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UNIVERSITY EXAMINATIONS 2023/2024

FIRST YEAR, FIRST SEMESTER EXAMINATION FOR THE DEGREE OF BACHELOR OF SCIENCE IN CLINICAL MEDICINE AND COMMUNITY HEALTH DEVELOPMENT

CCM 3112: MEDICAL BIOCHEMISTRY I

DATE: JANUARY 2025 **TIME: 3 HOURS**

INSTRUCTIONS: *Answer all questions in the booklet provided*

Ensure that all your answers are properly numbered

Section A: Multiple Choice Questions (MCQs) - Give one Best Answer

Section B: Short Answer Questions (Answer All Questions)

Section C: Long Answer Questions (Answer any 2 Questions)

SECTION A: MULTIPLE CHOICE QUESTIONS (20 MARKS)

1. What is the primary buffer system in the blood that regulates pH?
    a) Phosphate buffer system
    b) Bicarbonate buffer system
    c) Protein buffer system
    d) Ammonium buffer system
2. Which of the following best describes the structure of a triglyceride?
    a) Glycerol and three fatty acids
    b) Glucose and two fatty acids

c) Glycerol and two nucleotides

d) Glucose and three amino acids

3. Which type of biomolecule is responsible for catalyzing biochemical reactions?

a) Nucleic acids

b) Proteins (Enzymes)

c) Lipids

d) Carbohydrates

4. Which ion is most abundant inside the cell and plays a critical role in muscle contraction?

a) Sodium (Na+)

b) Potassium (K+)

c) Calcium (Ca2+)

d) Chloride (Cl-)

5. Which vitamin is essential for the production of collagen and healthy connective tissues?

a) Vitamin A

b) Vitamin B12

c) Vitamin C

d) Vitamin D

6. The main difference between passive and active transport across membranes is that:

a) Active transport requires energy, passive transport does not.

b) Passive transport involves carrier proteins, active transport does not.

c) Passive transport moves substances against their concentration gradient.

d) Active transport can only occur in eukaryotic cells.

7. The role of ATP in biochemical reactions is to:

a) Provide structural support to enzymes

b) Store and release energy for cellular processes

c) Act as a signaling molecule

d) Serve as a buffer for pH changes

8. In the fluid mosaic model, which component is responsible for the selective permeability of biological membranes?
    a) Proteins
    b) Lipids
    c) Carbohydrates
    d) Water
9. Which of the following vitamins plays a critical role in vision?
    a) Vitamin A
    b) Vitamin D
    c) Vitamin K
    d) Vitamin E
10. Enzyme activity can be regulated by:
    a) Changes in temperature and pH
    b) Altering the enzyme's primary structure
    c) Changing the concentration of the substrate
    d) All of the above
11. Which of the following macromolecules can serve as both structural components and as energy reserves?
    a) Nucleic acids
    b) Proteins
    c) Carbohydrates
    d) Lipids
12. Which clinical condition is caused by a deficiency of Vitamin B12?
    a) Rickets
    b) Scurvy
    c) Pernicious anemia
    d) Beriberi
13. In which cellular structure does the majority of ATP production occur?

a) Cytoplasm

b) Endoplasmic reticulum

c) Mitochondria

d) Nucleus

14. Which ion plays a key role in blood clotting?

a) Potassium (K+)

b) Calcium (Ca2+)

c) Chloride (Cl-)

d) Sodium (Na+)

15. What is the clinical significance of membrane asymmetry?

a) It allows for selective transport of molecules.

b) It prevents passive diffusion of ions.

c) It enables membrane fluidity.

d) It regulates enzyme activity on different membrane surfaces.

16. Which of the following is a clinical indicator of kidney function?

a) Serum creatinine

b) ALT (Alanine Aminotransferase)

c) Bilirubin

d) Hemoglobin

17. Proteins that help to facilitate chemical reactions in the body without being consumed in the process are called:

a) Coenzymes

b) Enzymes

c) Substrates

d) Hormones

18. What type of transport requires energy to move substances across the plasma membrane?

a) Active transport

b) Facilitated diffusion

c) Osmosis

d) Diffusion

19. Which of the following vitamins is essential for calcium absorption in the intestines?

a) Vitamin A

b) Vitamin C

c) Vitamin D

d) Vitamin K

20. The clinical use of enzymes in diagnosing diseases involves:

a) Measuring the activity of enzymes in blood or tissues

b) Using enzymes to treat infections

c) Replacing deficient enzymes

d) Breaking down dietary proteins

SECTION B: SHORT ANSWER QUESTIONS (40 MARKS)

1. Explain the biological significance of ions such as sodium and potassium in the human body (5 Marks)
2. Describe the structure and function of proteins in living organisms (5 Marks)
3. Explain the significance of biological membranes in maintaining cellular homeostasis (5 Marks)
4. Discuss the role of vitamins in metabolic reactions and their clinical relevance (5 Marks)
5. Explain how enzymes are used in clinical diagnosis and provide examples (5 Marks)
6. Describe how membrane transport processes are involved in nutrient absorption (5 Marks)
7. Explain the importance of pH regulation in the human body and its clinical implications (5 Marks)

8. Discuss the laws of thermodynamics and how they apply to bioenergetics in cells (5 Marks)

SECTION C: LONG ANSWER QUESTIONS (40 MARKS) ANSWER ANY TWO QUESTIONS

1. a) Explain the role of carbohydrates and nucleic acids in the human body (10 Marks)
   b) Discuss the clinical implications of imbalances in carbohydrate metabolism (10 Marks)
2. a) Describe the mechanisms by which enzymes catalyse biochemical reactions (10 Marks)
   b) Explain how enzyme deficiencies are diagnosed and treated in clinical practice (10 Marks)
3. a) Discuss the role of biological membranes in transport processes (10 Marks)
   b) Explain the clinical significance of membrane transport disorders, providing examples (10 Marks)