國立臺灣海洋大學一００學年度研究所碩士班暨碩士在職專班入學考試試題

考試科目： 生物化學

系所名稱： 食品科學系碩士班生技組、食品科學系碩士班食科組

1.答案以橫式由左至右書寫。2.請依題號順序作答。

I. Multiple choices: (單選, 2 points for each)

1. Which of the following conclusions about the human genome project are true?
   a. Nearly half of the human genome consists of repetitive DNA sequences.
   b. Only about 28% of the genome is transcribed to RNA, and only about 1-2% codes for protein.
   c. Most of the proteins found in humans are unique to vertebrates.
   d. a and b.
   e. a, b, and c.

2. The "salting in" of proteins can be explained by:
   a. proteins attracting primarily salt anions.
   b. proteins attracting primarily salt cations.
   c. hydration of the salt ions reducing solubility of proteins.
   d. releasing hydrophobic proteins from nonpolar tissue environments.
   e. salt counter-ions reducing electrostatic attractions between protein molecules.

3. The positive charge on proteins in electrospray ionization mass spectrometry is the result of:
   a. protonated Arg and Lys residues.
   b. protonated Asp and Glu residues.
   c. a high pH.
   d. protons fired at the gas-phase protein molecules.
   e. electrons fired at the gas-phase protein molecules.

4. Which of the following statements does **not** apply to collagen?
   a. The triple helical structure twists in the right-handed direction.
   b. It contains hydroxylated amino acids.
   c. Hydrogen bonds between the —OH groups of Hyp residues stabilize the helix.
   d. There is an absolute requirement for glycine every third position.
   e. The polypeptide forms a left-handed helix.

5. Which of the following statements does **not** apply to the K value in the equation for the oxygen binding curve of myoglobin?
   a. It is the value of pO_2 at which $Y = 0.5$.
   b. If $Y > K$, then myoglobin is less than 50% saturated with oxygen.
   c. It is a measure of the affinity of myoglobin for oxygen.

d. It is defined as that oxygen partial pressure at which half of the oxygen binding sites are occupied.

e. It is numerically equal to p_{50}.

6. Which of the following sugars is not a reducing sugar?

a. glucose

b. sucrose

c. galactose

d. starch

e. ribose

7. The imidazole side chain of histidine can function as either a general acid catalyst or a general base catalyst because:

a. the imidazole group is a strong reducing agent at physiological pH.

b. in the physiological pH range both H^+ and OH^- are present at high concentrations.

c. one guanidino group is protonated, and the other is deprotonated at physiological pH.

d. in the physiological pH range, the nitrogen in the ring can be easily protonated/deprotonated.

e. the sulfur atoms in the ring can either gain or lose a proton at physiological pH.

8. Which of the following is **wrong** about enzymes?

a. Enzymes typically catalyze reactions at much higher rates than chemical catalysts.

b. Enzymes typically act under milder conditions of temperature and pH than chemical catalysts.

c. Enzyme activities can often be regulated.

d. Enzymes are often very specific for their substrates.

e. Enzymes catalyze the reaction in only the forward direction.

9. K_M is:

a. a measure of the catalytic efficiency of the enzyme.

b. the rate at which the enzyme binds the substrate.

c. the [S] that half-saturates the enzyme.

d. the rate constant for the reaction ES → E + P.

e. the rate at which the enzyme dissociates from the substrate.

10. When glutamate is oxidatively deaminated by GDH, the products include_____.

a. NAD(P)H + H^+, NH_4^+, and α-ketoglutarate

b. NADH, glutamine, and NH_3

c. NADH, α-iminoglutarate, and NH_3

d. NAD(P)H, H_2O, and α-ketoglutarate

e. none of the above

11. Which of the following statements about tryptophan synthase is **wrong**?

a. The enzyme is a tetramer of four identical subunits.

b. The enzyme binds indole-3-glycerol phosphate and serine, and the final products are glyceraldehydes-3-phosphate, tryptophan, and water.

c. Indole can pass from one active site to another through a channel in the enzyme.

d. The enzyme has two states, an open and closed state, to ensure that bound indole is not lost to solvent.

e. Tryptophan synthase catalyzes two distinct reaction steps to form tryptophan.

12. In the initial step of purine biosynthesis the molecule _____, from the _____ pathway, is activated by ATP.

a. PEP, glycolytic

b. ribulose-1,5-bisphosphate, Calvin cycle

c. fructose, glycolytic

d. ribose-5-phosphate, pentose phosphate

e. none of the above

13. The end products of pyrimidine catabolism are:

a. β-alanine, uric acid

b. succinic acid, fumarate

c. β-alanine, β-aminoisobutyrate

d. succinic acid, uric acid

e. uric acid and allantoin

14. Which of the following statements about Pol I is **wrong**?

a. Pol I is not the primary replicase in *E. coli.*

b. Mutation analysis demonstrates the Pol I activity is not necessary for cell survival.

c. Pol I functions in DNA repair.

d. Pol I has exonuclease activity.

e. Pol I is used to radioactively label DNA in lab experiments.

