MASINDE MULIRO UNIVERSITY OF SCIENCE AND TECHNOLOGY (MMUST)

MAIN CAMPUS

UNIVERSITY EXAMINATIONS
2023/2024 ACADEMIC YEAR

FOR THE DEGREE OF BACHELOR OF SCIENCE IN NURSING (DL)

COURSE CODE: NCD 116

COURSE TITLE: Medical biochemistry I

Tuesday 5th December 2023 3.00pm-6.00pm

INSTRUCTIONS TO CANDIDATES

All Questions are compulsory

TIME: 3 Hours

MMUST observes ZERO tolerance to examination cheating

Please turn over

SECTION I: MULTIPLE CHOICE QUESTIONS (60 MARKS)

1. Lipids:

a) Are insoluble in organic solvents
b) Do not include waxes
c) Do not form structural forms of biological membranes
d) Have protective functions in bacteria, plants, insects, and vertebrates

2. Saturated fatty acids:

a) Melt at lower temperatures
b) Are liquids at room temperature
c) Have at least one double bond in their carbon chain
d) Do not have any double carbon to carbon bonds in their chain

3. A triglyceride is composed of:

a) Two fatty acids and one glycerol
b) Two glycerol molecules and one fatty acid
c) One glycerol molecule and one fatty acid
d) Three fatty acids and one glycerol molecule

4. Patients with gastroparesis should limit the amount of lipids in their diet because:

a) Lipids enhance gastric emptying
b) Lipids delay gastric emptying
c) They lack the enzymes that break down lipids
d) The lipids can cause intestinal obstruction

5. As metabolic fuels:

a) Lipids provide a third of the energy provided by carbohydrates
b) Lipids provide less energy than that provided by proteins
c) Lipids provide two to three times the energy provided by glucose
d) Lipids are the most preferred source of energy in the body

6. Partial hydrogenation of fatty acids:

a) Reduces the double bonds in unsaturated fatty acids
b) Converts monounsaturated fatty acids into polyunsaturated fatty acids
c) Increases the double bonds in fatty acids
d) Reduces hydrogen atoms in a fatty acid

7. Glycosidic bonds:

a) Form by hydrolysis reactions
b) Are formed by condensation reactions
c) Are formed between amino acids
d) Are formed between fatty acids and glycerol

8. Disaccharides:

a) Are insoluble in water

b) Include glycogen and starch

c) Are formed when two monosaccharaides are joined

d) Do not have carbon atoms in their structure

9. Maltose:

a) Is a monosaccharide
b) Is the storage form of carbohydrates in fungi
c) Is a disaccharide formed from two units of glucose joined with an $\alpha(1\rightarrow4)$ bond
d) Is not a reducing sugar

10. Reducing sugars:

a) Will reduce other compounds and get oxidized in the process
b) Will oxidize other compounds and get reduced in the process
c) Do not include all monosaccharides
d) Include all the disaccharides

11. The storage form of carbohydrates in human beings is:

a) Starch.
b) Cellulose
c) Glucose
d) Glycogen

12. When Benedict's solution and urine containing glucose are heated:

a) The copper(II) ions in Benedict's solution will be reduced to copper(I), which then forms a brick red copper(I) oxide precipitate
b) The copper(I) in Benedict's solution will be oxidized to copper II)
c) Neither oxidation nor reduction of copper ions will occur
d) The copper ions in the test solution will reduce the glucose

13. A carbonyl group:

a) Is a functional group composed of a carbon atom double-bonded to an oxygen atom
b) Is a derivative of hydrocarbons in which one or more of the hydrogen atoms in the hydrocarbon have been replaced by a hydroxyl group.
c) Is not found in carbohydrates
d) Does not affect the properties of a compound

14. Aldohexoses:

a) Are monosaccharides that have six carbon atoms and an aldehyde functional group
b) Are monosaccharides with six carbon atoms and a ketone functional group
c) Are monosaccharides with five carbon atoms and an alcohol functional group
d) Are monosaccharides with five carbon atoms and an aldehyde functional group

15. Oligosaccharides:

a) Are formed when three to 10 simple sugars are linked together
b) Are formed when more than 10 monosaccharides are linked together
c) Do not have Glycosidic bonds
d) Are proteins

