

考生注意事項：所有考題務必在答案卷上作答，凡在問題卷上作答者無效

一、選擇題(單選，每題一分，答錯倒扣0.25分)

1. Endogenously synthesized lipid is transported from the liver to the adipose tissue by
 - A. Chylomicrons.
 - B. High density lipoproteins.
 - C. Low density lipoproteins.
 - D. Very low density lipoproteins.
 - E. Oxidized lipoproteins.

2. Lipoprotein lipase cleaves fatty acids from positions
 - A. 1 and 3 of triacylglycerols.
 - B. 1, 2, and 3 of triacylglycerols.
 - C. 2 and 3 of triacylglycerols.
 - D. 1 and 2 of triacylglycerols.
 - E. only 2 of triacylglycerols.

3. The number of NADPHs required for addition of one acetyl unit to a growing fatty acid chain is
 - A. 7
 - B. 2
 - C. 1
 - D. 5
 - E. 8

4. The citrate shuttle ultimately generates
 - A. citrate and NADPH in the cytosol.
 - B. acetyl CoA and NADPH in the cytosol.
 - C. acetyl CoA in the cytosol.
 - D. acetyl CoA and NADH in the cytosol.
 - E. NADH and NADPH in the cytosol.

5. Each cycle of β -oxidation in the degradation of palmitate yields
 - A. 2 NADPHs
 - B. 1 NADH and 1 FADH_2
 - C. 2 FADH_2 s
 - D. 1 NADPH and 1 FADH_2
 - E. 2 NADHs

6. Regulation of fatty acid β -oxidation is largely mediated by
 - A. feedback inhibition by acetyl CoA.
 - B. the extent of acetyl CoA utilization by fatty acid synthesis.
 - C. the extent of acetyl CoA utilization by the TCA cycle.
 - D. Repression of acyl CoA dehydrogenase by ketone bodies.
 - E. the amount of fatty acyl CoA.

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7. Triacylglycerol synthesis in adipose tissue
 - A. requires free glycerol.
 - B. cannot use free glycerol.
 - C. involves 2-monoacyl intermediates.
 - D. does not require activated fatty acids.
 - E. does not required energy.

8. The synthesis of phosphatidylcholine involves
 - A. phosphocholine.
 - B. CMP-choline.
 - C. UDP-choline.
 - D. UMP-choline.
 - E. 2-monoacylglycerol.

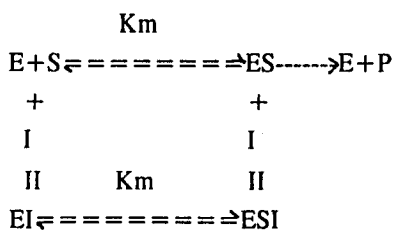
9. Phosphocholine is released from phosphatidylcholine by the action of
 - A. phospholipase A₁
 - B. phospholipase A₂
 - C. phospholipase C
 - D. phospholipase D
 - E. none of the above

10. Lipoxigenase enzymes are involved in the synthesis of
 - A. prostaglandins and thromboxanes
 - B. prostaglandins and HPETEs
 - C. thromboxznes and HETEs.
 - D. HPETEs and HETEs
 - E. Lipoxins.

二、選擇(單選,每題二分答錯倒扣0.5分)

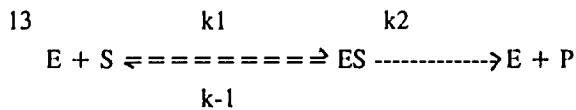
11. If the pyridoxal phosphate enzyme is treated with sodium borohydride (NaBH₄) and hydrolyzed with 6N HCl, the coenzyme is most likely covalently bound to which amino acid?
 - A. the NH₂ terminal amino acid.
 - B. the COOH terminal amino acid.
 - C. tyrosine
 - D. glutamine
 - E. lysine

12. If an inhibitor can interact with free enzyme as well as enzyme-substrate complex as shown in the diagram below



What type of inhibition could be observed with the inhibitor (I) ?

