

大葉大學 97 學年度 研究所碩士班 招生考試試題紙

系所別	組別	考試科目 (中文名稱)	考試日期	節次	備註
生物產業科技學系	甲	生物化學	4月13日	第1節	共3頁P1

註：考生可否攜帶計算機或其他資料作答，請在備註欄註明（如未註明，一律不准攜帶）

08:30~10:00

I. Simple Choice (60%, 2% each)

- Two amino acids of the standard 20 contain sulfur atoms. They are:
(A) cysteine and serine (B) cysteine and threonine (C) methionine and cysteine (D) methionine and serine
- Amino acids are ampholytes because they can function as either a(n):
(A) acid or a base (B) neutral molecule or an ion (C) polar or a nonpolar molecule
(D) standard or a nonstandard monomer in proteins
- The formation of a peptide bond between two amino acids is an example of a(n) _____ reaction.
(A) cleavage (B) condensation (C) group transfer (D) isomerization
- Which of the following pairs of bonds within a peptide backbone show free rotation around both bonds?
(A) $C_{\alpha}-C$ and $N-C_{\alpha}$ (B) $C=O$ and $N-C$ (C) $C=O$ and $N-C_{\alpha}$ (D) $N-C_{\alpha}$ and $N-C$
- In the α -helix the hydrogen bonds:
(A) are roughly perpendicular to the axis of the helix. (B) occur mainly between electronegative atoms of the R groups.
(C) are roughly parallel to the axis of the helix. (D) occur only near the amino and carboxyl termini of the helix.
- Proteins often have regions that show specific, coherent patterns of folding or function. These regions are called:
(A) subunits. (B) oligomers. (C) domains. (D) sites.
- Which of the following statements about oligomeric proteins is false?
(A) A subunit may be similar to other proteins. (B) All subunits must be identical.
(C) Many have regulatory roles. (D) Some oligomeric proteins can further associate into large fibers.
- An individual molecular structure within an antigen to which an individual antibody binds is as a(n):
(A) antigen. (B) epitope. (C) Fab region. (D) Fc region
- One of the enzymes involved in glycolysis, aldolase, requires Zn^{2+} for catalysis. Under conditions of zinc deficiency, when the enzyme may lack zinc, it would be referred to as the:
(A) prosthetic group. (B) coenzyme. (C) holoenzyme. (D) apoenzyme.
- Enzymes are potent catalysts because they:
(A) are very specific and can prevent the conversion of products back to substrates.
(B) drive reactions to completion while other catalysts drive reactions to equilibrium.
(C) increase the equilibrium constants for the reactions they catalyze.
(D) lower the activation energy for the reactions they catalyze.
- The concept of "induced fit" refers to the fact that:
(A) enzyme specificity is induced by enzyme-substrate binding.
(B) enzyme-substrate binding induces an increase in the reaction entropy, thereby catalyzing the reaction.
(C) substrate binding may induce a conformational change in the enzyme, which then brings catalytic groups into proper orientation.
(D) when a substrate binds to an enzyme, the enzyme induces a loss of water (desolvation) from the substrate.
- Starch and glycogen are both polymers of:
(A) α -D-glucose. (B) glucose 1-phosphate. (C) sucrose. (D) fructose.
- Which of the following is not true of all naturally occurring DNA?
(A) Deoxyribose units are connected by 3',5'-phosphodiester bonds. (B) The amount of A always equals the amount of T.
(C) The ratio A+T/G+C is constant for all natural DNAs. (D) The two complementary strands are antiparallel.
- The steps of glycolysis between glyceraldehyde 3-phosphate and 3-phosphoglycerate involve all of the following except:
(A) ATP synthesis. (B) catalysis by phosphoglycerate kinase. (C) oxidation of NADH to NAD^{+} .
(D) the formation of 1,3-bisphosphoglycerate.
- Glycogen is converted to monosaccharide units by:
(A) glucose-6-phosphatase (B) glycogen phosphorylase. (C) glycogen synthase. (D) glycogenase.

