

※ 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 (35 %):

Multiple Choice Questions:

1. Membranes with unsaturated fatty acids in their components are more flexible and fluid because: (2 %)
(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.
2. Which one is wrong about the regulation of enzymes? (2 %)
(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
(E) none of the above
3. All are true for cAMP-dependent protein kinase (PKA) except: (2 %)
(A) anchored into membranes by amide-linked myristoyl anchors
(B) adenylyl cyclase catalyzes the synthesis of cAMP which activates PKA
(C) consists of a pair of catalytic subunits
(D) two regulatory subunits block catalytic activity with cAMP binding
(E) phosphorylates phosphorylase kinase
4. Photosynthetic phosphorylation and oxidative phosphorylation are similar processes. All of the following are common to BOTH processes EXCEPT: (2 %)
(A) both have fixed and mobile electron carriers.
(B) both contain cytochromes in their electron carrier chains.
(C) both produce NADPH to be used in the reductive pentose phosphate pathway (Calvin cycle).
(D) both represent a major route of ATP synthesis.
(E) both have quinones as electron carriers.

5. The correct sequence for the hormone-activated enzymatic cascade that leads to activation of glycogen phosphorylase is: (2 %)
- 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
6. The major tissues carrying out gluconeogenesis are the _____ and _____. (2 %)
- (A) brain; muscles
 - (B) muscles; kidneys
 - (C) liver; kidneys
 - (D) liver; red blood cells
 - (E) red blood cells; brain
7. All of the enzymes of gluconeogenesis may be found in the cytosol EXCEPT _____ which is only found in the mitochondria. (2 %)
- (A) PEP carboxykinase
 - (B) pyruvate carboxylase
 - (C) fructose-1,6-bisphosphatase
 - (D) glucose-6-phosphatase
 - (E) all are only in cytosol
8. When a cell with the pentose phosphate pathway has need for more pentose phosphates, but no additional NADPH: (2 %)
- (A) glucose-6-phosphate dehydrogenase is activated.
 - (B) the oxidative and non-oxidative enzymes of the pentose phosphate pathway are active.
 - (C) the non-oxidative enzymes produce pentose phosphates from fructose-6-phosphate and glyceraldehyde-3-phosphate.
 - (D) all enzymes of glycolysis and pentose phosphate pathway are active.
 - (E) none are true.

Essay Questions:

9. We are going to do site-directed mutagenesis to alter some amino acid residues on chymotrypsin, if we

(A) change Ser195 to be Gly in the active site, will that affect the enzyme activity? Why? (2 %)

(B) change Asp102 to be Glu in the active site, will that affect the enzyme activity? Why? (2 %)

10. Please briefly explain the following terms.

(A) Isozyme (2 %)

(B) Phosphorylase (2 %)

11. How do you define the catalytic efficiency of an enzyme and why? (hint: using V_{max} , K_m , or k_{cat}) (3 %)

12. What are the metabolic fates of NADH and pyruvate produced in glycolysis? (4 %)

13. Please briefly describe the tricarboxylic acid (TCA) cycle and what is the purpose of TCA cycle. (4 %)

Part II (25 %):

14. Please explain what is the end replication problem? (5 %)

15. Please explain how telomerase works. Please draw figures to explain it. (10 %)

16. Please use the replication bubble as a model to show how DNA replication works. In the figure, please indicate origin, leading strand, lagging strand, Okazaki fragments. (10 %)

Part III (40 %)

17. Describe the components of a prokaryotic RNA polymerase. Explain their roles during the action of RNA transcription. (4 %)

18. What is a CAP (Catabolite Activator Protein)? Describe its role in gene expression regulation. (4 %)

19. What is the wobble hypothesis proposed by Francis Crick? (4 %)

20. Describe the actions of GroEL/GroES chaperonin system in protein folding. What is the role of ATP during folding of native protein? (4 %)

21. What is autophagy? Describe its role in protein homeostasis. (4 %)

22. What are the roles of signal peptide, signal recognition particles (SRPs), signal receptors (SRs), and translocons in secretory protein translocation? (4 %)

23. What are glycoproteins? Describe and contrast the O-linked and N-linked glycoproteins. (4 %)

24. Describe and contrast the roles of ATP, NADH and NADPH in cell metabolism. (4 %)

25. The receptor signals are transduced via secondary messengers. Describe the actions of cAMP and calcium during signal transduction. (4 %)

26. How do Glucagon and Insulin regulate fatty acid synthesis? (4 %)