

# 國立臺北科技大學 103 學年度碩士班招生考試

系所組別：3713 分子科學與工程系有機高分子碩士班甲組

## 第三節生物化學試題（選考）

第一頁 共四頁

### 注意事項：

1. 本試題共 40 題，配分共 100 分。
2. 請標明大題、子題編號作答，不必抄題。
3. 全部答案均須在答案卷之答案欄內作答，否則不予計分。

1. The enzyme fumarase catalyzes the reversible hydration of fumaric acid to l-malate, but it will not catalyze the hydration of maleic acid, the cis isomer of fumaric acid. This is an example of:  
A) biological activity.  
B) chiral activity.  
C) racemization.  
D) stereoisomerization.  
E) stereospecificity.
2. Which of the following statements about buffers is true?  
A) A buffer composed of a weak acid of  $pK_a = 5$  is stronger at pH 4 than at pH 6.  
B) At pH values lower than the  $pK_a$ , the salt concentration is higher than that of the acid.  
C) The pH of a buffered solution remains constant no matter how much acid or base is added to the solution.  
D) The strongest buffers are those composed of strong acids and strong bases.  
E) When  $pH = pK_a$ , the weak acid and salt concentrations in a buffer are equal.
3. What is the approximate charge difference between glutamic acid and  $\alpha$ -ketoglutarate at pH 9.5?  
A) 0  
B)  $\frac{1}{2}$   
C) 1  
D)  $1\frac{1}{2}$   
E) 2
4. The major reason that antiparallel  $\beta$ -stranded protein structures are more stable than parallel  $\beta$ -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.
5. 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  
E) MHC site.
6. 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  $K_m$ .  
C)  $K_m$  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  $\mu\text{m}/\text{min}$ .
7. Starch and glycogen are both polymers of:
- A) fructose.  
B) glucose1-phosphate.  
C) sucrose.  
D)  $\alpha$ -D-glucose.  
E)  $\beta$ -D-glucose.
8. The experiment of Avery, MacLeod, and McCarty in which nonvirulent bacteria were made virulent by transformation was significant because it showed that:
- A) bacteria can undergo transformation.  
B) genes are composed of DNA only.  
C) mice are more susceptible to pneumonia than are humans.  
D) pneumonia can be cured by transformation.  
E) virulence is determined genetically.
9. RFLP is a:
- A) bacteriophage vector for cloning DNA.  
B) genetic disease.  
C) plasmid vector for cloning DNA.  
D) protein.  
E) variation in DNA base sequence.
10. Tay-Sachs disease is the result of a genetic defect in the metabolism of:
- A) gangliosides.  
B) phosphatidyl ethanolamine.  
C) sterols.  
D) triacylglycerols.  
E) vitamin D.
11. The fluidity of a lipid bilayer will be increased by:
- A) decreasing the number of unsaturated fatty acids.  
B) decreasing the temperature.  
C) increasing the length of the alkyl chains.  
D) increasing the temperature.  
E) substituting 18:0 (stearic acid) in place of 18:2 (linoleic acid).