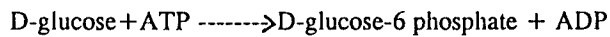
- A. Competitive inhibition.
- B. Noncompetitive inhibition.
- C. Uncompetitive inhibition.
- D. Heterotropic inhibition.
- E. Negative allosteric inhibition.



If the Michaelis-Menten equilibrium assumption could be applied to enzyme catalyzed reaction as shown above, the K_M in the Michaelis-Menten equation for the enzyme reaction is equal to :

- A. k_1
- B. k_{-1}
- C. k_2
- D. k_{-1}/k_1
- E. k_{-1}/k_2

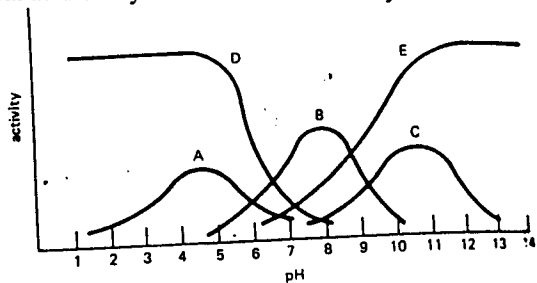
14. The enzyme which catalyzes the following reaction should be classified to what major classes of enzymes according to IUB naming system?



- A. Transferase
- B. Lyases
- C. Ligase
- D. Hydrolase
- E. Isomerase

15. An enzyme with aspartic acid residues participating in general acid catalysis would be most likely to have a pH-activity profile resembling:

- A. Curve A.
- B. Curve B.
- C. Curve C.
- D. Curve D.
- E. Curve E.



16. Which of the following statements of allosteric enzyme is incorrect?

- A. Allosteric enzymes are invariably multiple subunit proteins.
- B. The substrate binding V versus S curve gives a sigmoidal curve due to the homoallosteric effect.
- C. One of the physiological functions of allosteric enzyme is to regulate substrate levels to quite constant values.
- D. Most regulatory enzymes involved in the feedback control of the organisms are allosteric enzymes.
- E. The Lineweaver-Burk-plots corresponding to homoallosteric enzymes are linear in nature.

17. Which of the following compounds is essential in the biosynthesis of normal collagen molecule in mammalian?
- Vitamin K.
 - Pyridoxal phosphate .
 - Ascorbic acid.
 - Retinal.
 - Vitamin E.
18. Which of the following statements about serine proteases is incorrect?
- Most of serine proteases are evolutionary related.
 - There are always an aspartic acid residue, a histidine, and a serine in their active sites.
 - A tetrahedral transition state is formed between substrate and enzyme in the catalysis process.
 - An acyl enzyme intermediate formed in reaction with protein substrate in which carboxyl group of the N-terminal peptide is bound to the serine residue in the active site of the enzyme.
 - Diisopropylfluorophosphate irreversibly inhibits serine proteases by covalently bound to the histidine residue in the active site.
19. What is the effect of an uncompetitive inhibitor on the kinetics of an enzyme catalyzed reaction. (K_M app and V_{max} app are the kinetic constants obtained in the presence of the inhibitor.)
- K_M app $>$ K_M
 - V_{max} app $>$ V_{max} .
 - V_{max} app $>$ V_{max} , K_M app $<$ K_M
 - V_{max} app $<$ V_{max} , K_M app $>$ K_M
 - V_{max} app $<$ V_{max} , K_M app $<$ K_M
20. Pyridoxal phosphate is generally not involved in which of the following reactions?
- Glutamic acid + pyruvate----- α -ketoglutarate+ alanine
 - Serine ----- pyruvate + NH_3
 - Homocystine + methyl-FH₄ ----- methionine + FH₄
 - Glycine +succinyl-CoA----- δ -aminolevulinic acid
 - Glutamic acid----- γ -aminobutyric acid + CO₂
21. If the phosphorylation of ADP by creatine phosphate has a ΔG^0 of -1418 cal/mol. What is the K' eq of this reaction. ($R=1.987$ cal/mol.K, $T=310^{\circ}K$)
- 1
 - 0.1
 - 0.01
 - 0

22. The ΔG° of the reaction fructose-1,6-bisphosphate (FBP) \rightleftharpoons glyceraldehyde-3-phosphate (G3P) + dihydroxyacetone phosphate (DHAP) is +5.7 Kcal/mol. If the concentration of FBP is 0.5 M, G3P is 0.001 M, and DHAP is 0.005 M, ($R=1.987$ cal/mol.K, $T=310^{\circ}\text{K}$)

- A. the reaction will proceed from right to left.
- B. the reaction will proceed from left to right.
- C. the reaction is at equilibrium.
- D. the direction of the reaction cannot be predicted.
- E. none of the above.

