臺灣綜合大學系統111學年度學士班轉學生聯合招生考試試題

科目名稱	生物化學	類組代碼	C07
		科目碼	C0701

※本項考試依簡章規定所有考科均「不可」使用計算機。　　本科試題共計 5 頁

A. Multiple choice question (50%, 2% each; one correct answer only)

1. The chirality of an amino acid results from the fact that its α carbon:
   A) has no net charge.
   B) is a carboxylic acid.
   C) is bonded to four different chemical groups.
   D) is in the L absolute configuration in naturally occurring proteins.
   E) is symmetric.

2. All of the amino acids that are found in proteins, except for proline, contain a(n):
   A) amino group.
   B) carbonyl group.
   C) carboxyl group.
   D) ester group.
   E) thiol group.

3. The uncommon amino acid selenocysteine has an R group with the structure —CH_2—SeH (pK_a ≈ 5). In an aqueous solution, pH = 7.0, selenocysteine would:
   A) be a fully ionized zwitterion with no net charge.
   B) be found in proteins as D-selenocysteine.
   C) never be found in a protein.
   D) be nonionic.
   E) not be optically active.

4. The first step in two-dimensional gel electrophoresis generates a series of protein bands by isoelectric focusing. In a second step, a strip of this gel is turned 90 degrees, placed on another gel containing SDS, and an electric current is again applied. In this second step:
   A) proteins with similar isoelectric points become further separated according to their molecular weights.
   B) the individual bands become stained so that the isoelectric focus pattern can be visualized.
   C) the individual bands become visualized by interacting with protein-specific antibodies in the second gel.
   D) the individual bands undergo a second, more intense isoelectric focusing.
   E) the proteins in the bands separate more completely because the second electric current is in the opposite polarity to the first current.

5. Which of the following describes the overall three-dimensional folding of a polypeptide?
   A) Primary structure
   B) Secondary structure
   C) Tertiary structure
   D) Quaternary structure
   E) None of the above

6. In an aqueous solution, protein conformation is determined by two major factors. One is the formation of the maximum number of hydrogen bonds. The other is the:
   A) formation of the maximum number of hydrophilic interactions.
   B) maximization of ionic interactions.
   C) minimization of entropy by the formation of a water solvent shell around the protein.
   D) placement of hydrophobic amino acid residues within the interior of the protein.
   E) placement of polar amino acid residues around the exterior of the protein.

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7. In the α 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.
   E) occur only near the amino and carboxyl termini of the helix.

8. The major reason that antiparallel β-stranded protein structures are more stable than parallel β-stranded structures is that the latter:
   A) are in a slightly less extended configuration than antiparallel strands.
   B) do not have as many disulfide crosslinks between adjacent strands.
   C) do not stack in sheets as well as antiparallel strands.
   D) have fewer lateral hydrogen bonds than antiparallel strands.
   E) have weaker hydrogen bonds laterally between adjacent strands.

9. In the binding of oxygen to myoglobin, the relationship between the concentration of oxygen and the fraction of binding sites occupied can best be described as:
   A) hyperbolic.
   B) linear with a negative slope.
   C) linear with a positive slope.
   D) random.
   E) sigmoidal.

10. In hemoglobin, the transition from T state to R state (low to high affinity) is triggered by:
   A) Fe^{2+} binding.
   B) heme binding.
   C) oxygen binding.
   D) subunit association.
   E) subunit dissociation.

11. The fundamental cause of sickle-cell disease is a change in the structure of:
   A) blood.
   B) capillaries.
   C) hemoglobin.
   D) red cells.
   E) the heart.

12. The predominant structural feature in myosin molecules is:
   A) a β structure.
   B) an α helix.
   C) the Fab domain.
   D) the light chain.
   E) the meromyosin domain.

13. 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) apoenzyme. B) coenzyme. C) holoenzyme. D) prosthetic group. E) substrate.

 背面有題，請繼續作答。

14. Which one of the following statements is true of enzyme catalysts?
  A) Their catalytic activity is independent of pH.
  B) They are generally equally active on D and L isomers of a given substrate.
  C) They can increase the equilibrium constant for a given reaction by a thousand fold or more.
  D) They can increase the reaction rate for a given reaction by a thousand fold or more.
  E) To be effective, they must be present at the same concentration as their substrate.

15. Which of the following statements about a plot of V_0 vs. [S] for an enzyme that follows Michaelis-Menten kinetics is *false*?
  A) As [S] increases, the initial velocity of reaction V_0 also increases.
  B) At very high [S], the velocity curve becomes a horizontal line that intersects the y-axis at Km.
  C) Km is the [S] at which $V_0 = 1/2\ V_{max}$.
  D) The shape of the curve is a hyperbola.
  E) The y-axis is a rate term with units of μm/min.