15. Which one of these characteristics is **wrong** for the α helix?

a. It is right-handed.

b. There are 3.6 amino acids per turn.

c. A hydrogen bond forms between the carbonyl oxygen of the *n*th amino acid residue and the —NH group of the $(n + 4)$th amino acid residue.

d. Proline is typically not found in the α helix.

e. There is a requirement for glycine every third amino acid residue.

II. Fill in questions: (填空, 2 points for each)

1. The method that Sanger developed for sequencing DNA using dideoxy nucleotides is called the _____ method.

2. If the DNA sequence read directly from the dideoxy sequencing gel is 5′CCATCGGCTAGG3′ then the template sequence is _____.

3. For the dipeptide Lys–Glu, the p*I* is _____. (The p*K*s are α-amino 9.1, ε-amino 10.5, γ-carboxylate 4.1, α-carboxylate 2.1)

4. Repeated cycles of the technique known as _____ can reveal the complete sequence of a polypeptide containing fewer than about 100 residues.

5. A structurally independent unit of a protein, that forms a globular cluster and often possesses a specific function, is called a _____.

6. The bond that forms when an anomeric carbon of one monosaccharides reacts with a hydroxyl group on a second monosaccharide is a(n) _____ bond.

7. In addition to proteins, certain _____ molecules have been found to possess enzymatic activity.

8. On a Lineweaver–Burk plot, the intercept on the vertical axis is _____.

9. Proteins can be marked for degradation by being covalently linked to _____.

10. A database of _____ is being compiled to examine genetic differences between individual humans.

III. Choice Questions (50 points): (每題 2 分，作答請用大寫字母，單選猜答者以零分記)

1. The number of moles of reduced cofactors produced by the complete oxidation of 1 mol of capric acid (CH3-(CH2)8-COOH) to CO_2 and water will be closest to which of the following?
   A) 5 moles of $FADH_2$ and 10 moles of $NADH.H^+$
   B) 10 moles of $FADH_2$ and 10 moles of $NADH.H^+$
   C) 10 moles of $FADH_2$ and 15 moles of $NADH.H^+$
   D) 10 moles of $FADH_2$ and 20 moles of $NADH.H^+$
   E) 20 moles of $FADH_2$ and 20 moles of $NADH.H^+$

2. Which one of the following enzymes is involved in the mobilization of fatty acids from triacyglyerol stores in adipose tissue?
   A) carnitin acyl transferase
   B) gastric lipase
   C) hormone sensitive lipase
   D) lipoprotein lipase
   E) pancreatic lipase

3. Which of the following statements concerning dietary lipids is correct?
   A) Corn oil and soybean oil are examples of fats rich in saturated fatty acids
   B) Triacylglycerols obtained from plants generally contain less unsaturated fatty acids than those from animals
   C) Olive oil is rich in saturated fats
   D) Unsaturated fatty acids in our body are usually trans
   E) Fish triacylglycerols are richer in unsaturated fatty acids than triacylglycerols from other animals

4. Which of the following metabolic conditions do you expect that is going on in the muscles of a person that is doing an intense exercise, (like weight lifting):
   A) Increased formation of lactate
   B) ATP/ADP ratio higher that in a person at rest
   C) Increased gluconeogenesis
   D) Increased glycogenesis
   E) All above are true

5. The specificity of a ligand binding site on a protein is based on:
   A) the absence of competing ligands
   B) the amino acid residues lining the binding site
   C) the presence of hydrating water molecules
   D) the opposite chirality of the binding ligand
   E) the similar size and shape of protein and ligand

6. What are the membrane structures that function in active transport?
   A) peripheral proteins
   B) carbohydrates
   C) integral proteins
   D) hydrophobic molecules
   E) cholesterol

7. Which of the following is not an example of a lipid found in lipid-linked proteins?
   A) Farnesyl groups
   B) Palmitic acid
   C) Myristic acid
   D) Stearic acid
   E) Glycosylphosphatidylinositol

8. The active transport of Na^+ and K^+ by the membrane Na^+-K^+ pump uses energy from:
   A) the membrane potential, Y
   B) ATP hydrolysis to ADP and Pi
   C) ATP hydrolysis to AMP and PPi
   D) symport (or counter-transport) of Cl^-
   E) The third and fourth answers are both correct

9. Cellulose fibers resemble ___ in proteins; whereas a-amylose is similar to ___.
   A) α-helices; β-sheets
   B) β-sheets; α-helices
   C) β-sheets; the hydrophobic core
   D) α-helices; β-turns
   E) β-turns; coiled-coils