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16. Which one of the following statements about gluconeogenesis is false?
 (A) It consists entirely of the reactions of glycolysis, operating in the reverse direction.
 (B) It employs the enzyme glucose 6-phosphatase.
 (C) It is one of the ways that mammals maintain normal blood glucose levels between meals.
 (D) It requires metabolic energy (ATP or GTP).
17. The main function of the pentose phosphate pathway is to:
 (A) give the cell an alternative pathway should glycolysis fail. (B) supply energy.
 (C) supply NADH. (D) supply pentoses and NADPH.
18. Gluconeogenesis must use "bypass reactions" to circumvent three reactions in the glycolytic pathway that are highly exergonic and essentially irreversible. Reactions carried out by which three of the enzymes listed must be bypassed in the gluconeogenic pathway?
 (1) Hexokinase (2) Phosphoglycerate kinase (3) Phosphofructokinase-1
 (4) Pyruvate kinase (5) Triosephosphate isomerase
 (A) 1, 2, 3 (B) 1, 3, 4 (C) 1, 4, 5 (D) 2, 3, 4
19. Malonate is a competitive inhibitor of succinate dehydrogenase. If malonate is added to a mitochondrial preparation that is oxidizing pyruvate as a substrate, which of the following compounds would you expect to decrease in concentration?
 (A) Fumarate (B) Isocitrate (C) Pyruvate (D) Succinate
20. The reaction of the citric acid cycle that is most similar to the pyruvate dehydrogenase complex-catalyzed conversion of pyruvate to acetyl-CoA is the conversion of:
 (A) citrate to isocitrate. (B) malate to oxaloacetate. (C) succinyl-CoA to succinate.
 (D) α -ketoglutarate to succinyl-CoA.
21. Citrate synthase and the NAD^+ -specific isocitrate dehydrogenase are two key regulatory enzymes of the citric acid cycle. These enzymes are inhibited by:
 (A) acetyl-CoA and fructose 6-phosphate. (B) AMP and/or NAD^+ . (C) ATP and/or NADH.
 (D) ATP and/or NAD^+ .
22. The glyoxylate cycle is:
 (A) a means of using acetate for both energy and biosynthetic precursors.
 (B) an alternative path of glucose metabolism in cells that do not have enough O_2 .
 (C) defective in people with phenylketonuria.
 (D) is not active in a mammalian liver.
23. Fatty acids are activated to acyl-CoAs and the acyl group is further transferred to carnitine because:
 (A) acyl-carnitines readily cross the mitochondrial inner membrane, but acyl-CoAs do not.
 (B) acyl-CoAs easily cross the mitochondrial membrane, but the fatty acids themselves will not.
 (C) carnitine is required to oxidize NAD^+ to NADH.
 (D) fatty acids cannot be oxidized by FAD unless they are in the acyl-carnitine form.
24. Saturated fatty acids are degraded by the stepwise reactions of β -oxidation, producing acetyl-CoA. Under aerobic conditions, how many ATP molecules would be produced as a consequence of removal of each acetyl-CoA?
 (A) 2 (B) 3 (C) 4 (D) 5
25. The following fatty acid, in which the indicated carbon is labeled with ^{14}C , is fed to an animal:
 $^{14}\text{CH}_3(\text{CH}_2)_9\text{COOH}$
 After allowing 30 minutes for fatty acid β -oxidation, the label would most likely be recovered in:
 (A) acetyl-CoA. (B) beta-hydroxy butyryl-CoA. (C) both acetyl-CoA and propionyl-CoA. (D) propionyl-CoA.
26. Ketone bodies are formed in the liver and transported to the extrahepatic tissues mainly as:
 (A) acetoacetyl-CoA. (B) beta-hydroxybutyric acid. (C) beta-hydroxybutyryl-CoA. (D) acetone.

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08:30 ~ (0:00)

27. In amino acid catabolism, the first reaction for many amino acids is a(n):
 (A) decarboxylation requiring thiamine pyrophosphate (TPP). (B) hydroxylation requiring NADPH and O₂.
 (C) reduction requiring pyridoxal phosphate (PLP). (D) transamination requiring pyridoxal phosphate (PLP).
28. Uncoupling of mitochondrial oxidative phosphorylation:
 (A) allows continued mitochondrial ATP formation, but halts O₂ consumption. (B) halts all mitochondrial metabolism.
 (C) halts mitochondrial ATP formation, but allows continued O₂ consumption. (D) slows down the citric acid cycle.
29. During oxidative phosphorylation, the proton motive force that is generated by electron transport is used to:
 (A) create a pore in the inner mitochondrial membrane. (B) induce a conformational change in the ATP synthase.
 (C) oxidize NADH to NAD⁺. (D) reduce O₂ to H₂O.
30. Which of the following statements about the chemiosmotic theory is false?
 (A) Energy is conserved as a transmembrane pH gradient.
 (B) Oxidative phosphorylation cannot occur in membrane-free preparations.
 (C) The effect of uncoupling reagents is a consequence of their ability to carry protons through membranes.
 (D) The membrane ATPase, which plays an important role in other hypotheses for energy coupling, has no significant role in the chemiosmotic theory.

II. Questions (40%)

- In the amino acid glycine, what effect does the positively charged —NH₃⁺ group have on the pK_a of an amino acid's —COOH group? (7%)
- Give the Michaelis-Menten equation and define each term in it. Does this equation apply to all enzymes? If not, to which kind does it not apply? (10%)
- Explain the role of glycogenin in glycogen synthesis. (7%)
- The citric acid cycle begins with the condensation of acetyl-CoA with oxaloacetate. Describe three possible sources for the acetyl-CoA. (6%)
- Match the cofactors below with their roles in the pyruvate dehydrogenase complex reaction. (10%)

Cofactors:

- Coenzyme A (CoA-SH)
- NAD⁺
- Thiamine pyrophosphate (TPP)
- FAD
- Lipoic acid in oxidized form

Roles:

- _____ (1) Attacks and attaches to the central carbon in pyruvate.
- _____ (2) Oxidizes FADH₂.
- _____ (3) Accepts the acetyl group from reduced lipoic acid.
- _____ (4) Oxidizes the reduced form of lipoic acid.
- _____ (5) Initial electron acceptor in oxidation of pyruvate.