16. Amino acids:

a) Are the building blocks of lipids
b) Are the building blocks of a vast majority of proteins in living cells
c) Are the building blocks of carbohydrates
d) Do not occur in living tissues

17. All amino acids:

a) Are soluble in water
b) Are not colourless
c) Do not have any basic amino(-NH2) group
d) Do not have any acidic carboxylic acid (-COOH) group

18. Denaturation of proteins:

a) Can be achieved by the application of heat
b) Enhances the function of the protein
c) Does not have any effect on the functioning of the protein
d) Will not affect the secondary and tertiary structural levels of the protein

19. The first step in protein synthesis:

a) Is translation
b) Is called transcription
c) Is called termination
d) Occurs in the cytoplasm

20. Enzymes:

a) Are made of cholesterol
b) Are protein in nature
c) Cannot be denatured by heat
d) Slow down the rate at which chemical reactions occur

21. Coenzymes:
    a) Are inorganic protein molecules
    b) Include magnesium ions
    c) Are non-protein organic molecules
    d) Do not include biotin

22. The optimum pH for most enzymes is:
    a) 7.0
    b) 2.0
    c) 14
    d) 4.5
23. Activation energy of a chemical reaction:
    a) Is enhanced by enzymes
    b) Is lowered by enzymes
    c) Is not affected by enzymes
    d) Is not necessary in an exergonic reaction
24. Endergonic reactions:
    a) Do not require enzymes
    b) Absorb heat from the surroundings
    c) Release heat to the surroundings
    d) Do not include photosynthesis
25. Isoenzymes:
    a) Are alternative forms of the same enzyme activity that exist in different proportions in different tissues
    b) Do not exist in human beings
    c) Do not differ in amino acid composition and sequence and multimeric quaternary structure
    d) Are enzymes that catalyse different reactions in the same tissue
26. Energy:
    a) Can be created
    b) Cannot be transformed
    c) Cannot be transferred
    d) Cannot be destroyed
27. Enzyme inhibitors:
    a) Enhance the catalytic activity of enzymes
    b) Do not include drugs
    c) Do not include poisons like organophosphates
    d) Eliminate the catalytic activity of enzymes
28. Acids:
    a) Are proton donors in solution
    b) Are proton acceptors in solution
    c) Do not undergo ionization
    d) Neither accept nor donate protons in solution
29. How many reactions in Glycolysis are reversible?
    a) 2
    b) 3
    c) 7

d) 4

30. The net yield of ATP from Glycolysis is :
    a) 1ATP
    b) 6ATP
    c) 4ATP
    d) 2ATP
31. Condensation reactions:
    a) Involve the addition of water to a substance
    b) Involve the loss of a small molecule such as water
    c) Are also known as hydration reactions
    d) Occur when a complex molecule is broken down to form monomers
32. Weak acids:
    a) Don't ionize fully when in solution
    b) Dissociate completely in solution
    c) Accept H+ easily
    d) Are also known as conjugate bases
33. The strongest electron acceptor in biological systems is:
    a) Oxygen
    b) NAD+
    c) FAD
    d) Cu2+
34. Different amino acids are distinguished by :
    a) Their different side chains
    b) The type of bond that they have
    c) Their carboxylic acid groups
    d) Their amino groups
35. A monosaccharide containing three carbon atoms is known as::
    a) A triose
    b) A hexose
    c) A heptose
    d) A pentose
36. In anabolic reactions:

    a) The temperature of the cell may be lowered

    b) Energy is used to build more complex molecules from relatively simple raw materials

    c) Energy is not consumed

    d) Larger, more complex molecules are broken down into smaller, simpler molecules

37. Lactose is a combination of galactose and:

    a) Glucose

    b) Fructose

    c) Sucrose

    d) Maltose

38. In glycolysis:

a) Two molecules of glucose are converted to one molecule of pyruvate

b) One molecule of glucose is converted to one molecule of pyruvate

c) One molecule of pyruvate is converted to two molecules of glucose

d) One molecule of glucose is converted to two molecules of pyruvate

39. In the first reaction of glycolysis:

a) There is isomerization of glucose 6 phosphate to form fructose 6 phosphate

b) Glucose is phosphorylated

c) There is transfer of phosphate from phosphoenolpyruvate

d) Pyruvate is converted to acetyl coenzyme A

40. Under aerobic conditions, pyruvate is converted to :

a) Acetyl coenzyme A

b) Lactate

c) Ethanol

d) Alcohol

41. The enzyme fructose diphosphate aldolase:

a) Catalyzes the cleavage of fructose 1,6-bisphosphate between C3 and C4 resulting in two different triose phosphates

