

## 單選題 (40%) (每題 2 分，答錯倒扣 0.5 分)

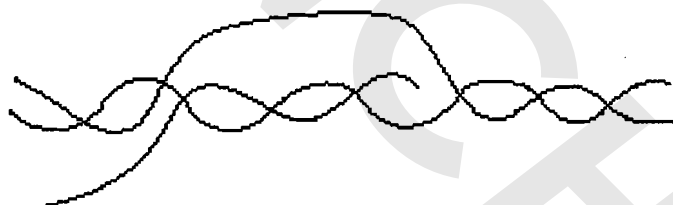
1. An enzyme-catalyzed reaction was carried out with the substrate concentration initially 1,000 times greater than the  $K_m$  for that substrate. After 9 minutes, 1% of the substrate had been converted to product, and the amount of product formed in the reaction mixture was 12  $\mu\text{mol}$ . If, 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  $\mu\text{mol}$ ) of product to be formed?  
A) 1.5 min B) 3 min C) 6 min D) 13.5 min E) 27 min
2. A small molecule that decreases the activity of an enzyme by binding to a site other than the catalytic site is termed a(n):  
A) alternative inhibitor. B) allosteric inhibitor. C) stereospecific agent.  
D) competitive inhibitor. E) transition-state analog.
3. The term *specific activity* differs from the term *activity* in that specific activity:  
A) is the activity (enzyme units) in a milligram of protein.  
B) is the activity (enzyme units) of a specific protein.  
C) is measured only under optimal conditions.  
D) refers to proteins other than enzymes.  
E) refers only to a purified protein.
4. An individual molecular structure within an antigen to which an individual antibody binds is known as a(n):  
A) epitope. B) antigen. C) MHC site. D) Fab region. E) Fc region
5. In comparison with DNA-DNA double helices, the stability of DNA-RNA and RNA-RNA helices is:  
A) RNA-RNA > DNA-RNA > DNA-DNA. B) DNA-DNA > DNA-RNA > RNA-RNA.  
C) RNA-DNA > RNA-RNA > DNA-DNA. D) RNA-RNA > DNA-DNA > DNA-RNA.  
E) DNA-DNA > RNA-RNA > DNA-RNA.
6. Compounds that generate nitrous acid (such as nitrites, nitrates, and nitrosamines) change DNA molecules by:  
A) formation of thymine dimers. B) transformation of A  $\rightarrow$  T. C) depurination.  
D) deamination of bases. E) breakage of phosphodiester bonds.
7. A certain bacterial mRNA is known to represent only one gene and to contain about 900 nucleotides. The largest polypeptide that this mRNA could code for would have a molecular weight of about:  
A) 9,000. B) 50,000.  
C) 33,000. D) 99,000.  
E) It is impossible to set an upper limit from the data given.
8. The operator region normally can be bound by:  
A) repressors. B) suppressor tRNAs. C) mRNA.  
D) attenuators. E) all of the above.
9. In competitive inhibition, an inhibitor:  
A) binds at several different sites on an enzyme. B) binds reversibly at the active site.  
C) binds only to the ES complex. D) binds covalently to the enzyme.  
E) lowers the characteristic  $V_{\text{max}}$  of the enzyme.

10. Which of the following amino acid residues is not a point of oligosaccharide attachment in glycoproteins?  
A) Thr B) Gly C) Ser D) Asn
11. In base-excision repair, the first enzyme to act is:  
A) AP endonuclease. B) DNA ligase. C) DNA glycosylase.  
D) DNA polymerase. E) Dam methylase.
12. In homologous genetic recombination, RecA protein is involved in:  
A) nicking the two duplex DNA molecules to initiate the reaction.  
B) resolution of the Holliday intermediate. C) branch migration.  
D) pairing a DNA strand from one duplex DNA molecule with sequences in another duplex, regardless of complementarity.  
E) introduction of negative supercoils into the recombination products.
13. 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.
14. 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  $\text{NAD}^+$  and 2 mol of ATP. B) 1 mol of NADH and 1 mol of ATP.  
C) 2 mol of  $\text{NAD}^+$  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.
15. Which of the following is *not* an intermediate of the citric acid cycle?  
A) Acetyl-coA B) Citrate C) Oxaloacetate D) Succinyl-coA E)  $\alpha$ -Ketoglutarate
16. Which one of the following antibiotics does not function by interfering with the translational process?  
A) Chloramphenicol B) Cycloheximide C) Penicillin D) Puromycin E) Streptomycin
17. 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
18. Which combination of cofactors is involved in the conversion of pyruvate to acetyl-CoA?  
A) Biotin, FAD, and TPP B) Biotin,  $\text{NAD}^+$ , and FAD C)  $\text{NAD}^+$ , biotin, and TPP  
D) Pyridoxal phosphate, FAD, and lipoic acid E) TPP, lipoic acid, and  $\text{NAD}^+$
19. 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.
20. If the 16-carbon saturated fatty acid palmitate is oxidized completely to carbon dioxide and water (via the  $\beta$ -oxidation pathway and the citric acid cycle), and all of the energy-conserving products are used to drive

ATP synthesis in the mitochondrion, the net yield of ATP per molecule of palmitate is:  
A) 3. B) 12. C) 48. D) 108. E) 160.

問答及簡答 (38%):

1. Diagram and describe how a transgenic plant is produced via *Agrobacterium*-mediated transformation (9%)
2. Diagram and describe the pathway of RNAi (RNA interference). (8%)
3. Diagram and describe the principle of enzyme-linked immunosorbent assay (ELISA). (8%)
4. Compare the process by which translation (protein synthesis) is initiated in *E coli* with that in eukaryotes. (8%)
5. Below, an RNA molecule is being transcribed from a strand of DNA. Indicate the 5' and 3' ends of the RNA molecule and of the strand of DNA that is complementary to the RNA molecule. In which direction is synthesis occurring? (5%)



解釋名詞 (22%)

1. yeast two-hybrid
2. Klenow fragment
3. ribozyme
4. yeast artificial chromosome (YAC)
5. SDS gel electrophoresis
6. site-directed mutagenesis
7. western blotting analysis
8. Southern blotting and northern blotting
9. two dimensional gel electrophoresis
10. introns and exons
11. real-time PCR