

[This question paper contains 4 printed pages.]

2023 →

(21)

Your Roll No. 2024

Sr. No. of Question Paper : 1522

G

Unique Paper Code : 2492012301

Name of the Paper : Metabolism of Lipids

Name of the Course : B.Sc. (Hons) Biochemistry
NEP

Semester : III

Duration : 2 Hours

Maximum Marks : 60

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. There are 6 questions.
3. Attempt any 4 questions.
4. All questions carry equal marks.
5. Question no. 1 is compulsory.



P.T.O.

1. (a) Answer the following :

- (i) Odd chain fatty acid oxidation is gluconeogenic in nature.
- (ii) Cholesterol is made from acetyl-CoA in four major stages.
- (iii) C^{14} labeled CO_2 is not incorporated into fatty acids synthesis.
- (iv) Bile helps in digestion and absorption of lipids.
- (v) Statins are used in the treatment of hypercholesterolemia.
- (vi) Two additional enzymes are required in polyunsaturated fatty acid breakdown.

(b) Write the reactions catalyzed by the following enzymes:

(i) Methyl malonyl-CoA mutase

(ii) Acetyl-CoA carboxylase

(12,3)

2. Differentiate between :

- (a) Fatty acid oxidation in mitochondria and peroxisome
- (b) Chylomicron and HDL
- (c) Alpha and omega oxidation (5×3)

Explain the following :

- (a) Reciprocal regulation of fatty acid oxidation and synthesis
- (b) Oxidation of odd chain fatty acids leads to net synthesis of oxaloacetate.
- (c) Carnitine plays an important role in fatty acid oxidation. (5×3)
- (a) Give the total number of ATP produced in the complete oxidation of palmitic acid with reactions involved.
- (b) Describe synthesis of triacylglycerol from glycerol.
- (c) How is HMG-CoA reductase regulated?

(7, 4, 4)

P.T.O.

5. Give the following conversions :

(a) Acetyl-CoA to Mevalonate

(b) Glycerol-3-phosphate to phosphatidic acid

(c) Palmitoyl-CoA to Ceramide

(5×3)

6. Write short notes on :

(a) Ketone bodies

(b) Fatty Acid Synthase Complex

(c) Atherosclerosis

(5×3)

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(22)

Your Roll No. 2024

Sr. No. of Question Paper : 1525

G

Unique Paper Code : 2162012301

Name of the Paper : Phycology – The World of
Algae

Name of the Course : B.Sc. (Hons.) Botany

Semester : III

Duration : 2 Hours

Maximum Marks : 60

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Attempt **four** Questions in all.
3. Question No. 1 is compulsory.
4. Draw well labelled diagrams wherever necessary.

1. (a) Provide a suitable example (genus) of the following
(any five) : (1×5=5)

- (i) Spermatophyte
- (ii) Watermelon algae
- (iii) Red tides



- (iv) Endophytic algae
- (v) Wanderplasm
- (vi) Cup-shaped chloroplast
- (vii) Hormogonia

(b) Fill in the blanks (**any five**) : (1×5=5)

- (i) Bioremediation of soil using Blue Green algae was studied by _____.
- (ii) _____ is an example of prokaryotic algae.
- (iii) Algal division which do not have any motile stages in their life cycle are _____ and _____.
- (iv) Multinucleate and multiflagellate zoospores are called _____.
- (v) The term algae was coined by _____.
- (vi) The reserve food material of red algae is _____.
- (vii) Having erect and prostrate system in thallus organization is known as _____.

