(1) Model Answers Q.P. code:- 65597

S.Y.B.Sc. Biotechnology Sem IV Applied Chemistry

[redacted] **Max. Marks = 75**

Q1. Choose the correct answers (any fifteen) **15**

1. _____ sampling requires minimum knowledge of bulk material.

a) Systematic b) Random c) Gross

Ans. b) random

2. Which of the following affects the procedure of sampling?

a) Size of sample b) Cost of sampling c) Location of sample

Ans. b) Cost of sampling

3. Partition coefficient and distribution ratio will be

a) always equal b) always different c) equal if molecular condition is same

d) equal when molecular condition is different

Ans. c) equal if molecular condition is same

4. High boiling point liquids are separated using _____

a) Fractional distillation b) Vacuum distillation c) Filtration

Ans. b) Vacuum Distillation

5. Liquid-liquid extraction is also known as

a) Solvent extraction b) Filtration c) Vacuum distillation

Ans. a) Solvent extraction

6. Solubility _____ with increase in temperature

a) increases b) decreases c) remains the same

Ans. a) Increases

7. Centrifugation is used for separation of solid from _____.

a) Solid b) Liquid c) Gases

Ans. b) Liquid

8. Which of the following is a primary metabolite?

a) Amino acids b) Terpenoids c) Phenolics

Ans. a) Amino acids

9. Cholesterol is an example of _____

a) Steroid b) Phenolic c) Alkaloid

Ans. a) Steroid

10. Isoprenes are the basic unit of _____

a) Terpenoids b) Alkaloids c) Phenolics

Ans. a) Terpenoids

11. What does TLC stand for?

a) Thick layer chromatography b) Thin layer chromatography

c) Thick liquid chromatography

Ans. b) Thin layer chromatography

12. Which of the following is not a fully automated procedure?

a) GC b) HPLC c) HPTLC

Ans. c) HPTLC

13. Essential oils are mostly derived from _____

a) Plants b) Animals c) Soil

Ans. a) Plants

14. Which of the following is an example of a polymer?

a) Ethene b) Polyethene c) Ethane

Ans. b) Polyethene

15. Which of the following is a heat stable polymer?

a) Plastic b) Thermoplastic c) Thermosets

Ans. c) Thermosets

16. Which of the following is an addition polymer?

a) Polyethene b) Polyester c) Polyamides

Ans. a) Polyethene

17. Which of these is a physical method of nanoparticle synthesis?

a) Mechanical grinding b) Nucleation c) Sol-gel formation

Ans .a) Mechanical grinding

18. Which of the following can be used to make nanotubes?

a) Carbon b) Sulfur c) Phosphorus

Ans. a) Carbon

19. Nanoparticles made by chemical synthesis produce what type of solutions?

3

a) True solution b) Colloidal Solution c) Suspensions

Ans. b) Colloidal Sollutions

20. Which of the following microscopes is used for characterization of nanoparticles?

a) Light Microscope b) Dark Microscope c) Electron Microscope

Ans. c) Electron microscope

Q2 a) Explain the importance of sampling and sampling techniques. 08

Ans. 1) Sampling is the process of obtaining a reasonable amount of material the has all the essential properties of the bulk material.

2) The purpose of sampling is to study the characteristics of the bulk material without studying the whole material.

3) Small portion of material is removed randomly from different parts of the material

4) Sample should match bulk material in chemical properties and particle distribution

5) It helps in identifying properties of material present in large quantities

6) Sampling Techniques – Random Sampling

Systematic or non-random sampling

7) Random Sampling – selection of sample without any bias

8) Non-random Sampling – Sample drawn in a definite sequence and at regular intervals.

Q2 b) Describe the process of distillation as a separation technique. 07

Ans. 1) Two liquids can be separated by distillation provided their boiling points differ by about 30 degrees Celsius.

2) Performed under reduced pressure or vacuum if liquid has high boiling point or decomposes before boiling

3) Steam distillation used for high boiling point liquids that are immiscible with water. Water vapour contributes to vapour pressure allowing the liquid to evaporate before it reaches its boiling point

4) The vapours of the liquids are collected in a separate chamber and cooled to enable separation.