10. The O-linked glycoproteins of eukaryotes usually have their sugar chains attached to
    A) buried carbonyls in the protein backbone
    B) surface carbonyls in the protein backbone
    C) the OH of Ser or Thr residues
    D) the carboxyl terminal residue
    E) the carboxyl groups of Asp or Glu

11. In a eukaryotic cell, the enzymes of glycolysis are located in the:
    A) plasma membrane
    B) inner mitochondrial membrane
    C) cytosol
    D) mitochondrial matrix
    E) intermembrane space

12. Mixing pure O_2 into a yeast culture growing on grape juice will cause the yeast to multiply faster and to metabolize the sugars much more rapidly. The effect on the desired final product (winE)would be:
    A) faster production of the wine
    B) a nearly alcohol-free "beverage"
    C) vlittle or no effect
    D) a higher ethanol level in the wine
    E) Both choices A)and D)are correct

13. For each molecule of glucose converted to pyruvate in the glycolytic pathway ___ molecules of ATP are used initially (Stage I) and ____ molecules of ATP are produced (Stage II) for an overall yield of ___ molecules of ATP/glucose. The "ATP math" is:
    A) -2 + 4 = 2
    B) -1 + 4 = 3
    C) -2 + 5 = 3
    D) -1 + 2 = 1
    E) 2 + 2 = 4

14. The active form of glycogen ___ is phosphorylated; the active form of glycogen ___ is dephosphorylated.
    A) hydrolase; dehydrogenase
    B) dehydrogenase; hydrolase
    C) hydrolase; semisynthase
    D) phosphorylase; synthase
    E) synthase; phosphorylase

15. In contrast to resting cells, muscle tissue in a highly active metabolic state will have _____ ATP/ADP and _____ $NADH/NAD^+$.
    A) high; high
    B) high; low
    C) low; high
    D) low; low
    E) medium; medium

16. Which metabolic pathway or process is common to both aerobic and anaerobic oxidation of sugar?
    A) Kreb's cycle
    B) Chemiosmosis in mitochondrion
    C) glycolysis

D) oxidation of NAD^+ by the electron transport chain
E) oxidation of pyruvic acid to CO_2

17. Coenzyme Q is involved in electron transport
A) as a lipid-soluble electron carrier
B) as a water-soluble electron donor
C) as a covalently attached cytochrome cofactor
D) as a water-soluble electron acceptor
E) directly to O_2

18. NaCN is a respiratory inhibitor because it
A) oxidizes NADH without transferring electrons
B) dissociates $FADH_2$ from succinic dehydrogenase
C) binds to the Fe redox center of cytochrome oxidase
D) forms an irreversible complex with O_2
E) promotes leakage of protons as HCN

19. Each cycle of b-oxidation produces
A) 1 FAD, 1 NADH, and 1 acetyl-CoA
B) 1 $FADH_2$, 1 NADH, and 1 acetyl-CoA
C) 1 FAD, 1 NAD^+, and 2 CO_2 molecules
D) 1 $FADH_2$, 1 NADH, and 2 CO_2 molecules
E) 1 $FADH_2$, 1 NAD^+, and 1 acetyl-CoA

20. The acyl-CoA formed in the cytosol is transported to the ___ for oxidation using a shuttle involving the intermediate formation of acyl- _____.
A) mitochondrial matrix, carnitine
B) mitochondrial matrix, coenzyme A
C) endoplasmic reticulum, albumin
D) endoplasmic reticulum, carnitine
E) microsomes, Coenzyme A

21. All of the following are derived from cholesterol except:
A) Bile salts
B) Progesterone
C) Glucocorticoids
D) Squalene
E) Mineralocorticoids

22. All of the following are true of cytochromes except:
A) They contain a heme
B) They are more prevalent in dark meat than white meat
C) They can accept or donate one electron
D) They are proteins
E) They contain Fe-S clusters

23. Coenzyme A is utilized as a carrier of acyl groups that form thioester bonds: What is the advantage of this bond?
A) Very stable bond is necessary to capture catabolic intermediates
B) It can form disulfide bonds with methionine residues
C) This high-energy bond is able to drive thermodynamically unfavorable reactions
D) It is important in fatty acid synthesis
E) All of the above

24. If a cell has high levels of ATP, which of the following enzymes will be negatively affected?
    A) Fructose 1, 6-bisphosphatase
    B) Hexokinase
    C) Phosphofructokinase and pyruvate kinase
    D) Glycogen phosphorylase
    E) Glycogen synthase

25. Which of the following statements is NOT true of glycolysis?
    A) Glucose is transformed into pyruvate
    B) It can take place by anaerobic metabolism
    C) It requires O_2. and the final product is CO_2
    D) It is utilized by both aerobic and anaerobic organisms
    E) It takes place mainly in cytoplasm