MASENO UNIVERSITY

UNIVERSITY EXAMINATIONS 2016/2017

FIRST YEAR MBCHB END OF SECOND TERM EXAMINATION FOR THE SCHOOL OF MEDICINE WITH INFORMATION TECHNOLOGY

MAIN CAMPUS

MBS 102: MEDICAL BIOCHEMISTRY I

Date: 7th July, 2017 Time: 8.30 - 11.30am

INSTRUCTIONS:

- Answer ALL Questions in sections A and B and any other TWO in section C.
- Answer questions in the answer sheet and booklet provided
- Section A has thirty (30) Multiple Choice Questions (MCQs) (60 mks)
- Section B has ten (10) Short Answer Questions (SAQs) (50 mks)
- Section C has two (2) Long Answer Questions (LAQs) (40 mks)

SECTION A: **MCQs** **(60 Marks)**

1. Which of the following statements regarding glycolysis is NOT TRUE?
   A. It has three reactions steps that are irreversible
   B. ATP is generated during the commitment step of the cycle
   C. A molecule of glucose is sequentially split into two molecules of pyruvate
   D. Fructose-1,6-biphosphate is split into DHAP and G-3-P
   E. It is a cytosolic process

2. Nucleic acid structure is NOT stabilized by;
   A) Weak electrostatic forces
   B) Low temperatures
   C) Cumulative Hydrogen bonding
   D) Absence of cations
   E) High G/C content

3. The number of unique enzymes between glycolysis and gluconeogensis are;
   A) 0
   B) 1
   C) 2
   D) 3
   E) 4

4. The enzyme alpha-amylase is used to alleviate digestive disorders by targeting which one of the following metabolic reactions?
   A) Bilirubin hydroxylase
   B) Collagen hydrolysis
   C) Starch hydrolysis
   D) Glycoprotein catabolism
   E) Protein hydrolysis

5. The gross production of ATP from glycolysis is;
   A) 0
   B) 1
   C) 2
   D) 3
   E) 4

6. Which of one the following conditions is associated with the enzyme deoxyribonuclease?
   A) Lesch Nyhan Syndrome
   B) Cystic fibrosis
   C) Marple syrup urine disease
   D) Gout (X linked recessive)
   E) Niemann-Pick disease

7. The following are cancer enzymes targeted by inhibitors EXCEPT?
   (A) Steroid 5-alpha reductase

(B) Topoisomerase 1
(C) Enolase
(D) Dihydrofolate reductase
(E) IMP dehydrogenase

8. What of the following statements about Creatine Kinase (CK) is NOT true;
   A. CK value in serum is decreased in myocardial infarction
   B. CK is used to detect early cases
   C. CK is not increased in haemolysis
   D. CK has an advantage over LDH

9. Which of the following is unlikely to be a method for cellular regulation of enzyme activity?
   (A) Dephosphorylation
   (B) Proteolytic cleavage
   (C) Transfer of an atom from a donor to an acceptor amino acid
   (D) Denaturation
   (E) Phosphorylation

10. Which of the following would be attached to the 5' carbon of the ribose of the first nucleotide in a polymer?
   A. A methyl group
   B. A nitrogenous base
   C. A phosphate group
   D. Another nucleotide
   E. A hydroxyl group

11. The synthesis of _____ provides the link between citric cid and urea cycles.
   A) Pyruvate
   B) Succinyl CoA
   C) Fumarate
   D) Oxaloacetate
   E) alpha-ketoglutarate

12. Which out of the following is **NOT** true of liver hexokinase?
   A. Has a low *Vmax*
   B. Is found in liver
   C. Has a high *Km*
   D. Catalyzes the commitment step of glycolysis
   E. Has a low *Km*

13. The levels of Creatine Kinase is a sensitive indicator of early stage myocardial ischemia. How many isoenzymes can be tested?
   (A) 1
   (B) 2
   (C) 3
   (D) 4
   (E) 5

14. The following statements are true of the DNA double helix EXCEPT;
(A) London forces between stacked bases stabilize the helix
(B) Base pairing is mediated by H-bonds
(C) The two strands are anti-parallel
(D) A-T has two bonds while G-C has three H-bonds
(E) Electrostatic repulsion between phosphates stabilize the helix

15. Which on of the following statements about lactate dehydrogenase is NOT true?
A. It is a tetramer
B. In myocardial infarction, LDH activity is decreased
C. The heart and muscle polypeptides are products of two distinct genes
D. M form is seen in muscle while H form is seen in heart
E. Has 5 isoenzymes seen in humans

16. Which one of the following statements about DNA is NOT TRUE;
(A) Is transcribed to proteins via mRNA
(B) Directs its own duplication
(C) Is the template for synthesis of RNA
(D) Susceptible to proteolysis
(E) Exhibits major and minor grooves

