

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環境生物學組(一般生) 科目：生物化學I (含代謝) 共 2 頁 第 1 頁

本科考試禁用計算器

*請在試卷答案卷(卡)內作答

Part I. Multiple choice questions (total 50%): each of questions or incomplete statements below is followed by five suggested answers or completions. Select the one that is best in each case.

- Which of the following statements is true?
 - A weak acid in a solution with a pH of 5.0. The $[H^+]$ is 10^{-5} M.
 - Varying the pH of a solution will alter the pKa of an ionizable group in that solution
 - Lemon juice, which has a pH of 2.0, is 60 times more acidic than ammonia, which has a pH of 12.0
 - The weak acid is a proton acceptor
 - At its pKa, the weak acid will be totally dissociated
- In a typical eukaryotic cell the pH is usually around 7.4. What is the $[H^+]$ in a typical eukaryotic cell?
 - 7.4×10^{-5} M (b) 4×10^{-8} M (c) 0.0000074M (d) 2.3 μ M (e) 6.6 nM
- An enzyme facilitates chemical reactions by:
 - Increasing the free-energy difference between reactants and products
 - Decreasing the free-energy difference between reactants and products
 - Lowering the activation energy of the reaction
 - Raising the activation energy of the reaction
 - None of the above
- In an α helix, the R groups on the amino acid residues:
 - Are found on the outside of the helix spiral
 - Participate in the hydrogen bonds that stabilize the helix
 - Allow only right-handed helices to form
 - A and B are true
 - A, B, and C are true
- Which of the following statements is/are true of both hemoglobin and myoglobin?
 - Acidic conditions lower the affinity for oxygen
 - The iron atom of the heme prosthetic group is bound at five of its six coordination sites to nitrogen atoms
 - The hill coefficient is equal to the number of subunits in the molecule
 - O₂ binding occurs in the cleft where the polypeptide come into contact
 - None of the above is true of both molecules
- Which of the following is a heteropolysaccharide?
 - Glucogen (b) Starch (c) Hyaluronate (d) Cellulose (e) Chitin
- Which of the following description about glycogen is **NOT TRUE**?
 - A homopolysaccharide of glucose units
 - The ($\alpha 1 \rightarrow 6$) linkage is found in branches
 - Each subunit is connected by ($\alpha 1 \rightarrow 4$) glycosidic bonds
 - Each subunit is connected by ($\beta 1 \rightarrow 4$) glycosidic bonds
 - A tightly coiled helical structure stabilized by hydrogen bonds
- Two molecules of double-stranded DNA are the same length (1000 base pairs), but differ in base composition. Molecule 1 contains 70% A+T; molecule 2 contains 30% A+T. Which molecule has a higher t_m (melting point)? How many C residues are there in the 70% A+T DNA molecule?
 - 2; 30 (b) 1; 300 (c) 2; 700 (d) 1; 700 (e) 2; 300
- The phosphodiester bonds that link adjacent nucleotides in DNA:
 - Join the 3' hydroxyl of one nucleotides to the 5' hydroxyl of the next
 - Are positively charged
 - Always link A with T and C with G
 - Are positively charged and always link A with T and C with G
 - Are positively charged and Join the 3' hydroxyl of one nucleotides to the 5' hydroxyl of the next
- Coconut oil contains only a very small amount of unsaturated fatty acids. How can it still have a low melting point?
 - It contains a lot of long-chain fatty acids
 - It contains mostly short-chain fatty acids
 - It has only a few hydrogen bonds per fatty acid chain
 - A and C are true
 - B and C are true
- Which of following statements about NAD⁺ is **TRUE**?
 - In its oxidized form is NADH
 - Accepts 2 electrons and 2 hydrogen ions
 - Accepts 2 electrons and 1 hydrogen ions
 - Accepts 1 electrons and 1 hydrogen ions
 - Transfer electrons in reductive biosynthesis
- Which of the following is not a membrane lipid?
 - Cholesterol (b) Phosphatidylglycerol (c) Cerebrosides (d) Triacylglycerol (e) Sphingomyelin
- Which of following acts as a "carrier" of fatty acids across the inner mitochondrial membrane?
 - Serum albumin (b) APoC-II (c) Apolipoprotein (d) Bile salt (e) Carnitine

