahedral complexes with only σ bond.
32. Describe the metallurgy of titanium.
33. Give an account of the preparation, properties, structure and uses of potassium permanganate.
34. a) Discuss the mechanism of sodium-potassium pump.
b) Write a note on biochemistry of calcium.

(2 × 11 = 22 marks)

**SIXTH SEMESTER (CUCBCSS—UG) DEGREE [SPECIAL] EXAMINATION
MARCH 2021**

Industrial Chemistry

IC 6B 03—INORGANIC CHEMISTRY—III

Time : Three Hours

Maximum : 80 Marks

Section A

Answer all questions.

Each question carries 1 mark.

1. Why wash solution contains electrolyte for precipitate washing in gravimetric analysis ?
2. Why Li and Be compounds are covalent ?
3. What is heavy hydrogen ?
4. Name the process for the manufacture of ammonia and nitric acid.
5. Unlike CCl_4 , the hydrolysis of SiCl_4 is due to the presence of _____ in silicon.
6. Number of unpaired orbitals in nitrogen atom is _____.
7. Chernobyl incident results in _____ pollution.
8. _____ project attracts a silent valley social movement.
9. Toxic heavy metal ion in water responsible for the mental retardation is _____.
10. Name two gases which cause acid rain.

(10 × 1 = 10 marks)

Section B

Answer at least five questions.

Each question carries 4 marks.

All questions can be attended.

Overall Ceiling 20.

11. How phosphate acid radicals interfere the basic radical analysis ?
12. Distinguish between accuracy and precision.
13. Write two methods to eliminate determinate errors.

Turn over

14. Give the chemical equation for the thermal decomposition of Li_2CO_3 .
15. What is inert pair effect and how it affects the oxidation state of carbon family ?
16. Give the basic structural unit of silicates. How silica differ from zeolites ?
17. Which are neutral nitrogen oxides ?
18. Arrange the halogens in the decreasing order of electron gain enthalpy.
19. Explain the bleaching action of SO_2 .
20. What is the basicity of H_2SO_4 and H_2SO_3 ?
21. Discuss the structure of ozone and hydrogen peroxide.
22. Write a short note on water quality parameters.

(5 × 4 = 20 marks)

Section C

*Answer at least **four** questions.*

Each question carries 7 marks.

All questions can be attended.

Overall Ceiling 28.

23. A solution of Cd^{2+} , Zn^{2+} and Mn^{2+} ions acidified with dil. HCl is passed with H_2S . Which ions precipitate as sulphide. Why ?
24. Arrange the hydrides of Nitrogen family and halogen family in the decreasing order of boiling points. Give the reason.
25. Discuss the structure of Borazine, Boron nitride (BN), AlCl_3 .
26. Why Boron halides (BX_3) are acidic ? Arrange all BX_3 in the increasing order of relative strength with explanation.
27. Write the two hydrolysis reaction for the preparation of phosphine. Also give the structure of phosphine.
28. What are poly(chlorophosphazenes) ? Explain the structure.
29. Write two compounds containing N and S. Give its preparation and properties.
30. What is Chemical Oxygen Demand (COD) ? How it was determined ?

(4 × 7 = 28 marks)

Section D (Essay Questions)

Answer any two questions.

Each question carries 11 marks.

31. (a) Give the structure and name of all oxy acids of chlorine and discuss on its acidic character. (6 marks)
- (b) Explain the preparation of Xenon compounds. (4 marks)
32. What are Silicones? Give methods of preparation and properties.
33. Briefly discuss the sources and effects of water pollution. Suggest the various control and remedial measures to curb water pollution.
34. (a) What are the three types of solid wastes? Write notes on the disposal of solid wastes. (8 marks)
- (b) 'Recycling' is an integral part of solid waste management. Comment. (2 marks)
- [2 × 11 = 22 marks]