(c) Match the following :

(1×5=5)

- | | |
|-------------------------|-----------------------|
| (i) Sea lettuce | (a) Diatoms |
| (ii) Rolling alga | (b) <i>Sargassum</i> |
| (iii) Laminarin | (c) <i>Ulva</i> |
| (iv) Diatomaceous earth | (d) <i>Dunaliella</i> |
| (v) Halophilic alga | (e) <i>Volvox</i> |

2. Differentiate between (any three) : (5×3=15)

- (i) Carposporophyte and tetrasporophyte
- (ii) Cyanophyceae and Chlorophyceae
- (iii) Unilocular and plurilocular sporangia of *Ectocarpus*
- (iv) Zoospore and Aplanospore
- (v) Nucule and Globule

3. Draw a well labelled diagram of any three of the following : (5×3=15)

- (i) E.M. of *Chlamydomonas* / *Chlorella*
- (ii) V.S Receptacle of *Sargassum* showing bisexual conceptacles
- (iii) Single trichome of *Nostoc*

P.T.O.

(iv) Pennate diatom

(v) Thallus showing sex organs of *Vaucheria*

4. Write short notes of the following (any three) :

(5×3=15)

(i) Asexual reproduction in *Volvox*

(ii) Criteria of classification by Fritsch

(iii) Evolutionary significance of *Prochloron*

(iv) *Chlamydomonas* as model system

(v) Significant contributions of R.N. Singh and M.O.P. Iyengar

5. (a) What are phycocolloids. Give their economic importance with suitable examples. (7)

(b) Explain the cell division in *Oedogonium*. Give an account of the special features and sexual reproduction in *Oedogonium*. (8)

(or)

Define ocean acidification. Discuss ecological importance of algae. (8)

(1000)

[This question paper contains 4 printed pages.]

(23)

Your Roll No 2024

Sr. No. of Question Paper : 1560

G

Unique Paper Code : 2492012302

Name of the Paper : Bioenergetics (DSC)

Name of the Course : B.Sc. (Hons.) Biochemistry

Semester : III

Duration : 2 Hours

Maximum Marks : 60

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. There are 6 questions.
3. Attempt any 4 questions.
4. All questions carry equal marks.
5. Question no. 1 is compulsory.



1. (a) Explain the following terms :

- (i) Iron sulfur Protein
- (ii) Biochemical Standard free energy change
- (iii) Nernst equation
- (iv) Energy charge

P.T.O.

- (v) Accessory pigments
- (vi) GFP
- (vii) Uncoupler
- (viii) State function

(b) Give the contribution of the following scientists :

- (i) Albert L. Lehninger
- (ii) Paul Boyer
- (iii) Efraim Racker (12,3)

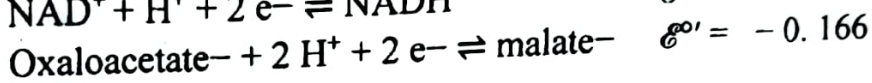
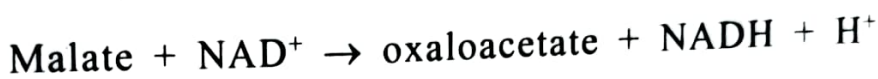
2. (a) Calculate $\Delta G^{\circ'}$ for the reaction $A + B \rightleftharpoons C + D$ at 25°C when the equilibrium concentrations are $[A] = 10 \mu\text{M}$, $[B] = 20 \mu\text{M}$, $[C] = 4 \mu\text{M}$, and $[D] = 6 \mu\text{M}$. Is the reaction exergonic or endergonic under standard conditions?

(b) If ΔH and ΔS for a reaction are both positive, can the reaction be spontaneous. If so then under what conditions?

(c) Phosphocreatine is an energy source in skeletal muscle during heavy exercise. Explain.

(d) ATP transfers energy by group transfers. Explain. (3,3,3,6)

3. (a) The reaction catalyzed by malate dehydrogenase is,



Calculate $\Delta G^{\circ'}$ for the reaction. Is the reaction Spontaneous?