參考用

注意：背面有試題

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14. Which of the following correctly matches the glycolytic reaction with the gluconeogenic enzyme used in the corresponding bypass reaction?
(a) Glucose → glucose 6-phosphate; glucose 6-phosphatase
(b) Fructose 6-phosphate → fructose 1, 6-bisphosphate; phosphofructokinase-2
(c) Fructose 1,6-bisphosphate → dihydroxyacetone phosphate + glyceraldehyde 3-phosphate; glyceraldehyde 3-phosphate dehydrogenase
(d) 2-phosphoglycerate → phosphoenolpyruvate; phosphoglycerate kinase
(e) Phosphoenolpyruvate → pyruvate; pyruvate kinase
15. Degradation and synthesis of saturated fatty acids occur separately in
(a) Plasma membrane and cytosol
(b) Mitochondria and cytosol
(c) Adipocyte and mitochondria
(d) Mitochondria and plasma membrane
(e) Cytosol and mitochondria
16. Which of the following descriptions is **NOT TRUE**?
(a) Storage of fatty acids in organism is largely in the form of triacylglycerols
(b) Fat rich in unsaturated fatty acids are liquid
(c) Glycerophospholipid contains two acyl side chains and both are saturated
(d) Phosphatidylcholine is the chief phospholipids found in membranes of animal cells
(e) Free sphingolipid base is toxic for cells, but it is the backbone structure for all sphingolipids
17. Which compound links glycolysis, nucleotide synthesis, and glycogen synthesis?
(a) Acetyl-CoA (b) Oxaloacetate (c) Citrate (d) Glucose 6-phosphate (e) Glycerol 3-phosphate
18. In order to examine the citric acid cycle, you have obtained a pure preparation of isolated, intact mitochondria. You add some succinyl-CoA to the suspension of isolated, intact mitochondria. How many moles of ATP would you expect to be generated in one turn of the citric acid cycle from each mole of succinyl-CoA added to the test tube?
(a) 3 (b) 4 (c) 5 (d) 5.5 (e) No ATP would form under these conditions
19. Which of the following enzyme that aspirin acts on
(a) Acyl-CoA dehydrogenase (b) Cyclooxygenase (c) Reductase (d) Phospholipase (e) Thymidylate synthase
20. Which of the following does not provide a carbon skeleton for the synthesis of amino acids?
(a) α -ketoglutarate (b) Pyruvate (c) Succinate (d) Oxaloacetate (e) Ribose 5-phosphate
21. Formation of bilirubin occurs in
(a) Liver (b) Adipose tissue (c) Blood (d) Spleen (e) Heart
22. The citric acid cycle and the urea cycle overlap to form what has sometimes been called the "Krebs bicycle" which of the following statements is relevant to the interactions between these two metabolic cycles?
(a) Oxaloacetate is converted to aspartate
(b) Aspartate combines with citrulline to produce argininosuccinate in the cytosol
(c) Argininosuccinate is cleaved to fumarate and arginine
(d) Fumarate is citric acid cycle intermediate
(e) All of the above are true
23. Which of the following is not true of cholesterol synthesis?
(a) It occurs in the mitochondrial matrix
(b) It is inhibited by elevated levels of intracellular cholesterol
(c) It is hormonally inactivated by glucagon and activated by insulin
(d) Reduction of HMG-CoA to mevalonate catalyzed by HMG-CoA reductase is the committed step
(e) Acetyl-CoA is the ultimate source of all 27 carbon atoms of cholesterol
24. Which of the following enzymes converts purine to nucleotides?
(a) Acyl-CoA dehydrogenase (b) Phosphoribosyltransferase (c) Reductase (d) Phospholipase (e) Thymidylate synthase
25. 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

參考用

Part II Questions (total 50%):

1. Which amino acids have positively charged at physiological pH? (6%)
2. Which amino acid has an R group with a pKa near 7, important in the active site of some enzymes? (5%)
3. What structural property of amino acids permits the measurement of protein concentration by UV light absorption? Which amino acids have this property? (12%)
4. What types of interactions are responsible for the close association of the nonidentical subunits (α and β) in the quaternary structure of hemoglobin? (6%)
5. The reactions of the urea cycle occur in two different cellular compartments. Which urea cycle intermediates must be transported across the inner mitochondrial membrane? (6%)
6. What is the net reaction of the calvin cycle? Include energy inputs and electron carriers. (5%)
7. Which two hormones affect the activity of acetyl-CoA carboxylase in fatty acid biosynthesis? Why does this make physiological sense? (10%)

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