17. The following describes the characteristics of nucleic acid bases EXCEPT;
A. Absorb ultraviolet (260 nm) light
B. Are precipitated by ethanol
C. Are polymers of nucleotides
D. Are positively charged
E. Are made of nitrogenous bases

18. An increased melting temperature of duplex DNA results from a high content of;
A. Cytosine + Adenine
B. Cytosine + Guanine
C. Thymine + Cytosine
D. Adenine + Guanine
E. Cytosine and Thymine

19. What is the complimentary sequence for the polymer below;
5'-TGTGATCAAGC-3'

A. 5'-ACACTAGTTCG-3'
B. 3'-ACACATGTTCG-5'
C. 5'-ACACTAGTTCG-3'
D. 3'-ACACTAGTTCG-5'
E. 5'-GCTTGATCACA-3'

20. Which of the following compounds is not a proenzyme?
A. Trypsinogen
B. Chymotrypsinogen
C. Lipogen

D. Pepsinogen
E. Prolipase

21. Accumulation of deoxyadenosine is associated with;
A) SCID
B) Pompe disease
C) Xanthine oxidase deficiency
D) Renal lithiasis
E) Von Gierke disease

22. How many molecules of pyruvate are fed into the TCA cycle per molecule of glucose during cellular aerobic respiration?
A. 1
B. 2
C. 3
D. 4
E. 5

23. The reaction of the citric acid cycle that produces an ATP equivalent (in the form of GTP) by substrate level phosphorylation is the conversion of;
A. Succinate to fumarate
B. Citrate to isocitrate
C. Fumarate to malate
D. Succinyl-CoA to succinate
E. Malate to oxaloacetate

24. The glyoxylate cycle is;
A) An alternative path of glucose metabolism in cells that do not have enough O_2.
B) Defective in people with phenylketonuria.
C) Is not active in a mammalian liver.
D) A means of using acetate for both energy and biosynthetic precursors.
E) The most direct way of providing the precursors for synthesis of nucleic acids.

25. How many allosteric control sites exist in the TCA cycle?
A. 1
B. 2
C. 3
A. 5
B. 4

26. The following are non-functional plasma enzymes EXCEPT;
(A) Acid phosphatase
(B) Creatine kinase
(C) Cholinesterase
(D) Amylase
(E) Alkaline Phosphatase

27. How many molecules of $FADH_2$ are produced from one molecule of glucose during glycolysis?

A. 1
B. 2
A. 3
B. 4
C. 5

28. Antimycin inhibits the mitochondrial electron transport chain at which of the following points;
A. Site I
B. Site II
C. Site III
D. Translocase site
E. ATPase site

29. Which one of the following intermediates is not involved in the Malate-aspartate shuttle;
A. Glycerol
B. Oxaloacetate
C. α-ketoglutarate
D. Malate
E. Glutamate

30. Oligomyacin is an inhibitor of;
A. Cytochrome oxidase
B. ADP phosphorylation
C. e^- transfer from cyt b to cyt c_1
D. NADH CoQ reductase
E. ADP-ATP transporter

SECTION B: **SAQs** **(50 Marks)**

31. For each of the 5 nitrogenous bases that constitute nucleic acids, list the corresponding
(i) Nucleoside (2.5 Marks)
(ii) Nucleotide (2.5 Marks)

32. Define the following (1 Mark each)
(a) Standard free energy
(b) Gibb's Free energy
(c) Equilibrium
(d) Exergonic reaction
(e) Endothermic reaction

33. (i) List ANY three genetic disorders (3 Marks)

(ii) Briefly explain the genetic basis of one disorder listed in (i) above (2 Marks)

34. Show how to derive net yield of 38 ATP for a complete metabolism of a molecule of glucose

35. Explain why all of the nine glycolytic intermediates are phosphorylated (5 Marks)

36. (i) List any TWO shuttling mechanisms for cytoplasmic NADH and $FADH_2$: (2 Marks)

(ii) Explain why the net yield of ATP from NADH differs from that of $FADH_2$ (3 Marks)

37. Explain the metabolic effect of Rotenone poisoning (5 Marks)

38. Compare and contrast Krebs and glyoxylate cycles (5 Marks)

39. Using an illustration, explain the variation in structural stability between DNA and RNA (5 Marks)

40. Explain the connection between mitochondrial ATP synthesis and Lufts disease/non-thyroidal hypermetabolism.

SECTION C: LEQ (Answer ALL questions). (40 Marks)

41. (i) Discuss the primary and secondary signals involved in the regulation of glycogen synthesis and breakdown.

(ii) For each of the listed GSDs, name (i) the affected enzyme (ii) the affected tissue (20 Marks)

42. Describe how each of the following factors would affect enzyme action. (20 marks)

(a) pH
(b) Enzyme concentration
(c) Temperature
(d) Substrate concentration
(e) Co-factors

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