

國立中央大學104學年度碩士班考試入學試題

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 3 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

*請在答案卷(卡)內作答

參考用

一. 單選題(每題 2 分; 共 80 分)

1. Which of the following organisms is a prokaryote? (a) *Saccharomyces cerevisiae* (b) *Caenorhabditis elegans* (c) *Aspergillus niger* (d) *Drosophila melanogaster* (e) *Escherichia coli*.
2. α helix of a polypeptide has a pitch of (a) 0.10 (b) 0.15 (c) 0.34 (d) 0.54 (e) 1 nm.
3. Which of the following descriptions about Hb (hemoglobin) is incorrect? (a) One Hb can bind 4 O₂ molecules (b) HbA has an $\alpha_2\beta_2$ structure (c) HbF has an $\alpha_2\gamma_2$ structure (d) HbF has a lower affinity for BPG than does HbA (e) CO₂ increases the binding affinity of Hb for O₂
4. Which of the following descriptions about the Michaelis-Menten rate equation is incorrect? (a) K_M measures the substrate concentration at which the reaction rate is $V_{max}/2$ (b) k_{cat} is the turnover number that measures the rate of the catalytic process (c) The ratio k_{cat}/K_M is a convenient measure of enzyme efficiency (d) $V_{max} = k_{cat}/K_M$ (e) A competitive inhibitor increases the apparent K_M .
5. Which of the following chemicals can be incorporated into DNA strands when DNA replication occurs? (a) bromophenol blue (b) EtBr (c) ninhydrin reagent (d) CNBr (e) BUdR.
6. A DNA segment of 1,000 base pairs in the A form. What is its approximate molecular weight? (a) 33 (b) 65 (c) 330 (d) 650 (e) 3,300 kD.
7. Which of the following α -amino acids has the highest absorbance at 280 nm? (a) Phe (b) Pro (c) Trp (d) Glu (e) Lys.
8. Which of the following compounds has the highest molecular weight? (a) adenosine (b) adenylyate (c) adenine (d) guanosine (e) uridine.
9. Which of the following descriptions regarding disaccharide is incorrect? (a) Sucrose is α -D-glucopyranosyl (1 \rightarrow 2) β -D-fructofuranoside (b) Sucrose is a reducing sugar (c) Maltose has an α (1 \rightarrow 4) linkage (d) Cellobiose is β -D-glucopyranosyl (1 \rightarrow 4) β -D-glucopyranose (e) Lactose is β -D-galactopyranosyl (1 \rightarrow 4) β -D-glucopyranose.
10. Which of the following restriction endonucleases is an isoschizomer of XbaI (TCTAGA)? (a) EcoRI (GAATTC) (b) SpeI (ACTAGT) (c) BamHI (GGATCC) (d) SalI (GTCGAC) (e) EagI (CGGCCG).
11. Which scientist made a significant contribution to the understanding of prion? (a) K. B. Mullis (b) J. D. Watson and H. C. Crick (c) A. D. Hershey and M. Chase (d) S. B. Prusiner (e) G. N. Ramachandran.
12. Triton X-100 is a nonionic surfactant that denatures proteins by disrupting which of the following? (a) Hydrogen bonds (b) Disulfide bridges (c) Hydrophobic interactions (d) Salt bridges (e) Covalent bonds.
13. How many stereoisomers for an aldopentose? (a) 2 (b) 4 (c) 6 (d) 8 (e) 16.
14. The chemical bond between ribose and base of UMP is an (a) Ether (b) Ester (c) Amide (d) Aldehyde (e) Ketone.
15. The major long-term energy storage molecules in many organisms are (a) Triacylglycerol (b) Waxes (c) Fatty acids (d) Cholesterol (e) Glycerophospholipids.
16. T ψ C loops are found in (a) mRNA (b) rRNA (c) tRNA (d) hnRNA (e) snRNA.
17. 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.
18. Which scientist made a significant contribution to the technology of DNA sequencing? (a) K. B. Mullis (b) J. D. Watson and H. C. Crick (c) A. D. Hershey and M. Chase (d) S. B. Prusiner (e) F. Sanger.
19. Which of the following codons is a translation initiation codon? (a) UAA (b) UAG (c) UGA (d) AUG (e) AGG.
20. There are approximately "N" protein-coding genes in human. "N" is (a) 100 (b) 500 (c) 5,000 (d) 20,000 (e) 200,000.
21. The Western blotting method is originally used for the measure of (a) protein (b) DNA (c) RNA (d) lipid (e)

