

國立中央大學 105 學年度碩士班考試入學試題

所別：生命科學系 碩士班 分子與環境生物學組(一般生)
生命科學系 碩士班 分子與環境生物學組(在職生)

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科目：生物化學 I(含代謝)

本科考試禁用計算器

*請在答案卷(卡)內作答

Part I. Multiple choice questions (total 70%): each of questions or incomplete statements below is followed by five suggested answers or completions. Select the one that is best in each case.

1. A water-soluble globular protein is most likely to have the highest proportion of which of the following amino acid residues buried within its core?
(a) Arginine (b) Isoleucine (c) Histidine (d) Cysteine (e) Aspartic acid
2. What molecule contributes at least two nitrogen atoms to each purine?
(a) Glutamine (b) Asparagine (c) Lysine (d) Arginine (e) 10-formyl-THF
3. Parkinson's disease can be treated L-Dopa that is derived from
(a) Tyrosine (b) Tryptophan (c) Phenylalanine (d) Glutamine (e) Asparagine
4. Which of the following is an essential amino acid for humans?
(a) Alanine (b) Histidine (c) Tyrosine (d) Serine (e) Glutamine
5. In animals, all the nitrogen of heme groups is derived from
(a) Succinate (b) Glycine (c) Alanine (d) Succinate and glycine (e) Succinate and alanine
6. For each molecule of CO₂ fixed by the Calvin cycle, how many ATP are required?
(a) 2 ATP (b) 3 ATP (c) 6 ATP (d) 4 ATP (e) 9ATP
7. Ubiquitination of protein is to added ubiquitine to which residues of the target protein
(a) Serine (b) Threonine (c) Lysine (d) Arginine (e) Cysteine
8. Which amino acid most commonly serves as a general acid and general base in an enzyme mechanism?
(a) Lysine (b) Serine (c) Histidine (d) Cysteine (e) Aspartic acid
9. The binding of oxygen to hemoglobin is said to be
(a) high affinity (b) low affinity (c) cooperative (d) sequential (e) sigmoidal
10. During glycolysis, each molecule of glucose is converted into
(a) 2 molecules of fructose 1,6 bisphosphate (b) 2 molecules of pyruvate (c) 4 molecules of NADH
(d) 4 molecules of ATP (e) 8 molecules of ATP
11. Which of the following types of tissue can use glucose, but not fatty acids, as a source of fuel?
(a) Cardiac muscle (b) Skeletal muscle (c) Brain (d) Liver (e) Adipose tissue
12. What is the C-4 epimer of glucose?
(a) Gulose (b) Mannose (c) Talose (d) Galactose (e) Idose
13. Which enzyme is important in the regulatory step for cholesterol biosynthesis?
(a) Squalene synthase (b) Squalene peroxidase (c) HMG-CoA lyase (d) HMG-CoA reductase (e) HMG-CoA synthase
14. In a circular DNA molecule of 126 bp with 10.5 bp/turn, which of the following represents in an unstrained circle? (L = linking number, T = twist and W = writhe)
(a) L = 12, T = 11, W = 0 (b) L = 11, T = 12, W = -1 (c) L = 11, T = 11, W = 0 (d) L = 12, T = 12, W = 0
(e) L = 11, T = 11, W = +1
15. Which enzyme is the most important regulator in fatty acid synthesis?
(a) Citrate lyase (b) Ketoacyl-ACP synthase (c) malonyl-CoA-ACP transacylase (d) Acetyl-CoA carboxylase
(e) Acetyl-CoA-ACP transacylase

