

(15)

[This question paper contains 6 printed pages.]

Your Roll No...2019

Sr. No. of Question Paper : 7363 J  
Unique Paper Code : 32491301  
Name of the Paper : Metabolism of Carbohydrates  
& Lipids  
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. Attempt **Five** questions in all.
3. Question No. 1 is compulsory.

1. (a) Comment on the following:

(i) Metabolism of a  $C_{15}$  fatty acid can lead to the net synthesis of glucose, but the metabolism of a  $C_{16}$  fatty acid cannot.



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- (ii) Fatty acid biosynthesis in a rat liver homogenate is severely inhibited when avidin, a protein found in egg white, is added.
  - (iii) Phosphofructokinase catalyzed step is the committed step of glycolysis.
  - (iv) Livers of Jamaican vomiting sickness victims are usually depleted of glycogen.
  - (v) Phosphorylation of glucose inside the cell is advantageous.
  - (vi) Glycogen is an efficient storage form of glucose.
- (b) State whether the following statements are true or false. If False, justify-
- (i) Liver does not utilize ketone bodies for energy even during starvation.
  - (ii)  $\alpha$  oxidation is an obligatory step in the oxidation of odd chain fatty acids.

(iii) Fats cannot be converted to glucose.

(iv) The Pentose phosphate pathway is present in plants, not in animals (12,7)

2. (a) What is substrate level phosphorylation? Explain with an example. How it is different from respiration linked oxidative phosphorylation?

(b) Explain the regulation of Rubisco in Calvin cycle.

(c) Describe how increased level of the following molecules will affect the glycolysis rate?

(i) Increased level of F-6-P

(ii) Increased ATP

(iii) Increased Citrate (4,4,6)

3. (a) Name the enzyme responsible and the associated symptoms for the following disorders-

(i) Niemann Pick Disease

(ii) Von Gierke disease

(iii) Pompe disease

(iv) Tay Sach Disease

- (b) If  $^{14}\text{C}$  —acetyl —CoA (labeled in both carbons) and a large excess of malonyl CoA are added to a sample of purified fatty acid synthase complex, the palmitate that results are labeled at only two positions. Which are they? Explain.
- (c) Describe the  $\beta$ -oxidation of fatty acids in peroxisomes. (6,4,4)
4. (a) Describe and calculate the total number of ATP produced from the complete oxidation of palmitic acid.
- (b) Describe citric acid cycle & indicate its control points, activators & inactivators. (5,9)
5. (a) Heart muscle and renal cortex prefer acetoacetate as a fuel over glucose. Write the sequence of reactions and the overall reaction for the process whereby these tissues transform acetoacetate to acetyl CoA for entry into TCA cycle.
- (b) Describe the reactions and the enzymes involved in the following synthesis (any 2).

(i) Biosynthesis of Ceramide

(ii) Biosynthesis of Phosphatidyl Choline

(iii) Biosynthesis of Triacylglycerol

(c) Describe the advantages of C4 plants over C3 plants. (3,8,3)

6. (a) Describe the digestion, absorption and transport of dietary fats.

(b) Describe the action of the following inhibitors -

(i) Aspirin

(ii) Fluoride

(iii) Iodoacetate

(iv) Arsenate (6,8)

7. Explain the following pathways alongwith its regulation

(i) Fatty acid synthesis and breakdown

(ii) Glycogenesis and glycogenolysis (14)

8. Write short notes on (any 4):

(i) Pasteur Effect

(ii) Glyoxylate Cycle

(iii) Cori Cycle

(iv) Cholesterol Synthesis

(v) Role of carnitine in fatty acid metabolism

(3.5 × 4 = 14)

[This question paper contains 6 printed pages.]

(16)

Your Roll No...2019...

Sr. No. of Question Paper : 7364 J

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. Attempt any **five** questions in all, including Question No. 1 which is compulsory.
3. Log tables and /or scientific calculator may be provided.