16. Which of the following monosaccharides is not an aldose?
  A) erythrose
  B) fructose
  C) glucose
  D) glyceraldehyde
  E) ribose

17. When two carbohydrates are epimers:
  A) one is a pyranose, the other a furanose.
  B) one is an aldose, the other a ketose.
  C) they differ in length by one carbon.
  D) they differ only in the configuration around one carbon atom.
  E) they rotate plane-polarized light in the same direction.

18. Which of the following is not a reducing sugar?
  A) Fructose
  B) Glucose
  C) Glyceraldehyde
  D) Ribose
  E) Sucrose

19. The biological role of restriction enzymes is to:
  A) aid recombinant DNA research.
  B) degrade foreign DNA that enters a bacterium.
  C) make bacteria resistant to antibiotics.
  D) restrict the damage to DNA by ultraviolet light.
  E) restrict the size of DNA in certain bacteria.

20. The PCR reaction mixture does *not* include:
  A) all four deoxynucleoside triphosphates.
  B) DNA containing the sequence to be amplified.
  C) DNA ligase.
  D) heat-stable DNA polymerase.
  E) oligonucleotide primer(s).

21. Which one of the following analytical techniques does *not* help illuminate a gene's cellular function?
   A) DNA microarray analysis
   B) Protein chip analysis
   C) Southern blotting
   D) Two-dimensional gel electrophoresis
   E) Two-hybrid analysis

22. Hydrolysis of 1 M glucose 6-phosphate catalyzed by glucose 6-phosphatase is 99% complete at equilibrium (i.e., only 1% of the substrate remains). Which of the following statements is most nearly correct? ($R = 8.315$ J/mol·K; $T = 298$ K)
   A) $\Delta G'^{\circ} = -11$ kJ/mol
   B) $\Delta G'^{\circ} = -5$ kJ/mol
   C) $\Delta G'^{\circ} = 0$ kJ/mol
   D) $\Delta G'^{\circ} = +11$ kJ/mol
   E) $\Delta G'^{\circ}$ cannot be determined from the information given.

23. The structure of NAD^+ does *not* include:
   A) a flavin nucleotide.
   B) a pyrophosphate bond.
   C) an adenine nucleotide.
   D) nicotinamide.
   E) two ribose residues.

24. The anaerobic conversion of 1 mol of glucose to 2 mol of lactate by fermentation is accompanied by a net gain of:
   A) 1 mol of ATP.
   B) 1 mol of NADH.
   C) 2 mol of ATP.
   D) 2 mol of NADH.
   E) none of the above.

25. The conversion of 1 mol of fructose 1,6-bisphosphate to 2 mol of pyruvate by the glycolytic pathway results in a net formation of:
   A) 1 mol of NAD^+ and 2 mol of ATP.
   B) 1 mol of NADH and 1 mol of ATP.
   C) 2 mol of NAD^+ and 4 mol of ATP.
   D) 2 mol of NADH and 2 mol of ATP.
   E) 2 mol of NADH and 4 mol of ATP.

B. Assay Questions (50%):

1. Beriberi is a disease caused by a thiamine deficiency. People with beriberi have higher levels of pyruvate and α-ketoglutarate in blood, especially after eating a meal with rich carbohydrates. Why? (5%)

2. Ketone bodies will be built up in people with a long fasting. Why? (5%)

3. Calculate the ATP yield for the complete oxidation of pyruvate. (5%)

4. Draw a diagram of LDL and describe the compositions of LDL. (5%)

5. How does malonyl-CoA regulate the fatty acid breakdown? (5%)

6. List five nonessential amino acids (5%)

7. (a) NAD^+ or NADH (b) Coenzyme B_{12} (c) biotin (d) PLP (e) TPP
   (f) N^5, N^{10}-methylene-H_4 folate (g) N^5-methyl- H_4 folate (h) AdoMet
   (i) Tetrahydrobiopterin
   Match the above cofactor(s) required in the reaction catalyzed by the following enzymes:
   _______ glyceraldehyde-3-phosphate dehydrogenase (1%)
   _______ pyruvate decarboxylase (1%)
   _______ lactate dehydrogenase (1%)
   _______, _______ methionine synthase (2%)
   _______ pyruvate carboxylase (1%)
   _______ aminotransferase (1%)
   _______, _______ glycine synthase (2%)
   _______ thymidylate synthase (1%)

8. Describe the melting point of a fatty acid affected by the chain length and unsaturation. (5%)

9. Nucleotides play a variety of roles in the cell. Give an example of a nucleotide that acts in each of the following roles or processes.
   (a) Second messenger in signal transduction (1%)
   (b) Phosphoryl-group transfer (1%)
   (c) Activation of diacylglycerol in biosynthesis of phospholipids (1%)
   (d) Transfer of electrons in beta-oxidation (1%)
   (e) Activation of glucose in glycogen biosynthesis (1%)