

國立中央大學101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 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

*請在試卷答案卷(卡)內作答

一. 單選題(每題2分;共72分)

1. Waxes are esters of (a) long-chain fatty acids with long-chain alcohols (b) long-chain fatty acids with short-chain alcohols (c) short-chain fatty acids with long-chain alcohols (d) short-chain fatty acids with short-chain alcohols (e) two fatty acids.
2. Which description about Hb (hemoglobin) is incorrect? (a) HbA has an $\alpha_2\beta_2$ structure (b) HbF has an $\alpha_2\gamma_2$ structure (c) HbA has a much higher affinity for BPG than does HbF (d) CO_2 reduces the binding affinity of HbA for O_2 (e) Decreased BPG levels are found in the blood of heavy smokers.
3. Which compound listed below is a "suicide" inhibitor? (a) cordycepin (b) puromycin (c) 2,4-dinitrophenol (d) fluoroacetate (e) ethidium bromide.
4. A protein of 1,000 amino acids has an approximate molecular weight of ___ kD. (a) 33 (b) 66 (c) 110 (d) 330 (e) 660.
5. Which of the following α -amino acids is called a helix breaker? (a) Arg (b) Lys (c) Gly (d) Phe (e) Pro.
6. Which of the following compounds has the highest molecular weight? (a) guanine (b) guanidine (c) guanidylate (d) xanthine (e) hypoxanthine.
7. Which of the following restriction endonucleases has a cohesive end compatible with that of XhoI (CTCGAG) after cleavage? (a) EcoRI (GAATTC) (b) BamHI (GGATCC) (c) XbaI (TCTAGA) (d) HindIII (AAGCTT) (e) SalI (GTCGAC).
8. Which of the following scientists made a significant contribution to the discovery of a protein's secondary structures, α helix and β sheet? (a) K. B. Mullis (b) J. D. Watson and H. C. Crick (c) L. Pauling (d) A. D. Hershey and M. Chase (e) R. Franklin.
9. Which of the following descriptions regarding monosaccharides is incorrect? (a) D-Threose and L-Threose are enantiomers (b) D-Threose and D-Erythrose are diastereomers (c) α -D-Glucopyranose and β -D-glucopyranose are anomers (d) The two favored structures for α -D-glucopyranose are the chair and boat conformations (e) Both the α and β anomers of D-ribofuranose exist in DNA structure.
10. Maltose is a disaccharide linked by an $\alpha(1\rightarrow4)$ linkage. This linkage is chemically an (a) ester (b) ether (c) amide (d) aldehyde (e) aldose.
11. "Biodiesel" can be converted from the lipid of algae or plants. Biodiesel is chemically a (a) free fatty acid (b) triacylglycerol (c) phospholipid (d) fatty acid methyl ester (e) wax.
12. How many different codons are used to decode tryptophan? (a) 0 (b) 1 (c) 2 (d) 3 (e) 4.
13. Which of the following descriptions about the cell wall of a Gram-positive bacterium is incorrect? (a) It has a multilayered peptidoglycan (b) The tetrapeptides of the peptidoglycan are linked by glycine pentapeptides (c) Each of the tetrapeptide contains a D-alanine (d) Each of the tetrapeptide contains an L-alanine (e) The glutamic acid residue is linked into the tetrapeptide through the usual α -carboxyl linkage.
14. Which of the following descriptions about the Michaelis-Menten equation is incorrect? (a) An enzyme with a high K_M means that it has high affinity for its substrate (b) An enzyme with a high k_{cat} means that it has a high catalytic rate (c) The units of k_{cat} are s^{-1} (d) The units of K_M are M (e) A competitive inhibitor increases the apparent K_M .
15. Which of the following descriptions about disaccharide is incorrect? (a) Sucrose is α -D-glucopyranosyl (1 \rightarrow 2) β -D-fructofuranoside (b) Cellobiose is β -D-glucopyranosyl (1 \rightarrow 4) β -D-glucopyranose (c) Lactose is β -D-galactopyranosyl (1 \rightarrow 4) β -D-glucopyranose (d) Lactose is a glucoside (e) The glucose moiety in lactose can undergo mutarotation.
16. The predominant form of fructose in honey is _____. (a) the open-chain form (b) α -D-fructopyranose (c) β -D-fructopyranose (d) α -D-fructofuranose (e) β -D-fructofuranose.
17. Coumadin, an isoprene-derived compound, is a widely prescribed anticoagulant. The key to this use lies in its ability to act as an antagonist of _____. (a) vitamin A (b) vitamin B1 (c) vitamin K (d) vitamin D (e) vitamin E.
18. The *E. coli* genome has around 4,000,000 base pairs and a superhelical density *in vivo* of about -0.06. Assuming the DNA has 10.5 base pairs per turn, what is the expected writhing number? (a) -22,857 (b) 358,095 (c) 380, 952 (d) -22,867 (e) -240,000.
19. Which oil listed below contains more than 60% unsaturated fatty acids? (a) beef (b) milk (c) coconut (d) palm (e) sunflower.