注意：背面有試題

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16. Phospholipids are synthesized in the
(a) Golgi complex (b) Mitochondria (c) Peroxisome (d) Rough endoplasmic reticulum (e) Smooth endoplasmic reticulum
17. In a typical eukaryotic cell the pH is usually around 7.4. What is the $[H^+]$ in a typical eukaryotic cell?
(a) $7.4 \times 10^{-5} M$ (b) $0.00000074 M$ (c) $7.6 nM$ (d) $6.6 \mu M$ (e) $4 \times 10^{-8} M$
18. Degradation and synthesis of saturated fatty acids occur separately in
(a) Plasma membrane and cytosol
(b) Cytosol and mitochondria
(c) Adipocyte and mitochondria
(d) Mitochondria and plasma membrane
(e) Mitochondria and cytosol
19. Which of the reactive oxygen species is thought to damage lipid membranes?
(a) Hydroxyl radical (b) Superoxide (c) Nitric oxide (d) Semiquinone radical (e) None of the above
20. Why do individuals who are heterozygous for sickle cell anemia have a resistance to malaria?
(a) Aggregation of hemoglobin prevents parasitic infection
(b) Shortened life span of red blood cells does not allow sufficient time for the parasite to mature in the red blood cell
(c) Diminished blood flow to the skin prevents mosquitoes from transferring the malaria parasite to individuals
(d) Sick cell hemoglobin fibers have decreased CO_2 carrying capacity, so diminished CO_2 exhalation does not attract mosquitoes
(e) None of the above
21. Which carrier is used in tissues for the transport of ammonia to the liver
(a) Alanine in all tissues
(b) Glutamine in all tissues
(c) Glutamine in most tissues but alanine in muscle
(d) Alanine in most tissues but glutamine in muscle
(e) None of the above
22. If a reaction $A \rightarrow B$ is energetically favorable reaction, how can the energetically unfavorable reaction $B \rightarrow A$ occur in a cell?
(a) Couple a reaction with $\Delta G=0$
(b) Couple a reaction with $\Delta G^\circ > 0$
(c) Couple a reaction with $\Delta G > 0$
(d) Couple a reaction with $\Delta G^\circ < 0$
(e) Couple a reaction with $\Delta G < 0$
23. Homocysteinemia can result from
(a) Defect in cystathionine β -synthase
(b) Defect in methionine synthase
(c) Defect in 5,10-methylenetetrahydrofolate reductase
(d) Dietary deficiency of folic acid, vitamin B_6 or B_{12}
(e) All above
24. In the pathway for conversion of phenylalanine to fumarate and acetoacetate, there are two well-known enzyme defects that cause inheritable metabolic diseases. What are the names of these two diseases?
(a) Alkaptonuria and phenylketonuria
(b) Homocysteinuria and nonketotic hyperglycinemia
(c) Phenylketonuria and maple syrup urine disease
(d) Akaptonuria and nonketotic hyperglycinemia
(e) Maple syrup urine disease and homocysteinuria

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25. In the citric acid cycle, CO₂ generation are catalyzed by
- (a) Succinate dehydrogenase and malate dehydrogenase
 - (b) Isocitrate dehydrogenase and malate dehydrogenase
 - (c) Isocitrate dehydrogenase and α -ketoglutarate dehydrogenase
 - (d) α -ketoglutarate dehydrogenase and succinate dehydrogenase
 - (e) α -ketoglutarate dehydrogenase and malate dehydrogenase
26. Which of the following pathways takes place primarily within the inner mitochondrial membrane?
- (a) Glycolysis
 - (b) Citric acid cycle
 - (c) Fatty acid β -oxidation
 - (d) Pentose phosphate pathway
 - (e) Electron transport
27. All of the following enzymes are linked to the reduction of NADH except:
- (a) Isocitrate dehydrogenase
 - (b) lactate dehydrogenase
 - (c) succinate dehydrogenase
 - (d) pyruvate dehydrogenase
 - (e) α -ketoglutarate dehydrogenase

Questions 28-32 refer to the following enzymes

- (a) Aconitase
 - (b) Arginase
 - (c) β -ketothiolase
 - (d) Rubisco
 - (e) Phosphofructokinase-1
28. An enzyme that catalyzes the primary regulation step of glycolysis _____
29. A Krebs cycle enzyme _____
30. An enzyme of biosynthesis of ketone bodies in the liver _____
31. A carboxylase and oxygenase of ribulose 1,5-bisphosphate _____
32. An enzyme that is required to produce urea from arginine _____

Questions 33-35 refer to the following enzymes

- (a) Hypoxanthine-guanine phosphoribosyltransferase
 - (b) Cyclooxygenase
 - (c) Reductase
 - (d) Tyrosinase
 - (e) Tryptophan oxygenase
33. The enzyme that aspirin acts on _____
34. The enzyme abnormality results in hyperuricemia and gout _____
35. The enzyme abnormality results in albinism _____

Part II. Short Answer and Essay Questions (total 30%):

36. Why cysteine is important in a cell? Can methionine perform the same function (5%)
37. How many turns of the fatty acid oxidation cycle are required for complete oxidation of arachidic acid to acetyl-CoA? (5%)
38. How would a riboflavin deficiency affect the functioning of the citric acid cycle? (6%)
39. Which two hormones affect the activity of acetyl-CoA carboxylase in fatty acid biosynthesis? Why does this make physiological sense? (14%)