國立成功大學 106 學年度碩士班招生考試試題

系　　所：生命科學系

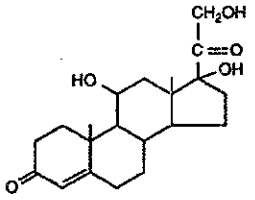
考試科目：生物化學及分子生物學　　考試日期：0214，節次：3

※ 考生請注意：本試題不可使用計算機。　請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

Part I (25 points)

Multiple Choice Questions

1. (1 point) The structure is an example of a(n):



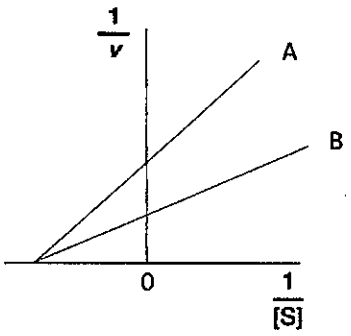
(A) Terpenes
(B) Triacylglycerol
(C) Wax
(D) Sphingolipid
(E) Steroids

2. (1 point) Membranes with unsaturated fatty acids in their components are more flexible and fluid because:
(A) Unsaturated fatty acids pack closely together to form ordered arrays
(B) Unsaturated fatty acids bend at the double bond preventing close packing
(C) Saturated fatty acids have a bend or "kink" that produces more fluid aggregates
(D) Unsaturated fatty acids have *cis* double bonds that prevent formation of the bend or "kink"
(E) All of the above are correct.

3. (1 point) The lipid composition of cell membrane affects the membrane fluidity. Which of the following fatty acids increases the membrane fluidity most?
(A) Palmitic acid (Hexadecanoic acid)
(B) Oleic acid (9-Octadecenoic acid)
(C) Lignoceric acid (Tetracosanoic acid)
(D) Stearic acid (Octadecanoic acid)
(E) Arachidic acid (Eicosanoic acid)

4. (1 point) Glucose transport across cell membranes varies depending upon blood glucose levels. When glucose levels are high, glucose transport exhibits saturation kinetics. When glucose concentrations are low, the transport of glucose across the membrane is dependent upon the sodium ion concentration. What types of transport is observed for glucose?
(A) facilitated diffusion at high [glucose], secondary active transport at low [glucose]
(B) simple diffusion at high [glucose], secondary active transport at low [glucose]
(C) facilitated diffusion at high [glucose], primary active transport at low [glucose]
(D) simple diffusion at high [glucose], primary active transport at low [glucose]
(E) none of the above are correct

5. (1 point) The Lineweaver-Burt plot below showing line A for enzyme X with inhibitors, and line B for enzyme X only. What types are these inhibitors?



(A) competitive inhibition
(B) noncompetitive inhibition
(C) mixed noncompetitive inhibition
(D) uncompetitive inhibition
(E) none are true

6. (1 point) Which one is wrong about the regulation of enzymes?
(A) Zymogen is usually activated after proteolytic cleavage
(B) Allosteric regulation of enzyme activity is usually reversible
(C) Feedback inhibition of enzyme activities occurs usually by the accumulated products of a reaction
(D) Covalent modifications are irreversible so enzyme activities are not regulated by covalent modifications

7. (1 point) Which amino acid could not be phosphorylated?
(A) Cys
(B) Tyr
(C) Thr
(D) Ser

8. (1 point) Which one is wrong for ribozymes?
(A) Ribozymes can link amino acids to form peptide
(B) Ribozymes are proteins
(C) Ribozymes can act as enzymes
(D) Ribozymes are substrate specific

9. Please briefly explain the following terms.
A. (1 point) Isozyme

B. (1 point) Abzyme

C. (1 point) Phosphorylase

10. (1 point) The mechanism of aspartate protease catalysis is proposed to be:
(A) covalent nucleophilic catalysis
(B) covalent electrophilic catalysis
(C) specific base catalysis
(D) general base-general acid catalysis facilitated by a low barrier hydrogen bond
(E) all of the above

11. (1 point) If the substrate for an enzyme catalyzed reaction contained a negative charge, which of the following amino acids would most likely be present in the active site to provide electrostatic destabilization of the ES complex?
(A) Val
(B) Asp
(C) Arg
(D) Ser
(E) Gln

12. (1 point) The correct sequence for the hormone-activated enzymatic cascade that leads to activation of glycogen phosphorylase is:
A. Phosphorylation to activate phosphorylase kinase
B. Activation of G-protein
C. Activation of adenylyl cyclase to produce cAMP
D. Phosphorylation of glycogen phosphorylase
E. cAMP activation of protein kinase A (PKA)
(A) A, B, C, D, E
(B) B, C, E, A, D
(C) C, B, A, D, E
(D) B, D, E, A, C
(E) E, A, D, C, B

13. (1 point) NADH, ____ and ____ are products of glycolysis, and the NADH must be recycled to ____ before it becomes limiting in glycolysis.
(A) ATP; pyruvate; NAD^+
(B) NAD^+; ATP; pyruvate
(C) ATP; NAD^+; ATP
(D) ATP; pyruvate; lactate
(E) None are true

