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Gambard

# Avinashilingam Institute for Home Science and Higher Education for Women

Deemed to be University Estd. u/s 3 of UGC Act 1956, Category 'A' by MHRD (now MoE)

Re-accredited with 'A++' Grade by NAAC. CGPA 3.65/4, Category I by UGC

Colombatore - 641 043, Tamil Nadu, India

**Bachelor's Degree Examination – May 2025**

**IV Semester**

**Class : II UG**

**Major : Biochemistry and Biotechnology**

**Time: 3 Hours**

**Max. Marks: 100**

## 23BBCC04 Metabolism and Bioenergetics

Course Outcomes :

At the end of the course students will be able to

1. Understand the structure and functions of biomolecules in a cell.
2. Relate the properties of biomolecules and their significant role in living systems.
3. Understand the role of enzymes in the metabolic pathway and their deficiency problems.
4. Relate the role distinct metabolic pathways used by cells to harvest the energy.
5. Recognize the role of vitamins and coenzymes in intermediary metabolism

### Part A

10 x 1 = 10

#### Choose the Correct Answer

1. What is the end product of glycolysis under aerobic conditions in mammalian cells? CO1K1
  - a. Pyruvate
  - b. Lactate
  - c. Acetyl-CoA
  - d. Ethanol
2. Who discovered the TCA cycle, also known as the citric acid cycle? CO1K1
  - a. Hans Krebs
  - b. Louis Pasteur
  - c. Melvin Calvin
  - d. Alexander Fleming
3. \_\_\_\_\_ is the starting molecule for the synthesis of saturated fatty acids in most organisms. CO2K1
  - a. Malonyl-CoA
  - b. Palmitate
  - c. Acetyl-CoA
  - d. Glycerol
4. Which organ is the main site for the enzymatic breakdown of triglycerides during digestion? CO2K1
  - a. Stomach
  - b. Liver
  - c. Pancreas
  - d. Small intestine
5. Decarboxylation is the process of removing a \_\_\_\_\_ group from a molecule, often releasing carbon dioxide. CO3K1
  - a. Methyl
  - b. Amino
  - c. Hydroxyl
  - d. Carboxyl
6. The urea cycle primarily occurs in the \_\_\_\_\_ of liver cells. CO3K1
  - a. Mitochondria
  - b. Endoplasmic reticulum
  - c. Golgi apparatus
  - d. Lysosomes
7. A reaction is said to be spontaneous if the Gibbs free energy change ( $\Delta G$ ) is \_\_\_\_\_. CO4K1
  - a. Positive
  - b. Zero
  - c. Negative
  - d. Undefined
8. Which high-energy molecule, apart from ATP, has the highest standard free energy of hydrolysis? CO4K1
  - a. GTP
  - b. PEP
  - c. ADP
  - d. NADH
9. Which molecule acts as the final electron acceptor in the electron transport chain? CO5K1
  - a. NADH
  - b. FADH<sub>2</sub>
  - c. Oxygen
  - d. Carbon dioxide
10. Which of the following processes produces oxygen as a byproduct? CO5K1
  - a. Non-cyclic photophosphorylation
  - b. Cyclic photophosphorylation
  - c. Phosphorylation
  - d. Oxidative phosphorylation

**Part B**

**5 x 6 = 30**

**Answer ALL questions**

**Each answer should not exceed 400 words or two pages**

- 11.a. Illustrate the TCA cycle and calculate the net gain of ATP. CO1K2  
(or)
- 11.b. Describe the Hexose Monophosphate Shunt and explain its significance in cellular metabolism. CO1K3
- 12.a. Distinguish between saturated and unsaturated fatty acids. Give examples for each. CO2K2  
(or)
- 12.b. Describe the synthesis of glycolipids and discuss their significance. CO2K3
- 13.a. Discuss the significance of metabolic engineering in biotechnology. CO3K3  
(or)
- 13.b. Explain the steps involved in degradation of purines and discuss the importance. CO3K3
- 14.a. State and explain the first law of thermodynamics with suitable example. CO4K3  
(or)
- 14.b. Define ATP. Discuss its structural features and explain its importance in cellular processes. CO4K2
- 15.a. Explain Peter Mitchell's chemiosmotic theory of ATP synthesis. CO5K3  
(or)
- 15.b. Explain the structure and function of Photosystem I and Photosystem II in photosynthesis. CO5K3

**Part C**

**5 x 12 = 60**

**Answer ALL questions**

**Each answer should not exceed 800 words or four pages**

- 16.a. Explain the glycolysis pathway and its energetics. CO1K3  
(or)
- 16.b. What is glycogenolysis? Outline the steps involved in it and discuss its significance. CO1K2
- 17.a. Explain the steps involved in beta-oxidation of fatty acids. CO2K3  
(or)
- 17.b. Explain the biosynthesis of cholesterol in humans, highlighting the key enzymes and intermediates involved. CO2K3
- 18.a. Discuss the general reactions involved in amino acid degradation with suitable examples. CO3K3  
(or)
- 18.b. Explain the steps involved in urea cycle and its significance in nitrogen metabolism. CO3K3
- 19.a. Define a coupled reaction. Differentiate between endergonic and exergonic reactions with examples. CO4K2  
(or)
- 19.b. Explain high-energy compounds and their types. CO4K3
- 20.a. Explain the organization and function of the Electron Transport Chain (ETC) in cellular respiration. CO5K3  
(or)
- 20.b. Compare and contrast cyclic and noncyclic photophosphorylation. CO5K4

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