23. Antimycin A

- A. allows pyruvate to be oxidized by mitochondria even in the absence of ADP.
- B. allows succinate to be oxidized by mitochondria even in the absence of ADP.
- C. inhibits oxidative phosphorylation when the substrate is pyruvate but not when the substrate is succinate.
- D. inhibits oxidative phosphorylation when the substrate is either pyruvate or succinate.
- E. none of the above.

三、擇選題(以下列方式選答,每題二分答錯倒扣0.5分)

- (A) if 1, 2 and 3 are correct.
- (B) if 1 and 3 are correct.
- (C) if 2 and 4 are correct.
- (D) if only 4 is correct.
- (E) if all four are correct.

24. Ketone bodies:

- 1. are formed by removal of CoA from the corresponding intermediate of β -oxidation.
- 2. are synthesized from cytoplasmic β -hydroxy- β -methylglutaryl coenzyme A.
- 3. are excellent energy substrates for liver.
- 4. include both β -hydroxybutyrate and acetoacetate, the ratio reflecting the intramitochondrial NADH/NAD⁺ ratio in liver.

25. Cholesterol synthesis

- 1. may be considered as a series of condensation reactions.
- 2. starts with acetyl CoA.
- 3. involves isopentenyl pyrophosphate intermediates
- 4. occurs in the mitochondria

26. The cholesterol present in LDL (low-density lipoproteins):

- 1. binds to a cell receptor and diffuses across the cell membrane
- 2. when it enters a cell, suppresses the cell's cholesterol synthesis by inhibiting HMG CoA reductase.
- 3. once in the cell is converted to cholesterol esters by LCAT (lecithin-cholesterol acyl transferase)
- 4. once it has accumulated in the cell, inhibits the replenishment of LDL receptors.

27. The effect of a high carbohydrate diet on the intracellular levels of the fatty acid synthase complex is believed to be mediated by
1. increased degradation of fatty acid synthase
 2. feed back inhibition
 3. a cAMP-mediated phosphorylation/dephosphorylation regulatory mechanism.
 4. increased synthesis of fatty acid synthase.
28. Lipids are especially suited for energy storage because they
1. are highly reduced.
 2. generally represent a large proportion of the dietary intake.
 3. are nonreactive substances.
 4. are usually less reduced than carbohydrate.
29. The free energy of a reaction is
1. a measure of the energy available for doing works when the concentrations of reactants and products are 1 M.
 2. dependent on the presence of a catalyst.
 3. the activation energy.
 4. dependent on the concentrations of reactants and products.
30. Which of the following sugars can undergo mutarotation?
1. Glycogen
 2. Lactose
 3. Sucrose
 4. Maltose
31. If oligomycin is added to tightly coupled mitochondria that are actively oxidizing succinate:
1. electron flow and ATP synthesis won't be affected.
 2. electron flow will continue, but ATP synthesis will cease.
 3. subsequent addition of 2,4-dinitrophenol will restore ATP synthesis.
 4. subsequent addition of 2,4-dinitrophenol will restore electron flow.
32. NADH dehydrogenase
1. contains a tightly bound prosthetic group, FMN.
 2. is associated with nonheme iron and sulfur.
 3. is a flavoprotein.
 4. contains noncovalently bound NAD.

33. Which of the following amino acids is involved in the O-glycosidic linkages between oligosaccharides and proteins?

1. Asparagine
2. Serine
3. Tryptophan
4. Threonine

34. α -D-Glucose

1. is an epimer of α -D-galactose.
2. is an epimer of α -D-mannose.
3. is an anomer of β -D-glucose.
4. is a constituent of glycogen.