14. (1 point) Which of the following enzymes is inhibited by phosphorylation?
(A) hexokinase
(B) glucokinase
(C) phosphofructokinase-1
(D) phosphoglycerate kinase
(E) pyruvate kinase

15. (1 point) In eukaryotic cells, glycolysis occurs in the ____, and the TCA cycle reactions take place in ____.
(A) mitochondria; mitochondria
(B) cytoplasm; mitochondria
(C) cytoplasm; cytoplasm
(D) mitochondria; ribosomes
(E) cytoplasm; ribosomes

16. (1 point) In the TCA cycle, carbon enters the cycle as ____ and exits as ____ with metabolic energy captured as ____, ____ and ____.
(A) malonate; water; NADH; ATP; NADPH
(B) acetyl-CoA; CO_2; NADH; ATP; NADPH
(C) succinyl-CoA; CO_2; ATP; NADH; NADPH
(D) acetyl-CoA; CO_2; ATP; NADH; [$FADH_2$]
(E) malonyl-CoA; water; NADH; [$FADH_2$]; ATP

17. (1 point) Which enzymes of the TCA cycle catalyze oxidative decarboxylation reactions?
(A) malate dehydrogenase and citrate synthase
(B) fumarase and succinate dehydrogenase
(C) α-ketoglutarate dehydrogenase and succinate dehydrogenase
(D) isocitrate dehydrogenase and α-ketoglutarate dehydrogenase
(E) aconitase and succinate dehydrogenase

18. (1 point) When acetyl-CoA levels exceed the _____ supply, allosteric activation of _____ by _____ raises the oxaloacetate (OAA) levels for condensation with acetyl-CoA to form _____.
(A) citrate; citrate synthase; acetyl-CoA; citrate
(B) malate; malate dehydrogenase; ATP; citrate
(C) OAA; citrate synthase; acetyl-CoA; isocitrate
(D) OAA; pyruvate carboxylase; acetyl-CoA; citrate
(E) Acetyl-CoA; pyruvate carboxylase; citrate; acetyl-CoA

19. (1 point) The only reaction of the citric acid cycle that provides substrate-level phosphorylation is catalyzed by:
(A) malate dehydrogenase
(B) citrate synthase
(C) isocitrate dehydrogenase
(D) succinyl-CoA synthetase
(E) nucleotide triphosphate kinase

20. (1 point) Which of the following correctly and completely describes electron movement in electron transport?
(A) NADH → complex I → complex III → coenzyme Q → Complex IV → O_2
(B) [$FADH_2$] → complex II → cytochrome c → complex III → coenzyme Q → Complex IV → O_2
(C) NADH → complex I → coenzyme Q → complex III → cytochrome c → Complex IV → O_2
(D) [$FADH_2$] → complex I → coenzyme Q →complex III → Complex IV → O_2
(E) none of the above

21. (1 point) All are characteristics of the malate-aspartate shuttle EXCEPT:
(A) OAA translocates inner mitochondrial membrane
(B) electrons of cytosolic NADH are translocated to mitochondrial NADH
(C) two malate dehydrogenase enzymes
(D) reactions are reversible
(E) all are true

22. (1 point) Carotenoids have primary roles in photosynthesis as:
(A) accessory light-harvesting and photooxidation.
(B) accessory light-harvesting and photoprotection from reactive oxygen species.
(C) resonance transfer pigments and photooxidation.
(D) resonance transfer and photodiffusion protection.
(E) none are true.

23. (1 point) All of the following are accomplished in the dark reactions of photosynthesis EXCEPT:
(A) carbon dioxide is fixed to ribulose-1,5-*bis*phosphate.
(B) two molecules of 3-phosphoglycerate are produced.
(C) glyceraldehyde-3-phosphate is used to synthesize glucose.
(D) glyceraldehyde-3-phosphate is used to re-synthesize ribulose-1,5-*bis*phosphate.
(E) ATP is produced.

Part II (25 points)

24. (5 points) Explain the role of hydrophobic interactions in protein folding.
25. (5 points) Why is cellulose extremely resistant to hydrolysis? Indicate enzyme that can digest cellulose in ruminates.
26. (5 points) Briefly explain lectins with an example.
27. (10 分) Discuss (A) the fate of pyruvate in a cell, (B) the advantage of a higher level of glycolysis in tumor growth

Part III (50 points)

28. (5 points) How is the lagging strand of DNA replicated?
29. (5 points) Describe and contrast the mechanism of promoter recognition by prokaryote and eukaryote.
30. (5 points) What is an operon? Use Lac repressor as an example to describe gene regulation of an operon.
31. (5 points) Describe the mechanism of pre-mRNA splicing.
32. (5 points) Describe the mechanisms of locating the initiation codon during translation by prokaryote.
33. (5 points) How does miRNA influence gene expression?
34. (5 points) How does Hsp70 (DnaK) help protein folding?
35. (5 points) Describe the function and mechanism of "autophagy"?
36. (5 points) How is G-protein Coupled receptor signals transduced? What are the secondary messenger(s) involved?
37. (5 points) How is lipid transported between tissues?