

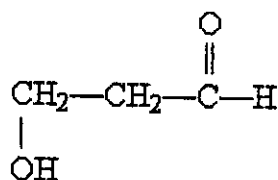
編號: E 432 系所: 生物化學暨分子生物學研究所乙組 科目: 生物化學

本試題是否可以使用計算機: 可使用, 不可使用 (請命題老師勾選)

※考生答題注意事項; 請務必依題號順序於答案卷上作答, 否則不予計分。答題方式請於答案卷上「由上而下」作答, 先書寫題號後接答案。

一、選擇題: 1-30 題, 每題二分, 均為單選題; 共六十分。

1. What functional groups are present on this molecule?



- A. ether and aldehyde
 - B. hydroxyl and aldehyde
 - C. hydroxyl and carboxylic acid
 - D. hydroxyl and ester
 - E. hydroxyl and ketone
2. Phosphoric acid is tribasic, with pK_a 's of 2.14, 6.86, and 12.4. The ionic form that predominates at pH 3.2 is:
- A. H_3PO_4 .
 - B. H_2PO_4^- .
 - C. HPO_4^{2-} .
 - D. PO_4^{3-} .
 - E. none of the above.
3. 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.
 - E. transparent or a light-absorbing compound.

(背面仍有題目, 請繼續作答)

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4. Which of the following refers to particularly stable arrangements of amino acid residues in a protein that give rise to recurring patterns?
- A. Primary structure
 - B. Secondary structure
 - C. Tertiary structure
 - D. Quaternary structure
 - E. None of the above
5. Myoglobin and the subunits of hemoglobin have:
- A. no obvious structural relationship.
 - B. very different primary and tertiary structures.
 - C. very similar primary and tertiary structures.
 - D. very similar primary structures, but different tertiary structures.
 - E. very similar tertiary structures, but different primary structures.
6. In glycoproteins, the carbohydrate moiety is always attached through the amino acid residues:
- A. asparagine, serine, or threonine.
 - B. aspartate or glutamate.
 - C. glutamine or arginine.
 - D. glycine, alanine, or aspartate.
 - E. tryptophan, aspartate, or cysteine.
7. A convenient cloning vector with which to introduce foreign DNA into *E. coli* is a(n):
- A. *E. coli* chromosome.
 - B. messenger RNA.
 - C. plasmid.
 - D. yeast "ARS" sequence.
 - E. yeast transposable element.
8. Which one of the following analytical techniques does *not* help illuminate a gene's cellular function?
- A. Southern blotting
 - B. DNA microarray analysis
 - C. Protein chip analysis
 - D. Two-dimensional gel electrophoresis
 - E. Two-hybrid analysis

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9. Sphingosine is *not* a component of:
- A. cardiolipin.
 - B. ceramide.
 - C. cerebrosides.
 - D. gangliosides.
 - E. sphingomyelin.
10. Membrane proteins:
- A. are sometimes covalently attached to lipid moieties.
 - B. are sometimes covalently attached to carbohydrate moieties.
 - C. are composed of the same 20 amino acids found in soluble proteins.
 - D. diffuse laterally in the membrane unless they are anchored
 - E. have all of the properties listed above.
11. Protein kinase A (PKA) is:
- A. activated by covalent binding of cyclic AMP.
 - B. affected by cyclic AMP only under unusual circumstances.
 - C. allosterically activated by cyclic AMP.
 - D. competitively inhibited by cyclic AMP.
 - E. noncompetitively inhibited by cyclic AMP.
12. The enzyme glycogen phosphorylase:
- A. catalyzes a cleavage of $\beta(1 \rightarrow 4)$ bonds.
 - B. catalyzes a hydrolytic cleavage of $(\alpha 1 \rightarrow 4)$ bonds.
 - C. is a substrate for a kinase.
 - D. uses glucose 6-phosphate as a substrate.
 - E. uses glucose as a substrate.
13. Which of the following is not an intermediate of the citric acid cycle?
- A. Acetyl-coA
 - B. Citrate
 - C. Oxaloacetate
 - D. Succinyl-coA
 - E. α -Ketoglutarate

(背面仍有題目,請繼續作答)

