TDC (CBCS) Odd Semester Exam., 2021
held in March, 2022

CHEMISTRY

(5th Semester)

Course No. : CHMHCC-501T

[Organic Chemistry (Biomolecules)]

Full Marks : 50
Pass Marks : 20

Time : 3 hours

The figures in the margin indicate full marks for the questions

SECTION—A

Answer any *ten* from the following : 2×10=20

1. Mention two important functions of nucleic acid. 2

2. *(a)* What is the nature of forces holding two long DNA molecules together? 1

(b) Write the structure of sugar present in DNA. 1

3. *(a)* What type of linkage holds together the monomers in DNA? 1

(b) What are the products obtained on complete hydrolysis of a nucleotide from DNA containing thymine? 1

4. *(a)* How do you explain the amphoteric behaviour of amino acid? 1

(b) Write the structure of ala-gly. 1

5. *(a)* Write two facts in support of zwitterion structure of α-amino acids. 1

(b) Write the reaction that forms the basis of van Slyke method for the estimation of amino acid. 1

6. Give the structure of one acidic and one basic amino acid. 2

7. What do you mean by the following? 1×2=2

(a) Oxido-reductase

(b) Transferases

8. What do you mean by substrate specificity of an enzyme? Give one example. 1+1=2

9. What happens to the enzymic activity above optimum temperature? Give reason. 1+1=2

10. *(a)* Oils and fats are mostly triglycerides. What is triglyceride? 1

(b) Give the name and structure of a mixed triglyceride. 1

11. *(a)* Give an example of phospholipid. 1

(b) What are the products of hydrolysis of phospholipids? 1

12. How can triglycerides be classified into fats and oils? 2

13. *(a)* How does WHO define a drug or medicine? 1

(b) Explain the term 'antipyretic' with example. 1

14. Write the medicinal values of vitamin C and azadirachtin (neem). 2

15. Classify analgesic medicines with example. 2

SECTION—B

Answer any *five* from the following : 6×5=30

16. *(a)* Carry out the synthesis of adenine from uric acid. 3

(b) How are nucleotides linked together in nucleic acid? 1½

(c) Write the structure of the pyrimidine base that occurs in DNA but not present in RNA. 1½

17. *(a)* Carry out the synthesis of uracil from urea. 3

(b) What do you mean by 'base pairing'? 1½

(c) Some nucleotides can act as energy carrier. Explain. 1½

18. *(a)* One mole of amino acid reacts with two moles of ninhydrin to produce a purple pigment. Write the sequence of reactions involved in the formation of purple colouration. 3

(b) Describe Sanger's method for the determination of N-terminal amino acid of the peptide. 3

19. *(a)* Describe Strecker's method of synthesis of valine. 3

(b) Write the name and structure of optically inactive natural amino acid. 1

(c) What is isoelectric point of an amino acid? Write its importance. 2

20. *(a)* What are enzymes and coenzymes? Mention their importance in living organisms. 1+1+2=4

(b) Account for the specificity of enzyme substrate complex. 2

21. *(a)* What do you mean by 'active sites' in enzymes? 1

(b) Discuss lock-and-key theory to explain the mechanism of enzyme action. 3

(c) What coenzymes are derived from niacin? Write their importance in living system. 1+1=2

22. *(a)* What do you mean by saponification value of fats or oils? Write its significance. Calculate the saponification value of tristearin (stearic acid : $C_{17}H_{35}CO_2H$). 1+1+2=4

(b) How can you convert oil into a fat? 2

23. *(a)* How can you determine the iodine value of a fat or oil using Wijs' solution? What is the significance of iodine value? 3+1=4

(b) Distinguish between the following : 1×2=2

(i) Mineral oil and Vegetable oil

(ii) Animal fat and Vegetable fat

24. *(a)* Identify the asymmetric centres in the structure of chloramphenicol. 2

(b) Describe the synthesis of paracetamol from 4-nitrophenol. 3

(c) What do you mean by antimalarials? 1

25. *(a)* What are the requirements of a substance to be an antibiotic? 2

(b) Give the structure which is responsible for penicillin activity. 2

(c) Write the structure and therapeutic uses of paracetamol. 2

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TDC (CBCS) Odd Semester Exam., 2021
held in March, 2022

CHEMISTRY

(5th Semester)

Course No. : CHMHCC-502T

(Physical Chemistry—V)

Full Marks : 50
Pass Marks : 20

Time : 3 hours

The figures in the margin indicate full marks for the questions

SECTION—A

Answer any *ten* from the following : 2×10=20

1. Write two postulates of quantum mechanics.

2. Show that Hermitian operators have real eigenvalues.

3. If $\hat{A}$ and $\hat{B}$ are two operators such that $[\hat{A}, \hat{B}] = 1$, then find the value of $[\hat{A}, \hat{B}^2]$.

4. Define exchange and Coulomb integrals.

5. Calculate the most probable distance of the electron from the nucleus in the ground state of H-atom.

6. Calculate the bond order of CN^-. Which one, CO^+ or O_2 will be stabilized by removal of an electron? 1+1=2

7. Discuss the effect of UV and IR radiations on the molecule.

8. How does the change in bond length of diatomic molecule affect the rotational spectra of the molecule?

9. Explain why homonuclear diatomic molecule does not show vibrational spectra.

10. Explain why Stokes lines are more intense than anti-Stokes lines.

11. What is fluorescence? Why does fluorescence occur much faster than phosphorescence?

12. What do you mean by spin-spin coupling in high resolution spectra of NMR spectroscopy?

13. State the two laws of photochemistry.

14. What is photosensitized reaction? Give one example each of natural and artificial photosensitized reactions. 1+1=2

15. Define the term 'chemiluminescence'. Give an example.

SECTION—B

Answer any *five* from the following : 6×5=30

16. *(a)* Solve the Schrödinger wave equation for a particle of mass m moving in a three-dimensional (3-D) cubical box with edge of length a. 3

(b) What is degeneracy? Calculate the degree of degeneracy for the energy level $\frac{14h^2}{8ma^2}$. 1+2=3

17. *(a)* Write and solve the Schrödinger's wave equation for a one-dimensional (1-D) simple harmonic oscillator (SHO). 5

(b) What is zero-point energy? 1

18. Set up Schrödinger's wave equation in spherical polar coordinates for H-atom and hence separate it into radial and angular parts. 6

19. Write the Hamiltonian operator for H_2^+ in terms of MOT and hence solve the Schrödinger's wave equation for H_2^+ to determine the secular equations. 6

20. *(a)* Explain the intensity curve of pure rotational molecule. 3

(b) Obtain an expression of energy for vibrating diatomic molecule. 3

21. *(a)* Explain mutual exclusion principle with an example. 3

(b) Explain the origin of *P*, *Q*, *R* branches of line in vibrational-rotational spectra. 3

22. *(a)* State and explain Franck-Condon principle of electronic transition. 3

(b) Explain the PMR spectra of $CH_3—CH_2—OH$. 3

23. *(a)* Discuss the effect of solvent polarity and conjugation on the absorption maxima of a compound. 3

(b) Explain the principle of NMR spectroscopy. 3

24. *(a)* Define quantum yield. Give two reactions each for high and low quantum yields of photochemical reactions. 1+2=3

(b) Explain the physical significance of absorption coefficient. 3

25. *(a)* Explain various photophysical processes in detail giving Jablonski diagram. 5

(b) What is quenching? 1

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