12. The specificity of signaling pathways includes all of the following *except*:
- A) flippase-catalyzed movement of phospholipids from the inner to the outer leaflet.
  - B) migration of signal proteins into membrane rafts.
  - C) phosphorylation of target proteins at Ser, Thr, or Tyr residues.
  - D) the ability to be switched off instantly by hydrolysis of a single phosphate-ester bond.
  - E) the assembly of large multiprotein complexes.
13. The reaction  $\text{ATP} \rightarrow \text{ADP} + \text{P}_i$  is an example of a(n) reaction.
- A) homolytic cleavage.
  - B) internal rearrangement.
  - C) free radical.
  - D) group transfer.
  - E) oxidation/reduction.
14. In an anaerobic muscle preparation, lactate formed from glucose labeled in C-2 would be labeled in:
- A) all three carbon atoms.
  - B) only the carbon atom carrying the OH.
  - C) only the carboxyl carbon atom.
  - D) only the methyl carbon atom.
  - E) the methyl and carboxyl carbon atoms.
15. Which one of the following statements about mammalian glycogen synthase is *not* correct?
- A) It is especially predominant in liver and muscle.
  - B) The donor molecule is a sugar nucleotide.
  - C) The phosphorylated form of this enzyme is inactive.
  - D) This enzyme adds glucose units to the nonreducing end of glycogen branches.
  - E) This enzyme adds the initial glucose unit to a tyrosine residue in glycogenin.
16. The two moles of  $\text{CO}_2$  produced in the first turn of the citric acid cycle have their origin in the:
- A) carboxyl and methylene carbons of oxaloacetate.
  - B) carboxyl group of acetate and a carboxyl group of oxaloacetate.
  - C) carboxyl group of acetate and the keto group of oxaloacetate.
  - D) two carbon atoms of acetate.
  - E) two carboxyl groups derived from oxaloacetate.
17. Which of the following statements apply (applies) to the  $\beta$  oxidation of fatty acids?
1. The process takes place in the cytosol of mammalian cells.
  2. Carbon atoms are removed from the acyl chain one at a time.
  3. Before oxidation, fatty acids must be converted to their CoA derivatives.
  4.  $\text{NADP}^+$  is the electron acceptor.
  5. The products of  $\beta$  oxidation can directly enter the citric acid cycle for further oxidation.
- A) 1 and 3 only
  - B) 1, 2, and 3
  - C) 1, 2, and 5
  - D) 3 and 5 only
  - E) 4 only
18. Which substance is *not* involved in the production of urea from  $\text{NH}_4^+$  via the urea cycle?

- A) Aspartate
  - B) ATP
  - C) Carbamoyl phosphate
  - D) Malate
  - E) Ornithine
19. Which of the following is correct concerning the mitochondrial ATP synthase?
- A) It can synthesize ATP after it is extracted from broken mitochondria.
  - B) It catalyzes the formation of ATP even though the reaction has a large positive  $\Delta G'^{\circ}$ .
  - C) It consists of  $F_0$  and  $F_1$  subunits, which are transmembrane (integral) polypeptides.
  - D) It is actually an ATPase and only catalyzes the hydrolysis of ATP.
  - E) When it catalyzes the ATP synthesis reaction, the  $\Delta G'^{\circ}$  is actually close to zero.
20. In "C<sub>4</sub>" plants of tropical origin, the first intermediate into which <sup>14</sup>CO<sub>2</sub> is fixed is:
- A) aspartate.
  - B) phosphoenolpyruvate.
  - C) oxaloacetate.
  - D) malate.
  - E) 3-phosphoglycerate.
21. Which of the following is true of sphingolipid synthesis?
- A) All of the carbon atoms of palmitate and serine are incorporated into sphingosine.
  - B) CDP-sphingosine is the activated intermediate.
  - C) CO<sub>2</sub> is produced during the synthesis of ceramide from palmitate and serine.
  - D) Glucose 6-phosphate is the direct precursor of the glucose in cerebrosides.
  - E) Phosphatidic acid is a key intermediate in the pathway.
22. The nitrogen atom in the indole ring of tryptophan is derived from which amino acid?
- A) Aspartic acid
  - B) Glutamic acid
  - C) Glutamine
  - D) Asparagine
  - E) Arginine
23. In skeletal muscle:
- A) amino acids are an essential fuel.
  - B) at rest, fatty acids are the preferred fuel.
  - C) large quantities of triacylglycerol are stored as fuel.
  - D) phosphocreatine can substitute for ATP as the direct source of energy for muscle contraction.
  - E) stored muscle glycogen can be converted to glucose and released to replenish blood glucose.
24. The most precise modern definition of a gene is a segment of genetic material that:
- A) codes for one polypeptide.
  - B) codes for one polypeptide or RNA product.
  - C) determines one phenotype.
  - D) determines one trait.
  - E) that codes for one protein.
25. In a mammalian cell, DNA repair systems:

