

國立中央大學100學年度碩士班考試入學試題卷

所別：生命科學系碩士班 分子與細胞生物組(一般生) 科目：生物化學 共 2 頁 第 1 頁  
生命科學系碩士班 分子與細胞生物組(在職生)

本科考試禁用計算器

\*請在試卷答案卷(卡)內作答

參考用

一. 單選題(每題2分;共50分)

1. An  $\alpha$  helix of a polypeptide has a pitch of (a) 0.10 (b) 0.15 (c) 0.32 (d) 0.54 (e) 3.2 nm.
2. Which of the following descriptions about hemoglobin (Hb) is incorrect? (a) HbA is a heterotetramer (b) HbF is a heterotetramer (c) HbF has a lower affinity for BPG than does HbA (d) High pH enhances the efficiency of  $O_2$  unloading from Hb (e)  $CO_2$  reduces the binding affinity of Hb for  $O_2$ .
3. Which of the following dyes is most commonly used in staining proteins on an SDS polyacrylamide gel? (a) bromophenol blue (b) EtBr (c) ninhydrin reagent (d) coomassie brilliant blue (e) CNBr.
4. An RNA segment of 1,000 nucleotides. What is its approximate molecular weight? (a) 3.3 (b) 33 (c) 65 (d) 330 (e) 650 kD.
5. Which of the following  $\alpha$ -amino acids has an aromatic ring? (a) Arg (b) Lys (c) Gly (d) Phe (e) Glu.
6. Which of the following compounds has the highest molecular weight? (a) adenine (b) adenosine (c) adenylyate (d) uridine (e) uridylyate.
7. Which of the following restriction endonucleases is an isoschizomer of SpeI (ACTAGT)? (a) EcoRI (GAATTC) (b) BamHI (GGATCC) (c) XbaI (TCTAGA) (d) HindIII (AAGCTT) (e) EagI (CGGCCG).
8. Which scientist made a significant contribution to the understanding of prion? (a) K. B. Mullis (b) J. D. Watson and H. C. Crick (c) S. B. Prusiner (d) A. D. Hershey and M. Chase (e) G. N. Ramachandran.
9. Detergents denature proteins by disrupting which of the following? (a) Hydrogen bonds (b) Disulfide bridges (c) Hydrophobic interactions (d) Salt bridges (e) Covalent bonds.
10. How many nucleotides are there in a tRNA molecule? (a) ~32 (b) ~52 (c) ~72 (d) ~92 (e) ~102.
11. Which of the following bond-pairs within a peptide backbone show free rotation around both bonds? (a)  $N-C_\alpha$  and  $N-C$  (b)  $C_\alpha-C$  and  $N-C_\alpha$  (c)  $C=O$  and  $N-C$  (d)  $C=O$  and  $N-C_\alpha$  (e)  $N-C$  and  $C_\alpha-C$ .
12. How many different codons are responsible for decoding methionine? (a) 0 (b) 1 (c) 2 (d) 4 (e) 6.
13. There are "N" genes in *E. coli*. "N" is approximately (a) 450 (b) 4,500 (c) 45,000 (d) 450,000 (e) 4,500,000.
14. Which pair of enzymes listed below is unique to pentose phosphate pathway? (a) citrate lyase and malic enzyme (b) malic enzyme and glucose-6-phosphate dehydrogenase (c) glucose-6-phosphate dehydrogenase and 6-phosphogluconate dehydrogenase (d) 6-phosphogluconate dehydrogenase and fructose-bisphosphatase-1 (e) fructose-bisphosphatase-1 and hexose kinase.
15. Which pair of enzymes listed below is unique to gluconeogenesis? (a) pyruvate carboxylase and phosphofructokinase-1 (b) phosphoenolpyruvate carboxykinase (PEPCK) and pyruvate kinase (c) PEPCK and pyruvate carboxylase (d) pyruvate carboxylase and 3-phosphoglycerate kinase (e) pyruvate dehydrogenase and fructose-bisphosphatase-1.
16. Which of the following statements about lipases is incorrect? (a) Pancreatic lipase releases the fatty acids from carbons 1 and 3 of the triglyceride backbone (b) Lipoprotein lipase releases fatty acids from chylomicron-triglyceride and VLDL-triglyceride in the blood (c) Hormone-sensitive lipase found in adipose tissue is activated by cyclic AMP (d) Phospholipase C is stimulated by the beta-adrenergic receptor (e) Phospholipase A2 is stimulated by the venom protein melittin.
17. Which of the following enzymes and pathways are correctly matched? (a) Phospholipase D and prostaglandin synthesis (b) HMG-CoA reductase and ketone body synthesis (c) Cyclooxygenase and thromboxane synthesis (d) Ethanolamine kinase and phosphatidylcholine synthesis (e) Phospholipase A2 and ceramide synthesis.
18. Which amino acid listed below can serve as the precursor for dopamine? (a) Ala (b) Leu (c) Asp (d) Thr (e) Tyr
19. A deficiency in folic acid will not impair the metabolism of which of the following amino acids? (a) Met (b) Val (c) Ser (d) Gly (e) His
20. Which of the following compounds has the greatest effect on the rate-limiting step in purine nucleotide synthesis? (a) aspartate (b) glutamine (c) ADP (d) ribose-1-phosphate (e) phosphoribosylpyrophosphate.