OR

Q2 c) Give the basic principles of sedimentation 08

Ans. 1) Sedimentation is a mechanical method of solid-liquid separation.

2) It uses the principle of gravity alone

3) Solids in suspension in a liquid can be separated by this method

4) The sample is made to stand undisturbed for certain amount of time

5) The heavy solid particles settle to the bottom of the container

6) the liquid can be decanted from the top

7) Does not bring complete separation and minute solids remain suspended.

8) These can be sedimented with the aid of sedimentation agents such as alum or charcoal.

Q2 d) What is solvent extraction? Explain in brief. **07**

Ans. 1) Solvent extraction is a method of separation based on the distribution of a substance between two immiscible liquids.

2) An aqueous solvent and an organic solvent are used.

3) The sample is mixed in a separating funnel containing the two solvents.

4) The solvents are separated and evaporated to get the pure substance

5) Organic solvents have low boiling points so evaporation is easy

6) It is simple, quick and convenient

7) But cannot be used for large quantities of material.

Q3 a) Explain the classification of natural products based on biosynthesis. **08**

Ans.1) Natural Products can be classified on the basis of biosynthesis as plant products and animal products.

2) Plant products include terpenoids, alkaloids, phenolics and essential oils

3) Animal products are hormones, vitamins

4) Some products come from both sources – vitamins and steroids, carbohydrates and proteins.

5) Plant products further divided into primary and secondary metabolites.

6) Primary metabolites – carbohydrates, proteins

7) Secondary metabolites – alkaloids, phenolics, essential oils

(one line description of each)

Q3 b) What is HPTLC? Give its applications in analysis of natural products. **07**

Ans. 1) HPTLC stands for High Performance Thin Layer Chromatography.

2) It uses commercially available pre-coated plates with uniform thickness and small particle size.

3) sample application can be done uniformly using an automated applicator.

4) Detection of separated components done using a scanning instrument.

Applications: 1) Most suited for impurity profile of drug substances

2) Used in herbal analysis

3) Assay of multi-component formulations

4) Pharmaceutical industry (uniformity, purity, assay and dissolution rates)

5) Separation of nutrients

(any four)

5

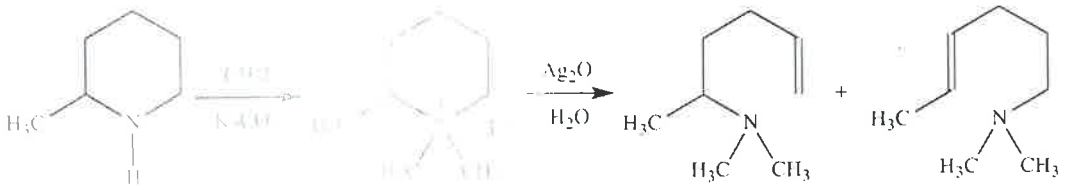
OR

Q3 c) Give the steps of structure determination of natural products. **08**

Ans. Two methods of structural determination:

i) Ozonolysis of terpenoids

ii) Hofmann exhaustive methylation and degradation in alkaloids

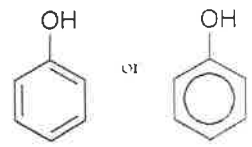


(explain each type with example)

Q3 d) What are phenolics? Give their significance and uses. **07**

*In organic chemistry, **phenols**, sometimes called **phenolics**, are a class of chemical compounds consisting of a hydroxyl group (—OH) bonded directly to an aromatic hydrocarbon group.*

Phenolic compounds are classified as simple phenols or polyphenols based on the number of phenol units in the molecule.



Phenol - the simplest of the phenols.

Phenolic compounds are synthesized industrially; they also are produced by plants and microorganisms, with variation between and within species.

Although similar to alcohols, phenols have unique properties and are not classified as alcohols (since the hydroxyl group is not bonded to a saturated carbon atom). They have higher acidities due to the aromatic ring's tight coupling with the oxygen and a relatively loose bond between the oxygen and hydrogen. The acidity of the hydroxyl group in phenols is commonly intermediate between that of aliphatic alcohols and carboxylic acids.