- A) are extraordinarily efficient energetically.
  - B) are generally absent, except in egg and sperm cells.
  - C) can repair deletions, but not mismatches.
  - D) can repair most types of lesions except those caused by UV light.
  - E) normally repair more than 99% of the DNA lesions that occur.
26. A branched ("lariat") structure is formed during:
- A) attachment of a 5' cap to mRNA.
  - B) attachment of poly(A) tails to mRNA.
  - C) processing of preribosomal RNA.
  - D) splicing of all classes of introns.
  - E) splicing of group II introns.
27. Which of the following is (are) true for protein synthesis in eukaryotes?
- A) All proteins are initially synthesized with methionine at their C-terminus.
  - B) All proteins are initially synthesized with methionine at their N-terminus.
  - C) All proteins are initially synthesized with tryptophan at their C-terminus.
  - D) All proteins are initially synthesized with a multiple of 3 amino acids in their sequence.
  - E) None of the above.
28. A regulon is a(n):
- A) group of related triplet codons.
  - B) network of operons with a common regulator.
  - C) operon that is subject to regulation.
  - D) protein that regulates gene expression.
  - E) ribosomal protein that regulates translation.
29. 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.
30. An  $\alpha$  helix would be destabilized most by:
- A) an electric dipole spanning several peptide bonds throughout the  $\alpha$  helix.
  - B) interactions between neighboring Asp and Arg residues.
  - C) interactions between two adjacent hydrophobic Val residues.
  - D) the presence of an Arg residue near the carboxyl terminus of the  $\alpha$  helix.
  - E) the presence of two Lys residues near the amino terminus of the  $\alpha$  helix.
31. 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.
32. Which one of the following is not among the six internationally accepted classes of enzymes?

- A) Hydrolases
  - B) Ligases
  - C) Oxidoreductases
  - D) Polymerases
  - E) Transferases
33. From the abbreviated name of the compound Gal( $\beta$ 1  $\rightarrow$  4)Glc, we know that:
- A) C-4 of glucose is joined to C-1 of galactose by a glycosidic bond.
  - B) the compound is a D-enantiomer.
  - C) the galactose residue is at the reducing end.
  - D) the glucose is in its pyranose form.
  - E) the glucose residue is the  $\beta$ anomer.
34. Fatty acids are a component of:
- A) carotenes.
  - B) cerebrosides.
  - C) sterols.
  - D) vitamin D.
  - E) vitamin K.
35. Glycolysis in the erythrocyte produces pyruvate that is further metabolized to:
- A) CO<sub>2</sub>.
  - B) ethanol.
  - C) glucose.
  - D) hemoglobin.
  - E) lactate.
36. Which one of the following is *not* associated with the oxidation of substrates by the citric acid cycle?
- A) All of the below are involved.
  - B) CO<sub>2</sub> production.
  - C) Flavin reduction.
  - D) Lipoic acid present in some of the enzyme systems.
  - E) Pyridine nucleotide oxidation.
37. For the oligoribonucleotidepACGUAC:
- A) the nucleotide at the 3' end has a phosphate at its 3' hydroxyl.
  - B) the nucleotide at the 3' end is a purine.
  - C) the nucleotide at the 5' end has a 5' hydroxyl.
  - D) the nucleotide at the 5' end has a phosphate on its 5' hydroxyl.
  - E) the nucleotide at the 5' end is a pyrimidine.
38. 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.

39. The coenzyme required for all transaminations is derived from:

- A) niacin.
- B) pyridoxine (vitamin B<sub>6</sub>).
- C) riboflavin.
- D) thiamine.
- E) vitamin B<sub>12</sub>.

40. 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) 5,000.
- C) 30,000.
- D) 80,000.
- E) An upper limit cannot be determined from the data given.