注意：背面有試題

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21. How many moles of  $FADH_2$  plus  $NADH_2$  can be generated by the complete oxidation of 1 mole of acetyl-CoA to  $CO_2$  and water? (a) 5 (b) 4 (c) 3 (d) 2 (e) 1.
22. Hydroxymethylglutaryl-CoA reductase (a) is the rate-limiting enzyme for triglyceride synthesis (b) is the rate-limiting enzyme for estrogen synthesis (c) is activated by lovastatin (d) is inhibited by cholesterol (e) uses NADH as the cofactor
23. Phosphofructokinase (a) is inhibited by ATP and fructose-2,6-bisphosphate (b) is inhibited by ATP and citrate (c) is inhibited by ADP and fructose-2,6-bisphosphate (d) is activated by citrate and fructose-2,6-bisphosphate (e) is activated by ADP and citrate
24. Allopurinol specifically (a) inhibits xanthine oxidase (b) inhibits thymidylate synthase (c) causes gout (d) inhibits pyrimidine phosphorylase (e) inhibits phosphoribosylpyrophosphate amidotransferase
25. A hereditary deficiency of the following enzyme is responsible for phenylketonuria (a) phenylalanine aminotransferase (b) phenylalanine hydroxylase (c) tyrosine hydroxylase (d) tryptophan hydroxylase (e) nitric oxide synthase

二、簡答題(共 50 分)

1. Deoxycytidylate residues in DNA undergo deamination fairly readily. (a) What is the product of dCMP deamination? (2%) (b) What would be the genetic consequences if this deaminated site were not repaired? (2%) (c) What is the repair mechanism for such a mutation in *E. coli*? (2%)
2. Bluebird migrates from Japan to Taiwan in the winter. This species must store enough energy for the long-range flying. Answer the following questions: (a) What form of lipid energy is stored? (2%) (b) Why is lipid, but not protein or glycogen, stored as the energy source? (2%) (c) Which portion of this class of lipid can be converted to glucose in birds? (2%)
3. Calculate the (a)  $K_m$ , (b)  $V_{max}$ , and (c)  $k_{cat}$  from the following data: (6%)

[S] ( $\mu M$ )	$V_o$ ( $mM \cdot s^{-1}$ )
0.1	0.34
0.2	0.53
0.4	0.74
0.8	0.91
1.6	1.04

The enzyme concentration is  $1 \mu M$ . [S]: initial substrate concentration.  $V_o$ : initial rate

4. The fructose in honey is mainly in the  $\beta$ -D-pyranose form. This is one of the sweetest substances known. The  $\beta$ -D-fructofuranose is much less sweet. (a) Draw the chemical structure of  $\beta$ -D-fructopyranose. (2%) (b) Why is honey generally used for sweetening cold but not hot drinks? (2%) (c) Propose a biochemical mechanism to explain the observation in (b). (2%)
5. Fatty acid can be biosynthesized from the substrate of acetyl-CoA, and its fatty acyl-CoA can be metabolized to the product of acetyl-CoA. (a) What is the rate-limiting enzyme for the fatty acid biosynthesis? (2%) (b) What is the biochemical function of carnitine acyltransferase in the fatty acid oxidation? (2%) (c) How many moles of ATP are produced from the oxidation of 1 mole of 16:0 fatty acid to  $CO_2$ ? (2%) (d) Compare the major differences between fatty acid  $\beta$ -oxidation and fatty acid biosynthesis in terms of the electron carriers and acyl group carriers? (4%)
6. Draw the chemical structure of the following compounds (2% for each): (a) cholesterol (b) dATP (c) urea (d) phosphatidylinositol-4,5-bisphosphate (e) D-Shikimate
7. Specify the biochemical reaction or enzyme inhibited by the following compounds (2% for each): (a) cycloheximide (b) actinomycin D (c) Niagra

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