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14. Pyridoxal phosphate is a cofactor in this class of reactions:
- A. acetylation.
 - B. desulfuration.
 - C. methylation.
 - D. reduction.
 - E. transamination.
15. A certain bacterial mRNA is known to represent only one gene and to contain about 800 nucleotides. If you assume that the average amino acid residue contributes 110 to the peptide molecular weight, the largest polypeptide that this mRNA could code for would have a molecular weight of about:
- A. 800.
 - B. 30,000.
 - C. 5,000.
 - D. 80,000.
 - E. An upper limit cannot be determined from the data given.
16. An allosteric interaction between a ligand and a protein is one in which:
- A. binding of a molecule to a binding site affects binding properties of another site on the protein.
 - B. binding of the ligand to the protein is covalent.
 - C. multiple molecules of the same ligand can bind to the same binding site.
 - D. binding of a molecule to a binding site affects binding of additional molecules to the same site.
 - E. two different ligands can bind to the same binding site.
17. 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.
 - E. catalyze the addition of a certain amino acid to a specific tRNA.
18. Which of these statements about hydrogen bonds is *not* true?
- A. Hydrogen bonds account for the anomalously high boiling point of water.
 - B. In liquid water, the average water molecule forms hydrogen bonds with three to four other water molecules.
 - C. Individual hydrogen bonds are much weaker than covalent bonds.
 - D. Individual hydrogen bonds in liquid water exist for many seconds and sometimes for minutes.
 - E. The strength of a hydrogen bond depends on the linearity of the three atoms involved in the bond.

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19. Experiments on denaturation and renaturation after the reduction and reoxidation of the —S—S— bonds in the enzyme ribonuclease (RNase) have shown that:
- A. folding of denatured RNase into the native, active conformation, requires the input of energy in the form of heat.
 - B. native ribonuclease does not have a unique secondary and tertiary structure.
 - C. the completely unfolded enzyme, with all —S—S— bonds broken, is still enzymatically active.
 - D. the enzyme, dissolved in water, is thermodynamically stable relative to the mixture of amino acids whose residues are contained in RNase.
 - E. the primary sequence of RNase is sufficient to determine its specific secondary and tertiary structure.
20. A monoclonal antibody differs from a polyclonal antibody in that monoclonal antibodies:
- A. are labeled with chemicals that can be visualized.
 - B. are produced by cells from the same organism that produced the antigen.
 - C. are synthesized by a population of identical, or "cloned," cells.
 - D. are synthesized only in living organisms.
 - E. have only a single polypeptide chain that can recognize an antigen.
21. An enzyme-catalyzed reaction was carried out with the substrate concentration initially a thousand times greater than the K_m for that substrate. After 9 minutes, 1% of the substrate had been converted to product, and the amount of product formed in the reaction mixture was 12 μmol . If, in a separate experiment, one-third as much enzyme and twice as much substrate had been combined, how long would it take for the same amount (12 μmol) of product to be formed?
- A. 1.5 min
 - B. 13.5 min
 - C. 27 min
 - D. 3 min
 - E. 6 min
22. Which of the following statements about starch and glycogen is *false*?
- A. Amylose is unbranched; amylopectin and glycogen contain many ($\alpha 1 \rightarrow 6$) branches.
 - B. Both are homopolymers of glucose.
 - C. Both serve primarily as structural elements in cell walls.
 - D. Both starch and glycogen are stored intracellularly as insoluble granules.
 - E. Glycogen is more extensively branched than starch.

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23. In the Watson-Crick model of DNA structure:
- A. both strands run in the same direction, 3' → 5'; they are parallel.
 - B. phosphate groups project toward the middle of the helix, where they are protected from interaction with water.
 - C. T can form three hydrogen bonds with either G or C in the opposite strand.
 - D. the distance between the sugar backbone of the two strands is just large enough to accommodate either two purines or two pyrimidines.
 - E. the distance between two adjacent bases in one strand is about 3.4 Å.
24. "Footprinting" or DNase protection is a technique used to identify:
- A. a region of DNA that has been damaged by mutation.
 - B. *E. coli* cells that contain a desired, cloned piece of DNA.
 - C. the position of a particular gene of a chromosome.
 - D. the position of internally double-stranded regions in a single-stranded DNA molecule.
 - E. the specific binding site of a repressor, polymerase, or other protein on the DNA.
25. In the laboratory, recombinant plasmids are commonly introduced into bacterial cells by:
- A. electrophoresis -- a gentle low-voltage gradient draws the DNA into the cell.
 - B. infection with a bacteriophage that carries the plasmid.
 - C. microinjection.
 - D. mixing plasmids with an extract of broken cells.
 - E. transformation -- heat shock of the cells incubated with plasmid DNA in the presence of CaCl₂.
26. Which of the following statements about the polymerase chain reaction (PCR) is *false*?
- A. DNA amplified by PCR can be cloned.
 - B. DNA is amplified at many points within a cellular genome.
 - C. Newly synthesized DNA must be heat-denatured before the next round of DNA synthesis begins.
 - D. The boundaries of the amplified DNA segment are determined by the synthetic oligonucleotides used to prime DNA synthesis.
 - E. The technique is sufficiently sensitive that DNA sequences can be amplified from a single animal or human hair.
27. Which of the following statements concerning signal transduction by the insulin receptor is *not* correct?
- A. Activation of the receptor protein kinase activity results in the activation of additional protein kinases.
 - B. Binding of insulin to the receptor activates a protein kinase.