*Loss of a hydrogen cation (H^+) from the hydroxyl group of a phenol forms a corresponding negative **phenolate ion** or **phenoxide ion**, and the corresponding salts are called **phenolates** or **phenoxides**, although the term **aryloxides** is preferred according to the IUPAC Gold Book. Phenols can have two or more hydroxy groups bonded to the aromatic ring(s) in the same molecule. The simplest examples are the three benzenediols, each having two hydroxy groups on a benzene ring.*

Q4 a) What are the different types of polymers? Explain with examples. **08**

(b)

Ans. Different types of polymers on the basis of origin : i) Natural polymers

ii) Synthetic polymers

On the basis of monomers used: i) Homopolymer

ii) Copolymer

Based on properties of polymers: i) Plastics

ii) Thermoplastics

iii) Thermosets

iv) Fibres

v) Resins

vi) Elastomers

(Definitions and examples of each)

Q4 b) Compare and contrast between addition and condensation polymers giving suitable examples. **07**

Ans. Addition Polymers: Unsaturated monomers add to each other to give addition polymers. Also called chain growth polymerization. Radicals, anions or cations are formed as intermediates.

Examples (any two)

Condensation Polymers: Also called step growth polymers. Uses monomers with atleast two functional groups. Polymerization happens with elimination of simple molecules like water, alcohol etc.

Example (any two)

OR

Q4 c) Explain the different methods of synthesis of nanomaterials. **08**

Nanomaterials is the design, characterization, production and application of structures, devices and systems by controlled manipulation of size and shape at the nanometer scale (atomic, molecular and macromolecular scale) that produces structures, devices and systems with at least one novel/superior characteristic or property (Page No: 1.3)

Methods of synthesis are: (Page no: 1.3-1.8)
Physical methods
- *Gas phase evaporation method*
- *Matrix isolation method*
- *Metal vapor-covalent co-deposition method*

Chemical methods
- *Sol gel processing*
- *Chemical reduction*

Biological method
Use of reductants produced by biological agents

Q4 d) What are nanoparticles? Explain their properties.07

The accepted definition of nanomaterials is the design, characterization, production and application of structures, devices and systems by controlled manipulation of size and shape at the nanometer scale (atomic,

7

molecular and macromolecular scale) that produces structures, devices and systems with at least one novel/superior characteristic or property (Page No: 1.3)

Properties: (Page No: 2.2 to 2.11)

1. *Formation of dangling bonds*
   Atom like behaviour of NPs
2. *Physicochemical properties*
3. *Optical properties*
   Semiconductor NPs
   Metal NPs
4. *Electrical and electronic properties*
   Electronic properties of carbon nanotubes (CNT)
5. *Redox properties*
   Semiconductor NPs
6. *Mechanical properties*
7. *Magnetic properties*
   Magnetic properties of Fe_2O_3 NPs
8. *Catalytic activity*

5. Write a short note on (any three) **15**

a) Non-Random Sampling

Ans. Non-random sampling- also called systematic sampling

Sample units are drawn in a definite sequence at equal intervals from one another

Method has an element of bias or prejudice

The sample may not represent the entire material

b) Secondary metabolites

Ans. End products of primary metabolites

Not involved in growth and development of plants

Eg. Alkaloids, phenolics, lignins, resins, tannins, steroids, essential oils etc.

Carbohydrates give terpenes, alkaloids

Fats give Steroids, tannins, essential oils

(one line description of these secondary metabolites)

c) Alkaloids

Ans. Organic compounds from plants with at least one nitrogen atom present in heterocyclic ring.

They are of four types – glycosides, esters, amides and salts of organic acids (examples, use and structural description of each

d) Thermoplastics

Ans. Have ordered crystalline region and amorphous non-crystalline region .

They are hard at room temperature but soft when heated

Thus can be remoulded several times and can be re-used

Examples PE,PP,PS, PVC

e) Nanomaterial

- *What are nanomaterials*
- *They can be synthesized by physical, chemical and biological methods*
- *The properties of nanomaterials are drastically different than their bulk counterparts*
- *They can be characterized by methods such as UV-Visible absorption, Fourier Transform Infra-Red, X-Ray diffraction and Electron microscopy (SEM, TEM) methods*
- *They find applications in various fields such as communication, energy, environment (pollution abatement), medicine, electronic (sensors) to name a few*