

大葉大學 九十四 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
生物產業科技學系碩士班	甲組	生物化學	3月27日	第 2 節 10:30~12:00	P2-1

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）

**I. Simple choice (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.
- All of the following are considered "weak" interactions in proteins, **except**:  
(a) hydrogen bonds. (b) hydrophobic interactions. (c) ionic bonds. (d) peptide bonds.
- In the  $\alpha$  helix the hydrogen bonds:  
(a) are roughly parallel to the axis of the helix.  
(b) are roughly perpendicular to the axis of the helix.  
(c) occur mainly between electronegative atoms of the R groups.  
(d) occur only between some of the amino acids of the helix.
- An allosteric interaction between a ligand and a protein is one in which:  
(a) binding of a molecule to a binding site affects binding of additional molecules to the same site.  
(b) binding of a molecule to a binding site affects binding properties of another site on the protein.  
(c) binding of the ligand to the protein is covalent.  
(d) multiple molecules of the same ligand can bind to the same binding site.
- 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) substrate binding may induce a conformational change in the enzyme, which then brings catalytic groups into proper orientation.  
(b) enzyme-substrate binding induces an increase in the reaction entropy, thereby catalyzing the reaction.  
(c) enzyme-substrate binding induces movement along the reaction coordinate to the transition state.  
(d) when a substrate binds to an enzyme, the enzyme induces a loss of water (desolvation) from the substrate.
- In competitive inhibition, an inhibitor:  
(a) binds at several different sites on an enzyme. (b) binds covalently to the enzyme.  
(c) binds *only* to the ES complex. (d) binds reversibly at the active site.
- The DNA oligonucleotide abbreviated pATCGAC:  
(a) has 7 phosphate groups. (b) has a hydroxyl at its 3' end. (c) has a phosphate on its 3' end. (d) has an A at its 3' end.
- What is the approximate length of a DNA molecule (in the B form) containing 10,000 base pairs?  
(a) 3.4 $\mu$ m (b) 3.4nm (c) 6.8nm (d) 6.8mm.
- Restriction enzymes:  
(a) act at the membrane to restrict the passage of certain molecules into the cell.  
(b) are highly specialized ribonucleases that degrade mRNA soon after its synthesis.  
(c) are sequence-specific DNA endonucleases.  
(d) are very specific proteases that cleave peptides at only certain sequences.
- An enzyme used in both glycolysis and gluconeogenesis is:  
(a) 3-phosphoglycerate kinase. (b) glucose 6-phosphatase. (c) hexokinase. (d) phosphofructokinase-1.
- Glycogen is converted to monosaccharide units by:  
(a) glucokinase. (b) glucose-6-phosphatase (c) glycogen phosphorylase. (d) glycogen synthase.
- Glycogen phosphorylase *a* can be inhibited at an allosteric site by:  
(a) AMP. (b) calcium. (c) GDP. (d) glucose.
- 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) citrate to isocitrate. (b) fumarate to malate. (c) malate to oxaloacetate. (d) succinyl-CoA to succinate.
- The carbon atoms from a fatty acid with an odd number of carbons will enter the citric acid cycle as acetyl-CoA and:  
(a) butyrate. (b) succinyl-CoA. (c) malate. (d) citrate.
- 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 O<sub>2</sub>.  
(c) transamination requiring pyridoxal phosphate (PLP). (d) reduction requiring pyridoxal phosphate (PLP).

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- During oxidative phosphorylation, the proton motive force that is generated by electron transport is used to:
  - induce a conformational change in the ATP synthase.
  - oxidize NADH to NAD<sup>+</sup>.
  - generate the substrates (ADP and P<sub>i</sub>) for the ATP synthase.
  - reduce O<sub>2</sub> to H<sub>2</sub>O.
- Which of the following is *not* required in the synthesis of fatty acids?
  - Acetyl-CoA
  - NADH
  - HCO<sub>3</sub><sup>-</sup> (CO<sub>2</sub>)
  - Malonyl-CoA
- The rate-limiting step in fatty acid synthesis is:
  - condensation of acetyl-CoA and malonyl-CoA.
  - formation of acetyl-CoA from acetate.
  - formation of malonyl-CoA from malonate and coenzyme A.
  - the reaction catalyzed by acetyl-CoA carboxylase.
- Precursors for the biosynthesis of the pyrimidine ring system include:
  - glutamate, NH<sub>3</sub>, and CO<sub>2</sub>.
  - carbamoyl phosphate and aspartate.
  - glycine and succinyl-CoA.
  - glycine, glutamine, CO<sub>2</sub>, and aspartate.

II. Multiple choices (4 % each)

- Which of the following statements about allosteric control of enzymatic activity is **false**?
  - Allosteric proteins are generally composed of one subunit.
  - An effector may either inhibit or activate an enzyme.
  - Binding of the effector changes the conformation of the enzyme molecule.
  - Heterotropic allosteric effectors compete with substrate for binding sites.
- Which of the following are true of all naturally occurring DNA?
  - Deoxyribose units are connected by 3',5'-phosphodiester bonds.
  - The amount of A always equals the amount of T.
  - The ratio A+T/G+C is constant for all natural DNAs.
  - The two complementary strands are antiparallel.
- Which of the following statements about the pentose phosphate pathway is **correct**?
  - It generates CO<sub>2</sub> from C-6 of glucose.
  - It involves the conversion of an aldohexose to an aldopentose.
  - It is prominent in lactating mammary gland.
  - It is principally directed toward the generation of NADH.
- 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 the enzymes listed must be bypassed in the gluconeogenic pathway?
  - Hexokinase
  - Phosphoglycerate kinase
  - Phosphofructokinase-1
  - Pyruvate kinase
- Entry of acetyl-CoA into the citric acid cycle is **decreased** when:
  - [AMP] is high.
  - NADH is rapidly oxidized through the respiratory chain.
  - the ratio of [ATP]/[ADP] is high.
  - the ratio of [NAD<sup>+</sup>]/[NADH] is low.
- Which of the following statements apply (applies) to the  $\beta$  oxidation of fatty acids?
  - The process takes place in the cytosol of mammalian cells.
  - Before oxidation, fatty acids must be converted to their CoA derivatives.
  - NAD<sup>+</sup> is the electron acceptor.
  - The products of  $\beta$  oxidation can directly enter the citric acid cycle for further oxidation.

III. Questions (36%)

- The composition (mole fraction) of **one** of the strands of a double-helical DNA is [A] = 0.3, and [G] = 0.24. Calculate the following, if possible. If impossible, write "X" (9%)
 

For the **same** strand: (a) [T] (b) [C] (c) [T] + [C]

For the **other** strand: (d) [A] (e) [T] (f) [A] + [T] (g) [G] (h) [C] (i) [A] + [G]
- Why is it advantageous to phosphorylate glucose immediately after being transported into cells? (4%)
- List five general ways in which enzyme activity is controlled. (5%)
- Define the following terms (a) nucleotide (b) DNA (c) nucleosome (d) gene, and (e) chromosome. (10%)
- List the four levels of protein structure and give a brief definition of each. (8%)