- (b) Explain how Ubiquinone is a two-electron carrier and cytochrome c is a one electron carrier.
- (c) Explain the Chemiosmotic theory, proposed by Peter Mitchell. Give two experimental proofs in support of this theory.
- (d) Give the role of Brown adipose Tissue in new born. (4,4,5,2)
4. (a) Give the schematic diagram of electron transport chain in mitochondria for transport of 2 electrons from NADH to oxygen. Show the complexes involved in proton translocation
- (b) What is Malate Aspartate shuttle? Give its functional importance.
- (c) Draw a labeled diagram of F_1F_0 -ATP synthase. Mention the subunits that are static, subunits that rotate and which change conformation.

- (d) Explain how do the following inhibit ATP synthesis :
- (i) Rotenone
 - (ii) DCCD (4,4,5,2)
5. (a) Calculate the free energy change for moving a proton from the thylakoid lumen to the stroma when $\Delta\text{pH} = 3.4$, $\Delta\Psi = 0.5$, and $T = 25^\circ\text{C}$.
- (b) Give a diagrammatic representation of electron carriers in PSII from Reaction Center to Plastoquinone.
- (c) Compare the cyclic electron transport in Purple and Green Sulfur photosynthetic bacteria.
- (d) Give the role of phycobilisome in red algae. (4,4,5,2)
6. (a) Explain how firefly Luciferin / Luciferase system is used for ATP assay.
- (b) How are ROS species generated in mitochondria? Give an account of the ROS scavenging mechanism present in mitochondria.
- (c) Give an account of water splitting complex in thylakoid membrane. (5,5,5)

$$[R=8.314\text{J/mol.K, } F=96,480\text{J/V.mol,}]$$

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2023

(24)

Your Roll No. 2024

Sr. No. of Question Paper : 1598

G

Unique Paper Code : 2492012303

Name of the Paper : Membrane Biology

Name of the Course : B.Sc. (Hons) Biochemistry

Semester : III

Duration : 2 Hours

Maximum Marks : 60

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. There are 6 questions.
3. Attempt any 4 questions.
4. All questions carry equal marks.
5. Question no. 1 is compulsory.



P.T.O.

1. (a) Justify the following statements (**ANY FIVE**) :

- (i) Phosphatidylcholine is found predominately in outer (extracellular) side of the bilayer.
- (ii) Critical micellar concentration of ionic detergents decreases with the addition of electrolytes.
- (iii) Vanadate inhibits P-type ATPases.
- (iv) Rate of uncoupling by valinomycin is temperature dependent whereas gramicidin is not.
- (v) Transport proteins present on the apical side of membrane cannot diffuse to the basolateral side of the membrane in the intestinal epithelial cells.

(vi) *Halobacterium salinarum* can survive under very high salt concentrations.

(b) Give the contributions of the following scientists

(Any Two) :

(i) Peter Agre

(ii) Jens Christian Skou

(iii) A. D. Bangham

(c) Identify the following :

(i) Technique used to determine transition temperature of membrane

(ii) Cardiac glycoside that blocks the $\text{Na}^+\text{-K}^+$ pump.

- (iii) A family of proteins which help in transportation of glucose across the RBC membrane. (10,2,3)

2. (a) How is membrane fluidity affected by the following?

(i) Change in temperature

(ii) Lipid composition

(b) What are lipid anchored membrane proteins?

Explain different types of lipid anchored membrane proteins.

(c) Explain the structure of acetylcholine receptor.

How does the ligand binding open the acetylcholine receptor at neuromuscular junction?

(d) What do you understand by homeoviscous adaptations? Mention one example. (4,4,5,2)

3. (a) Differentiate between (any two) :

(i) COP I and COP II coated vesicles

(ii) Carrier and Channel forming Ionophores

(iii) Primary active and Secondary active transport

(b) Diagrammatically represent the architecture of RBC membrane.

(c) Explain the structure of the CFTR protein. What is the molecular basis of development of the disease Cystic Fibrosis?

4. (a) Explain the structure and function of following :

(i) Lipid rafts in membranes

(ii) Potassium ion channels

(b) Explain the structure and mechanism of calcium ATPase present on the plasma membrane.

(c) Explain the TNBS labeling experiment to demonstrate the flip-flop movement of membrane lipids.