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20. All are characteristics of anabolism EXCEPT: (a) assembly of complex molecules (b) formation of new covalent bonds (c) ATP provides energy (d) NADPH is an electron donor (e) all are true.
21. In prokaryotic cells, phospholipid synthesis and oxidative phosphorylation are carried out in (a) plasma membranes (b) cytosol (c) mitochondria (d) ribosomes (e) endoplasmic reticulum.
22. Glucokinase has a K_M value of 10.0 mM, whereas hexokinase has a K_M value of 0.1 mM. This is consistent with which of the following? (a) Glucokinase acts on glucose at low concentrations (b) Glucokinase acts on glucose only at high glucose concentrations (c) Glucokinase phosphorylates most of the glucose at low glucose levels (d) Hexokinase acts on glucose only at high levels of glucose (e) Hexokinase acts at about half-maximal velocity at glucose concentrations of 4-5 mM.
23. In eukaryotic cells, glycolysis occurs in the _____, and the TCA cycle reactions take place in _____. (a) mitochondria; mitochondria (b) cytoplasm; mitochondria (c) cytoplasm; cytoplasm (d) mitochondria; ribosomes (e) cytoplasm; ribosomes.
24. The isocitrate lyase-catalyzed reaction cleaves isocitrate into (a) glyoxylate and fumarate (b) succinate and acetyl-CoA (c) malate and acetyl-CoA (d) succinate and glyoxylate (e) glyoxylate and acetyl-CoA.
25. Gluconeogenesis is the synthesis of (a) glucose from non-carbohydrate precursors (b) glycogen from glucose (c) pyruvate from glucose (d) fatty acids from glucose (e) glucose from fatty acids.
26. Fatty acids are mobilized from adipose cells in response to all of the hormones EXCEPT: (a) ACTH (adrenocorticotropic hormone) (b) glucagon (c) insulin (d) epinephrine (adrenaline) (e) all are true.
27. The product of β -oxidation, acetyl-CoA, can be used for all EXCEPT: (a) synthesis of ketone bodies (b) synthesis of amino acids (c) catabolism in the TCA cycle (d) synthesis of glucose (e) none of the above.
28. All of the following are true of the urea cycle EXCEPT: (a) It helps in the excretion of excess nitrogen (b) It is mainly confined to the liver (c) It is linked to the citric acid cycle through fumarate (d) Stimulation of carbamoyl-phosphate synthetase I decreases the activity of the urea cycle (e) It is completed by the regeneration of ornithine from arginine.
29. The coenzyme for two single carbon additions in purine biosynthesis is (a) THF (b) biotin (c) SAM (d) TPP (e) none of the above.
30. All are major components of anabolic pathways EXCEPT: (a) NADH (b) glycolysis and citric acid cycle intermediates (c) ATP, GTP, CTP, UTP (d) NADPH (e) all of the above.
31. During fasting or starvation, the brain (a) converts endogenous fatty acids into β -hydroxybutyrate (b) utilizes β -hydroxybutyrate from the blood stream (c) utilizes amino acids for fuel from degradation of brain protein (d) utilizes its glycogen stores as a first responding source of fuel (e) all of the above.
32. The primary storage form of lipid is _____ and it is normally stored in the _____. (a) phospholipid; liver (b) cholesterol; muscles (c) monoacylglycerol; adipocytes (d) triacylglycerols; adipocytes (e) triacylglycerols; liver.
33. Which of the following metabolic pathways is strictly anabolic? (a) glycolysis (b) gluconeogenesis (c) citric acid cycle (d) pentose phosphate cycle (e) β -oxidation of fatty acids.
34. All of the following enzymes are unique to gluconeogenesis EXCEPT: (a) phosphoglucoisomerase (b) glucose-6-phosphatase (c) pyruvate carboxylase (d) fructose-1,6-bisphosphatase (e) PEP carboxykinase.
35. All of the carbons and nitrogens of ornithine come biosynthetically from (a) proline (b) valine (c) alanine (d) glutamate (e) glycine.
36. Allopurinol is an analog of _____ that tightly binds to _____ and prevents _____ formation. (a) hypoxanthine; xanthine oxidase; uric acid (b) guanine; guanine deaminase; xanthine (c) inosine; xanthine oxidase; xanthine (d) hypoxanthine; guanine deaminase; xanthine (e) none of the above.

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二、簡答題(共 28 分)

1. Please specify the functions and action mechanisms of the following compounds: (a) Cordycepin (b) Chloramphenicol (c) Diisopropyl fluorophosphate (2% for each question)
2. IPTG can be used to induce the expression of genes with a *Lac* operator. (a) Draw the chemical structure of IPTG (b) Describe its action mechanism. (c) Why is it better than lactose as an inducer? (2% for each question)
3. How does amino acid catabolism lead into pathways of energy production? (10%)
4. How do mitochondria mediate apoptosis? (6%)