35. Proteoglycans

1. are largely composed of carbohydrates.
2. are composed of random sequences of disaccharides.
3. include both heparin and hyaluronic acid.
4. are polycations.

四、簡答題

36. A solution containing aspartic acid (PI=2.88) glycine (PI=5.97), threonine (PI=6.53), leucine (PI=5.98) and lysine (PI=9.74) in a pH3.0 citrate buffer was applied to a Dowex-50 cation-exchange column equilibrated with the same buffer. The column was then elute with the buffer and fractions collected. In what order will the five amino acids elute from the column? (2%)

37. What are the relative electrophoretic mobilities of glycine, leucine, aspartic acid, glutamic acid and lysine at pH 4.70 ? (2%)

38. Partial hydrolysis of a protein yield a number of polypeptides, one of them was purified. Deduce the sequence of amino acids in this polypeptide from the following information. (3%)
- A. complete acid hydrolysis yield ala + arg + 2 ser + lys + phe + met + trp + pro
 - B. treatment with fluorodinitrobenzene (FDNB, the sanger reagent) followed by complete acid hydrolysis yield dinitrophenylalanine (DNP-ala) and ϵ -dinitrophenyllysine (ϵ -DNP-lys) as the only DNP derivatives.
 - C. neither carboxypeptidase A nor carboxypeptidase B released a C-terminal amino acid.
 - D. treatment with cyanogen bromide (CNBr) yielded two peptides, one contained ser + trp + pro. The other contained all the remaining amino acid (including the second ser)
 - E. treatment with chymotrypsin yield three peptides, one contained only ser + trp, another contained only met + trp. The third contained phe + lys + ser + arg + ala
 - F. treatment with trypsin yield three peptides, one contained only ala + arg, another contained only lys + ser. The third contained phe + trp + met + ser + pro
39. Muscle glycogen phosphorylase a electe from a calibrated biogel P-300 column at a position corresponding to a MWt of 360,000 SDS gel electrophoresis suggested a MWt of 90,000. A microbiological assay on an enzymatically hydrolyzed sample of phosphorylase a disclosed the presence of 1.86 μ g of pyridoxal (MWt=167.2) per milligram of protein. What conclusion can be drawn about the structure of phosphorylase a ? (2%)
40. Which of the following sets of three amino acids and probably clustered within a protein ? (2%)
- (1) asn, gly, lys
 - (2) met, asp his
 - (3) phe, val, Ile
 - (4) tyr, ser, lys
 - (5) ala, arg, pro
41. Why do most enzymes lose activity if dissolved in distilled water ? (2%)
42. (A). What is the structure of polyarginine at pH7 (1%)
(B). How might the structure be changed (1%)

43. The pK of amino acid depends in part on its environment, predict the effect of the following environmental change on the pK of a glutamic acid side chain (3%)
- A. A lysine side chain is brought into close proximity.
 - B. The terminal carboxyl group of the protein is brought into close proximity.
 - C. The glutamic acid side chain is shifted from the outside of the protein to a nonpolar site inside
44. If two substances are found whose absorption spectra are identical and whose CD (circular dichroism) curves are identical except that one curve is positive and the other negative. What can probably be said about the structural relation between the two substances? (2%)
45. You have just purified a DNA molecule from eucaryotic cells, and wish to determine whether it is circular single-strand DNA (ssDNA) or circular double-strand DNA (ds DNA). Describe two methods that can distinguish circular ssDNA from circular ds DNA. (4%)
46. Mutant that fail to synthesize a substance A have been found in five complementation groups, none of which are cis-acting, How many proteins are required to synthesize A? (2%)
47. Describe a protocol for constructing and isolating a hybrid plasmid containing the gene for E. coli DNA polymerase I? (4%)

五、解釋下列名詞(每題二分)

- 48. Alu repeats in human genome
- 49. U1 snRNA in transcription
- 50. Nucleosome in chromatin
- 51. Chromosome walking
- 52. Catenation