(d) State the function of the following :

(i) SNARE Proteins

(ii) Flippase

(5,4,4,2)

5. (a) Calculate the free energy change for transporting 1 mole of glucose into the cell from blood at 37°C .

Given that the concentration of glucose outside the cell is 10 folds higher than intracellular concentration. ($R=8.314 \text{ J/mol.K}$)

- (b) Justify the following statements :

(i) Rate of glucose transport can be compared with enzyme catalysed reactions.

(ii) Defected aquaporins may lead to diabetes insipidus.

- (c) What is the mechanism of acid secretion in gastric lumen? How does cimetidine inhibit the process of gastric acid secretion?

- (d) Cholesterol plays a dual role in maintaining fluidity.

Justify the statement.

(3,4,5,3)

P.T.O.

6. Write short notes on the following :

(a) FRAP

(b) Patch clamp Technique

(c) Receptor Mediated Endocytosis of LDL

(d) Group translocation in bacteria (4,3,4,4)

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(25)

Your Roll No. 2024

Sr. No. of Question Paper : 1641

G

Unique Paper Code : 2493012003

Name of the Paper : DSE- Microbiology

Name of the Course : B.Sc. (Hons.) Biochemistry

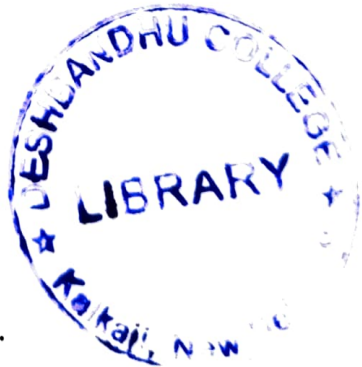
Semester : III

Duration : 2 Hours

Maximum Marks : 60

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. There are 6 questions.
3. Attempt any 4 questions.
4. All questions carry equal marks.
5. Question no. 1 is compulsory.



P.T.O.

1. (a) Choose the correct option :

- (i) The acellular entity which causes the Creutzfeldt Jacob disease is _____ .
- (ii) The scientist who helped in introducing the use of agar for the first time in the microbiology laboratory is _____ .
- (iii) The process by which one bacterium transfers genetic material to another through direct contact is called _____ .
- (iv) _____ cannot be sterilized by autoclaving.

(b) Give reason for the following :

- (i) 75% ethanol is preferred over absolute ethanol for sterilization.

(ii) Gelatin is not a preferred solidifying agent for culture medium.

(iii) D- amino acids are present in the cell wall of bacteria.

(iv) Mannitol Salt agar is both selective and differential media.

(c) Define Gut Microbiome. Discuss its role in human health. (4,8,3)

2. (a) Define generation time and the mean growth rate constant. Calculate the mean growth rate constant and generation time of a culture that increases in the exponential phase from 5×10^2 to 1×10^8 in 12 hours.

(b) Briefly describe the role of following environmental factors on the growth of micro-organism (give appropriate examples wherever applicable) :

(i) Temperature

(ii) Oxygen concentration

(iii) Water Activity

(iv) pH

(c) Discuss the contribution of following scientists :

(i) Elie Metchnikoff

(ii) Sergei Winogradsky

(iii) Charles Chamberland

(4,8,3)

3. (a) Differentiate between the following :
- (i) Gram-positive and Gram-negative cell wall
 - (ii) Continuous and Discontinuous culture
 - (iii) Bacterial Transformation and Transduction
- (b) Compare and contrast between Viruses and Viroids.
- (c) What advantages does microbial growth confer to the soil? (9,3,3)
4. (a) Discuss with the help of a suitable diagram/ flowchart all the steps involved in the production of beer.

(b) Compare and contrast the characteristic features between eubacteria and archaebacteria.

(c) What is gene mapping and its significance?

(7,5,3)

5. (a) What is the Germ Theory of Diseases? How was it proved experimentally?