b) Catalyzes the phosphorylation of glucose

c) Is responsible for converting dihydroxyacetone phosphate to glyceraldehyde 3 phosphate

d) Does not catalyze any reaction in glycolysis

42. The products of glycolysis include:

a) ATP, NADH, Pyruvate

b) Pyruvate, oxygen, FADH2

c) FADH2, NADH, Glucose

d) Fructose, ADP, Pyruvate

43. The second reaction of glycolysis of glycolysis occurs in the:
    a) Cytoplasm.
    b) Mitochondrion
    c) Nucleus
    d) Ribosomes
44. Glycolysis:
    a) Is the first step by which cells make ATP from carbohydrates
    b) Occurs in the mitochondrion
    c) Does not use ATP
    d) Uses oxygen
45. Red blood cells:
    a) Have a nucleus and a mitochondrion
    b) Have a mitochondrion ,but lack a nucleus
    c) Obtain their energy from anaerobic oxidation of glucose
    d) Do not form ATP
46. Water:
    a) Does not ionize at all
    b) Is a strong electrolyte
    c) Is a weak electrolyte
    d) Does not have any role in living tissues
47. In pure water:
    a) The concentration of hydrogen ions is equal to the concentration of hydroxide ions
    b) The concentration of hydroxide ions is higher than the concentration of hydrogen ions
    c) The concentration of hydrogen ions is higher the concentration of hydroxide ions
    d) The concentration of hydrogen ions is less than the concentration of hydroxide ions

48. Aqueous solutions such as plasma and urine:
    a) Are electrically neutral
    b) Are not electrically neutral
    c) Do not maintain constant the ionic product for water
    d) Do not have electrolytes
49. Glycolysis in muscle tissue during intense exercise:
    a) Is inefficient from an energetic viewpoint
    b) Is aerobic
    c) Leads to complete oxidation of glucose to release ATP
    d) Does not cause accumulation of lactic acid
50. Which disaccharide is known as the milk sugar?
    a) Sucrose
    b) Lactose
    c) Maltose
    d) Pyruvate
51. The enzyme lactase is responsible for the hydrolysis of lactose into:
    a) Glucose and fructose
    b) Glucose and galactose
    c) Glucose and glucose
    d) Glucose and ribose
52. Saturated fatty acids:
    a) Have double bonds between carbon atoms
    b) Have a higher melting point
    c) Have a lower melting point
    d) Are fluid at room temperature

53. The enzyme is responsible for the conversion of glucose to glucose-6-phosphate is:

a) Hexokinase

b) Phosphofructokinase

c) Aldolase

d) Pyruvate kinase

54. How many ATP molecules are consumed during the energy investment phase of glycolysis?

a) 1 ATP

b) 2 ATP

c) 3 ATP

d) 4 ATP

55. The coenzyme reduced to form NADH during glycolysis is:

a) NAD+

b) FAD

c) CoA

d) ATP

56. The primary product of glycolysis is:

a) Pyruvate

b) Acetyl-CoA

c) ATP

d) NADH

57. The pH of a neutral solution is:

a) 7

b) 0

c) 14

d) 10

58. The pH of a solution with a hydrogen ion concentration of 1×10^{-11} M is:

a) 2

b) 5

c) 9

d) 11

59. The ionic product of water at 25°C is:

a) 1×10^{-7} M

b) 1×10^{7} M

c) 14

d) 7

60. The pH of a solution is a measure of the concentration of:

a) Hydroxide ions (OH-)

b) Hydrogen ions (H+)

c) Both hydroxide and hydrogen ions

d) Water molecules (H2O)

SECTION II: SHORT ANSWER QUESTIONS (20 MARKS)

1. Describe any four reactions of glycolysis that are reversible(8mks)
2. Using appropriate examples ,explain the criteria used to classify monosaccharides(8mks)
3. State four methods that can be used to denature proteins (4mks)

SECTION III: LONG ANSWER QUESTIONS (20 MARKS)

1. Describe the functions of lipids(20mks)