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- carbohydrates.
22. Non-steroidal anti-inflammatory drugs (NSAIDs) like aspirin and ibuprofen act by blocking production of: (a) vitamin D (b) biological waxes (c) sphingolipids (d) prostaglandins (e) none of the above.
 23. When a bacterium such as E. coli is shifted from a warmer growth temperature to a cooler growth temperature, it compensates by: (a) increasing its metabolic rate to generate more heat (b) putting more unsaturated fatty acids into its membranes (c) putting longer-chain fatty acids into its membranes (d) shifting from aerobic to anaerobic metabolism (e) synthesizing thicker membranes to insulate the cell.
 24. Which of the following compounds has the greatest effect on the rate-limiting step in purine nucleotide synthesis? (a) aspartate (b) glutamine (c) phosphoribosylpyrophosphate (d) ribose-1-phosphate (e) ADP
 25. Which pair of enzymes listed below is unique to pentose phosphate pathway? (a) glucose-6-phosphate dehydrogenase and 6-phosphogluconate dehydrogenase (b) malic enzyme and glucose-6-phosphate dehydrogenase (c) citrate lyase and malic enzyme (d) 6-phosphogluconate dehydrogenase and fructose-bisphosphatase-1 (e) fructose-bisphosphatase-1 and hexose kinase.
 26. Which pair of enzymes listed below is unique to gluconeogenesis? (a) pyruvate dehydrogenase and fructose-bisphosphatase-1 (b) pyruvate carboxylase and 3-phosphoglycerate kinase (c) PEPCK and pyruvate carboxylase (d) phosphoenolpyruvate carboxykinase (PEPCK) and pyruvate kinase (e) pyruvate carboxylase and phosphofructokinase-1.
 27. After drinking of coke, the major monosaccharides absorbed into the blood are (a) glucose (b) fructose (c) glucose and galactose (d) glucose and fructose (e) galactose, glucose, and fructose.
 28. Which of the following reactions is not located in the mitochondria? (a) tricarboxylic acid cycle (b) ketone body synthesis (c) cholesterol biosynthesis (d) β -oxidation (e) electron transport and oxidative phosphorylation.
 29. 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) uses NADH as the cofactor (e) is inhibited by cholesterol.
 30. Phosphofructokinase (a) is activated by ADP and citrate (b) is inhibited by ATP and citrate (c) is activated by citrate and fructose-2,6-bisphosphate (d) is inhibited by ADP and fructose-2,6-bisphosphate (e) is inhibited by ATP and fructose-2,6-bisphosphate
 31. Which of the following pairs of enzymes participate in the major route of nitrogen transfer from amino acids to urea? (a) transaminases and glutamate dehydrogenase (b) glutaminase and asparaginase (c) transaminases and glutaminase (d) glutamate dehydrogenase and glutaminase (e) amino acid oxidases and glutamate dehydrogenase.
 32. Lactate produced by anaerobic muscle tissue is: (a) further oxidized to acetate in muscle (b) carried by the blood to the liver for gluconeogenesis back to glycogen (c) stored in muscle until oxygen is available (d) transferred to erythrocytes to release oxygen from hemoglobin (e) none of the above.
 33. How many NADH molecules are produced in the TCA cycle per molecule of acetyl-CoA oxidized? (a) 5 (b) 4 (c) 3 (d) 2 (e) 1.
 34. The model of electron transport includes all EXCEPT: (a) four independent mobile complexes (b) mobile coenzyme Q collecting electrons (c) cyt c moving in the intermembrane space (d) proton gradient generated to produce ATP (e) protons driven into the matrix.
 35. What are the β -oxidation products of oleic acid ($18:1^{\Delta 9}$) and how many ATP equivalents are required for activation?
(a) 8 acetyl CoA, 8 NADH, 7 FADH₂, 1 ATP equivalents (b) 9 acetyl CoA, 8 NADH, 7 FADH₂, 2 ATP equivalents

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- (c) 8 acetyl CoA, 7 NADH, 7 FADH₂, 1 ATP equivalents (d) 8 acetyl CoA, 7 NADH, 6 FADH₂, 2 ATP equivalents
(e) 9 acetyl CoA, 9 NADH, 8 FADH₂, 1 ATP equivalents.
36. What reaction does glutamate dehydrogenase (GDH) catalyze? (a) The reductive amination of α -ketoglutarate to yield glutamate (b) Phosphorylation of carbamate to yield carbamoyl-phosphate (c) The amidation of the γ -carboxyl group of glutamate to form glutamine (d) The deadenylation of glutamine synthetase (e) The adenylation of glutamine synthetase.
37. All of the following are paired with their preferred substrate EXCEPT: (a) brain: glucose (b) heart: fatty acids (c) anaerobic skeletal muscle: glucose (d) resting skeletal muscle: glucose (e) adipose tissue: fatty acids.
38. The adapter molecule that interacts specifically with both nucleic acids and amino acids is: (a) mRNA. (b) rRNA. (c) tRNA (d) ssRNA (e) all are true.
39. A highly conserved protein that is involved in protein degradation is: (a) ricin (b) met-aminopeptidase (c) degradase (d) ubiquitin (e) peptidyl transferase.
40. Which of the following do NOT correctly pair a hormone with its function? (a) ACTH – promotes production of thyroxin (b) insulin – regulates metabolism and blood glucose (c) FSH – stimulates processes within the gonads (d) calcitonin – regulates plasma Ca²⁺ (e) prolactin – stimulates milk production.

參考用

二、簡答題(共 20 分)

1. Please define the following terms: (a) tautomers (b) abzymes (c) anomers (d) ribozymes (e) nonsense mutation. (2% each)
2. The biosynthesis of fatty acids and their breakdown by β -oxidation occur by different pathways. Compare the two paths by filling in the blanks below. (Some blanks may require more than one answer.) (10 %)

	β - oxidation	Synthesis
Activating group	_____	_____
Basic units added or removed	_____	_____
Electron carrier coenzyme(s)	_____	_____
Cellular location of reactions	_____	_____