(b) Discuss general characteristic features of the following microorganisms by giving suitable example :

(i) Algae

(ii) Protozoa

(c) What do you understand by a 'Pure Culture'?

Explain with the help of a diagram, any one method of obtaining a pure culture. (5,6,4)

6. (a) Define the following :

(i) Bioremediation

(ii) F factor

(iii) Biochemical Oxygen Demand

(b) Write short notes on :

(i) Physical methods of microbial control

(ii) Nutritional types of micro-organisms

(c) Describe Briefly the Primary, Secondary and
Tertiary Wastewater Treatment processes.

(3,6,6)

[This question paper contains 4 printed pages.]

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Your Roll No. 2024

Sr. No. of Question Paper : 4339

G

Unique Paper Code : 32491301

Name of the Paper : Metabolism of Carbohydrates and Lipids

Name of the Course : B.Sc. (Hons) Biochemistry (CBCS)

Semester : III

Duration : 3 Hours

Maximum Marks : 75

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. There are 8 questions.
3. Attempt any 5 questions.
4. All questions carry equal marks.
5. Question no. 1 is compulsory.



1. (a) Comment on the following :

(i) Glucose-6- phosphate is not administered intravenously

P.T.O.

- (ii) High NADPH/NADP ratio decreases the rate of pentose phosphate pathway
- (iii) Fatty acids cannot cross mitochondrial membrane to carry out beta oxidation in mitochondrial matrix
- (iv) Fructose 2,6 biphosphate is a potent activator of glycolysis
- (v) Water soluble vitamins play a crucial role in the citric acid cycle.
- (vi) Bile helps in digestion and absorption of lipids.

(b) Identify the defective enzyme in the following disorders :

- (i) Gaucher's disease
 - (ii) MC Ardles syndrome
 - (iii) Galactosemia
- (12,3)

2. Differentiate between :

- (a) Substrate level phosphorylation and oxidative phosphorylation
- (b) Glycogen synthesis and Glycogen breakdown

- (c) Malate Aspartate shuttle and Glycerol 3 phosphate shuttle (5,5,5)

3. Give the following conversions with enzymes involved in :

- (a) Acetyl CoA to Mevalonate
- (b) Galactose to glucose-6- phosphate
- (c) Glucose to ribose 5 phosphate
- (d) Glycerol-3-phosphate to phosphatidic acid (4,4,4,3)

4. (a) Explain bypass reactions of gluconeogenesis.

(b) How does mannose enter glycolytic pathway?

(c) What do you understand by anaplerotic reactions of TCA Cycle? Give examples. (5,5,5)

5. Explain the following :

(a) Reciprocal regulation of gluconeogenesis and glycolysis with specific reference to Glucokinase, PFK I and PFK II.

(b) Oxidation of odd chain fatty acids leads to net synthesis of oxaloacetate.

- (c) Regulation of Rubisco enzyme.
 - (d) Liver glycogen contribute to blood glucose but not muscle glycogen (6,3,3,3)
6. (a) Give the total number of ATP produced in the complete oxidation of Palmitic acid with reactions involved.
- (b) Give synthesis of triacylglycerol from glycerol.
- (c) Explain Pasteur Effect (7,5,3)
7. (a) Explain digestion and absorption of lipids.
- (b) Describe the regulation of fatty acid oxidation by malonyl CoA.
- (c) Carnitine plays an important role in fatty acid oxidation. Discuss. (5,5,5)
8. Write short notes on :
- (a) Pyruvate Dehydrogenase Complex
 - (b) Starve Feed Cycle
 - (c) Ketone bodies
 - (d) CAM plants (4,4,4,3)

[This question paper contains 8 printed pages.]

(27)

Your Roll No. 2024

Sr. No. of Question Paper : 4393

G

Unique Paper Code : 32491302

Name of the Paper : Membrane Biology and Bioenergetics

Name of the Course : B.Sc. (Hons.) Biochemistry

Semester : III

Duration : 3 Hours

Maximum Marks : 75

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. There are 8 questions.
3. Attempt any 5 questions.
4. All questions carry equal marks.
5. Question no. 1 is compulsory.
6. Simple Calculators are allowed.



