國立中興大學105學年度碩士班招生考試試題

科目：生物化學　　系所：植物病理學系乙組

本科目不得使用計算機　　本科目試題共 3 頁

單選題 (40%) (每題 2 分，答錯倒扣 0.5 分)

1. For amino acids with neutral R groups, at any pH below the pI of the amino acid, the population of amino acids in solution will have:
   A) a net negative charge. B) a net positive charge. C) no charged groups. D) no net charge.
   E) positive and negative charges in equal concentration.

2. What is the approximate charge difference between glutamic acid and α-ketoglutarate at pH 9.5?
   A) 0 B) ½ C) 1 D) 1½ E) 2

3. The average molecular weight of the 20 standard amino acids is 138, but biochemists use 110 when estimating the number of amino acids in a protein of known molecular weight. Why?
   A) The number 110 is based on the fact that the average molecular weight of a protein is 110,000 with an average of 1,000 amino acids.
   B) The number 110 reflects the higher proportion of small amino acids in proteins, as well as the loss of water when the peptide bond forms.
   C) The number 110 reflects the number of amino acids found in the typical small protein, and only small proteins have their molecular weight estimated this way.
   D) The number 110 takes into account the relatively small size of nonstandard amino acids.
   E) The number 138 represents the molecular weight of conjugated amino acids.

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 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. An average protein will *not* be denatured by:
   A) a detergent such as sodium dodecyl sulfate. B) heating to 90°C.
   C) iodoacetic acid. D) pH 10. E) urea.

6. Which of the following is *not* known to be involved in the process of *assisted* folding of proteins?
   A) Chaperonins B) Disulfide interchange C) Heat shock proteins
   D) Peptide bond hydrolysis E) Peptide bond isomerization

7. 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.

8. 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.

9. 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

 背面有題，請繼續作答。

10. 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.

11. The biochemical property of lectins that is the basis for most of their biological effects is their ability to bind to:
A) amphipathic molecules. B) hydrophobic molecules. C) specific lipids.
D) specific oligosaccharides. E) specific peptides.

12. Which of the following deoxyoligonucleotides will hybridize with a DNA containing the sequence (5′)AGACTGGTC(3′)?
A) (5′)CTCATTGAG(3′) B) (5′)GACCAGTCT(3′) C) (5′)GAGTCAACT(3′)
D) (5′)TCTGACCAG(3′) E) (5′)TCTGGATCT(3′)

13. In comparison with DNA-DNA double helices, the stability of DNA-RNA and RNA-RNA helices is:
A) DNA-DNA > DNA-RNA > RNA-RNA. B) DNA-DNA > RNA-RNA > DNA-RNA.
C) RNA-DNA > RNA-RNA > DNA-DNA. D) RNA-RNA > DNA-DNA > DNA-RNA.
E) RNA-RNA > DNA-RNA > DNA-DNA.

14. Which vitamin is derived from cholesterol?
A) A B) B_{12} C) D D) E E) K

15. The shortest α-helix segment in a protein that will span a membrane bilayer has about _____ amino acid residues.
A) 5 B) 20 C) 50 D) 100 E) 200

16. Ubiquitin is a:
A) component of the electron transport system. B) protease. C) protein kinase.
D) protein phosphorylase. E) protein that tags another protein for proteolysis.

17. Cyclin-dependent protein kinases can regulate the progression of cells through the cell cycle by phosphorylation of proteins such as:
A) insulin. B) myoglobin. C) myosin. D) retinal rod and cone proteins.
E) all of the above.

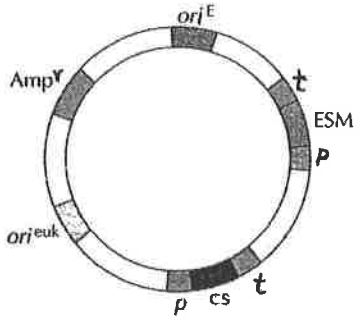
18. The conversion of 1 mol of fructose 1,6-bisphosphate to 2 mol of pyruvate by the glycolytic pathway results in a net formation of:
A) 1 mol of NAD^+ and 2 mol of ATP. B) 1 mol of NADH and 1 mol of ATP.
C) 2 mol of NAD^+ and 4 mol of ATP. D) 2 mol of NADH and 2 mol of ATP.
E) 2 mol of NADH and 4 mol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

19. If glucose labeled with ^{14}C in C-1 were fed to yeast carrying out the ethanol fermentation, where would the ^{14}C label be in the products?
A) In C-1 of ethanol and CO_2 B) In C-1 of ethanol only C) In C-2 (methyl group) of ethanol only
D) In C-2 of ethanol and CO_2 E) In CO_2 only

20. Which combination of cofactors is involved in the conversion of pyruvate to acetyl-CoA?
A) Biotin, FAD, and TPP B) Biotin, NAD^+, and FAD C) NAD^+, biotin, and TPP
D) Pyridoxal phosphate, FAD, and lipoic acid E) TPP, lipoic acid, and NAD^+

問答 (40 %):

1. A generalized eukaryotic expression vector is showed below. Please use one sentence to describe each term and its function. (14%)
   a) p　b) cs　c) t　d) ESM　e) ori^{E}　f) Amp^{r}　g) ori^{euk}



2. Describe the functions of the following reagents used in SDS-polyacrylamide gel electrophoresis. (10%)
   (1) acrylamide　(2) bisacrylamide　(3) TEMED　(4) SDS　(5) ammonium persulfate

3. Diagram and describe how a transgenic plant is produced via *Agrobacterium*-mediated trnasformation (10%)

4. Show the reaction in which 3-phosphoglycerate is converted into glyceraldehyde 3-phosphate. Show all required cofactors, and circle the carbon atom(s) in glyceraldehyde 3-phosphate that is (are) derived from CO_2 during the photosynthetic fixation of CO_2. (6%)

解釋名詞 (20%)

1. CRISPR/Cas9 system
2. Next Generation Sequencing (NGS)
3. forward genetics
4. gene silencing suppressor
5. Shine-Dalgarno sequence
6. site-directed mutagenesis
7. codon optimization
8. *O*-glycosylation
9. yeast artificial chromosome (YAC)
10. scfv