1. (A) Explain the following terms:

- (a) CMC of a detergent
- (b) Critical packing parameter of a lipid
- (c) Resonance energy transfer

(d) Homeoviscous adaptation

(e) Polarized cells

(f) Proton motive force (1.5x6)

(B) Give reasons for the following:

(a) Phosphatidyl choline is found predominantly on the outer (extracellular) side of the bilayer

(b) Rate of uncoupling by valinomycin is temperature dependent whereas gramicidin is not

(c) Rafts are detergent insoluble membrane domain

(d) Cardiac glycosides increase the intensity of heart muscle contraction

(e) Iron sulfur clusters are single electron carriers

(2x5)

2 (A) For the reaction  $A \rightleftharpoons B$  at  $298^\circ \text{K}$ , the change in enthalpy is  $8 \text{ kJ. mol}^{-1}$  and the change in entropy is  $30 \text{ J.K}^{-1}. \text{ mol}^{-1}$ . Is the reaction spontaneous? If not, then should the temperature be increased or decreased to make it spontaneous?

(B) Describe the anti-oxidant mechanism present in the mitochondria to destroy ROS.

(C) Give the basis of high energy of hydrolysis of the following compounds:

(a) 1,3 - Bis phosphoglycerate

(b) GTP

(D) Give one contribution of the following scientists:

(a) Albert L. Lehninger

(b) Paul Boyer

(c) Deisenhofer and Michel (4,3,4,3)

3 (A) Compare the composition of eukaryotic and prokaryotic plasma membranes.

(B) Give one experimental proof of the following:

(a) Bilayer structure of membranes

(b) Lateral diffusion in membranes.

(C) Give one application of the following membrane models:

(a) Monolayer in Langmuir trough

(b) Planar bilayer at tip of patch pipette

(c) Liposomes

(D) Explain how Brown adipose tissue (BAT) generates non-shivering thermogenesis.

(2,4,6,2)

4. (A) Explain how the passage of protons through the  $F_0F_1$ -ATPase induce the rotation of the C — ring resulting in the synthesis of ATP.

(B) What is effect of the following molecules on the electron transport chain in intact mitochondria with respect to ATP generation and  $O_2$  utilization? Give justification of your answer.

(a) DNP

(b) Oligomycin

(c) Cyanide

(C) Show how malate aspartate shuttle transports NADH from cytosol to mitochondria. (5,8.3)

5 (A) Draw the schematic model of PSII showing electron transport from  $H_2O$  molecule to  $Q_B$ .

(B) Calculate the energy of one mole of photon of

light of wavelength 680 nm. How many moles of ATP could theoretically be synthesized if 100% energy is conserved under standard conditions?

(C) What is the efficiency of non-cyclic photosynthetic light reaction? Compare it to the efficiency of cyclic photosynthetic reaction. (4,5,5)

6. Differentiate between:

(a) Photosynthetic electron transport in Purple photosynthetic bacteria and green sulfur bacteria.

(b)  $\text{NAD}^+$  and FAD as electron carriers

(c) Rotenone sensitive and rotenone resistant NADH dehydrogenase

(d) LHCI and LHCII. (4,4,4,2)

7. (A) Show diagrammatically, how  $\text{Na}^+$  Glucose transporter and GLUT-2 together are involved in the absorption of glucose from the intestinal lumen into the blood stream. Also contrast between the functioning of the two glucose transporters

(B) Explain how, does the anion exchanger in the RBC operates in one direction in the tissues and in the opposite direction in the lungs.