P.T.O.

1. Explain the following terms :

(a) Energy charge of the cell

(b) Hilla reaction

(c) Phycobilisomes

(d) Critical packing parameter

(e) Polarized cells

(f) Antenna pigments

(g) Cystic fibrosis

(h) Proton motive force

(i) CMC

(j) BAT

(1.5×10)

2. Give an experimental proof of the following :

(a) Bilayer structure of membranes.

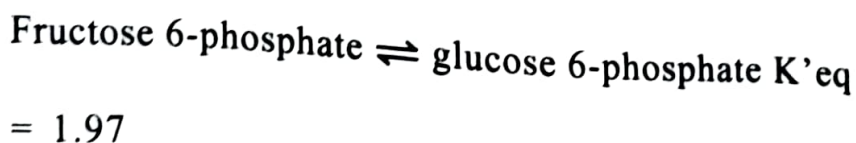
(b) Membrane fluidity

(c) Singer and Nicolson mosaic model of membranes.

(d) Transbilayer movement of membrane molecules

(4,3,4,4)

3. (a) Consider the following interconversion, which occurs in glycolysis

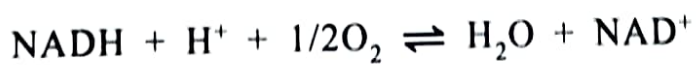


What is $\Delta G'^{\circ}$ for the reaction (K'_{eq} measured at 25°C)?

If the concentration of fructose 6-phosphate is adjusted to 1.5 M and that of glucose 6-phosphate is adjusted to 0.50 M, what is ΔG ?

($R = 8.314 \text{ J/mol.K}$)

(b) Electron transfer in the mitochondrial respiratory chain may be represented by :



- (i) Calculate ΔE° for the net reaction of electron transfer
- (ii) Calculate ΔG° for the net reaction of electron transfer
- (iii) How many ATP can be theoretically be generated by this reaction if free energy of ATP synthesis under cellular conditions is 52 KJ/mol.

$$\Delta E^{\circ'} \text{ NAD/NADH} = -0.320\text{V}$$

$$\Delta E^{\circ'} \text{ O}_2/\text{H}_2\text{O} = 0.820\text{V}$$

$$(F = 96.5\text{KJ/V.mol})$$

(c) Give the basis of high energy of hydrolysis of the following molecules :

(i) ATP

(ii) Phosphoenol pyruvate (5,6,4)

4. (a) State the chemiosmotic theory. Give an experimental proof validating the theory.

(b) Give the binding change mechanism of ATP synthesis catalyzed by F_0F_1 ATP synthase.

- (c) Calculate the proton motive force generated across the inner mitochondrial membrane per pair of electrons transferred through the respiratory chain from NADH to O_2 . Assume $\Delta\psi$ is 0.15V and pH difference is 0.3 units. (6,5,4)

$$[R = 8.314\text{J/mol.K, } F = 96,480\text{J/V.mol}]$$

5. Differentiate between the following :

(a) PSI and PSII

(b) Cyclic and non-cyclic photophosphorylation

(c) Flippases and Floppases (6,5,4)

6. Explain the mechanism of the following membrane transporters :

(a) Phospho transferase system

(b) Aquaporins

(c) $\text{Na}^+ \text{K}^+ \text{ATPase}$

(5,5,5)

7. (a) Mention the site and mechanism of action of the following Inhibitors :

(i) Cyanide

(ii) DCMU

(iii) Oligomycin

(iv) Antimycin A

(b) What are the different mechanisms to scavenge reactive oxygen species in mitochondria.

(c) Explain the Malate aspartate shuttle. (8,4,3)

8. Write short notes on the following :

(a) Lipid rafts

(b) Porins

(c) RBC membrane

(d) Ionophores

(4,4,4,3)