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- C. Binding of insulin to the receptor results in a change in its quaternary structure.
D. The receptor protein kinase activity is specific for tyrosine residues on the substrate proteins.
E. The substrates of the receptor protein kinase activity are mainly proteins that regulate transcription.
28. Steroid hormones are carried on specific carrier proteins because the hormones:
- A. are too unstable to survive in the blood on their own.
B. cannot dissolve readily in the blood because they are too hydrophobic.
C. cannot find their target cells without them.
D. need them in order to pass through the plasma membrane.
E. require subsequent binding to specific receptor proteins in the nucleus.
29. E° of the NAD^+/NADH half reaction is -0.32 V . The E° of the oxaloacetate/malate half reaction is -0.175 V . When the concentrations of NAD^+ , NADH , oxaloacetate, and malate are all 10^{-5} M , the "spontaneous" reaction is:
- A. Oxaloacetate + $\text{NADH} + \text{H}^+ \rightarrow \text{malate} + \text{NAD}^+$.
B. Malate + $\text{NAD}^+ \rightarrow \text{oxaloacetate} + \text{NADH} + \text{H}^+$.
C. Malate + $\text{NADH} + \text{H}^+ \rightarrow \text{oxaloacetate} + \text{NAD}^+$.
D. $\text{NAD}^+ + \text{NADH} + \text{H}^+ \rightarrow \text{malate} + \text{oxaloacetate}$.
E. $\text{NAD}^+ + \text{oxaloacetate} \rightarrow \text{NADH} + \text{H}^+ + \text{malate}$.
30. Which of the following is *not* true of the citric acid cycle?
- A. All enzymes of the cycle are located in the cytoplasm, except succinate dehydrogenase, which is bound to the inner mitochondrial membrane.
B. In the presence of malonate, one would expect succinate to accumulate.
C. Oxaloacetate is used as a substrate but is not consumed in the cycle.
D. Succinate dehydrogenase channels electrons directly into the electron transfer chain.
E. The condensing enzyme is subject to allosteric regulation by ATP and NADH.

二·簡答題：31-33 題，共四十分。

31. Please write down the key words best defined by each description of the followings: (2% each)

Note: Don't exceed three words in each description!

- A. The randomness or disorder of the components of a chemical system
B. A type of macromolecules combining with lipids to form several classes of lipoprotein particles, spherical complexes with hydrophobic lipids in the core and hydrophilic amino acid side chains at

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the surface.

- C. The type of processing reactions altering some newly made proteins, both prokaryotic and eukaryotic, to attain their final biologically active conformations.
- D. The effect of pH and CO₂ concentration on the binding and release of oxygen by hemoglobin.
- E. A sensitive diagnostic biochemical measurement on blood and urine samples which is essential in the diagnosis and treatment of diabetes. For example, the patient fasts overnight, then drinks a test dose of 100 g of glucose dissolved in a glass of water. The blood glucose concentration is measured before the test dose and at 30 min intervals for several hours thereafter.
- F. A system of flat membranous vesicles surrounding each myofibril.
- G. Isomeric forms of monosaccharides that differ only in their configuration about the hemiacetal or hemiketal carbon atom.
- H. A glucose derivative with oxidation of the carbon at the C-6 of glucose.
- I. A cloning technique can be used not only to overproduce proteins but to produce protein products subtly altered from their native forms in that specific amino acids may be replaced individually.
- J. A sophisticated genetic approach (technique) to defining protein-protein interactions is based on the properties of the Gal4 protein (Gal4p), which activates transcription of certain genes in yeast.
32. Please draw the Lineweaver-Burk plots to briefly describe the three types of reversible enzyme inhibitions. Use three different concentrations of inhibitor (including $[I]=0$) to indicate what the line-interception terms (values) on the $1/V_0$ axis and on the $1/[S]$ axis are and how K_m and V_{max} change their values (increased, decreased, or unchanged). (4% each)
- (a) Competitive inhibition; (b) Non-competitive inhibition; (c) Un-competitive inhibition.
33. Please briefly **describe and compare the differences of** the genomics and proteomics and **give each one example** of the most commonly exercised analysis technique. (4% each)