(C) Give the schematic representation of transport of  $\text{Ca}^{2+}$  out of the cell via plasma membrane  $\text{Ca}^{2+}$  ATPase pump. (6,5,3)

8. Give diagrammatic explanation of the following:

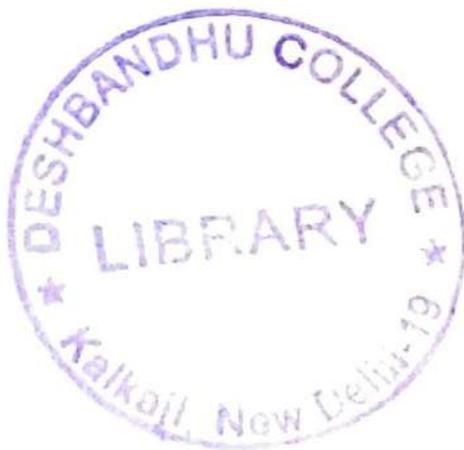
(a) RBC membrane architecture

(b) Membrane fusion

(c) Iron uptake by cells via receptor mediated endocytosis

(d) Caveolae (4,4,3,3)

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



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(17)

Your Roll No...2019

Sr. No. of Question Paper : 7365

J

Unique Paper Code : 32491303

Name of the Paper : Hormone Biochemistry and function

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. Attempt **Five** questions in all.
3. Question No. 1 is compulsory.

1. (a) Expand the following and give their physiological significance. (7x2)

(i) MAP kinase

(ii) PH domain



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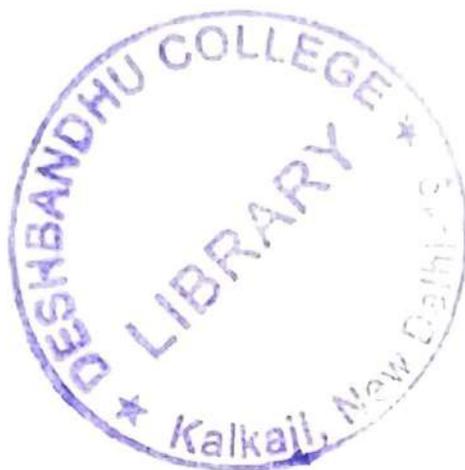
(iii) COMT

(iv) CCK

(v) IGF-1I

(vi) FSH

(vii) POMC



(b) Define the following terms:

(5×1)

(i) Natriuresis

(ii) Autocrine

(iii) Polydipsia

(iv) Agonist

(v) Cross phosphorylation

(vi) Neurotransmitter

2. Differentiate between the following:

(i) Cretinism and Myxedema

(ii) IDDM and NIDDM

(iii) PKA and PKG

(iv) Conn and Cushing syndrome (4×3.5)

3. (i) Describe the role of various hormones in menstrual cycle.

(ii) Explain the model for control of GH secretion by somatostatins and somatomedins.

(iii) Explain the effect of PTH on osteoblast and osteoclast activity. (6,4,4)

4. (i) What is Baroreceptor hypothesis? How does Renin secretion affect the blood pressure?

(ii) Illustrate the major effects of cortisol on carbohydrate and lipid metabolism.

(iii) Explain the role of testosterone on male reproduction. (5,5,4)

5. Diagrammatically illustrate the following:

(i) Oxidative coupling scheme for Iodothyronine formation in the follicular cell

(ii) Glucagon activation of hepatic adenylate cyclase and glucose formation

(iii) Feedback control of Vitamin D synthesis

(iv) JAK-STAT pathway (4x3.5)

6. Comment on the following:

(i) Catecholamines regulate carbohydrate and fat metabolism.

(ii) The gut is considered a neuroendocrine organ.

(iii) Oxytocin action during Parturition is an example of feed forward response.

(iv) The Pituitary is considered a dual gland, anatomically and functionally (4x3.5)

7. (i) Explain the mechanism of action of Insulin hormone.

(ii) Explain signal transduction pathway utilizing DAG and calcium as second messenger.

(iii) Illustrate the role of Vitamin D, Calcitonin and Estradiol in controlling bone mineralization and demineralisation (5,5,4)

8. Write short notes on:

(i) Lactation

(ii) NO as a vasodilator

(iii) Scatchard plot

(iv) Leptin

(3.5x4)

