

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(均為單選,每題1分,答錯倒扣0.25分)

Properties of lipids.

1. Which of the following is an essential fatty acid?

- A. Oleic acid.
- B. Linoleic acid.
- C. Palmitoleic acid.
- D. Stearic acid.
- E. Palmitic acid.

2. Which of the following is not a phospholipid?

- A. Cerebroside.
- B. Plasmalogen.
- C. Sphingomyelin.
- D. Cephalin.
- E. Lecithin.

3. The depot fat of mammalian tissues consists largely of

- A. glycolipids.
- B. cholesterol esters.
- C. cholesterol.
- D. phospholipids.
- E. triglycerides.

4. A biological membrane which contains more unsaturated fatty acids

- A. has a higher melting point.
- B. has a higher density of packing in a monolayer.
- C. has a greater fluidity.
- D. has a higher PK.
- E. none of above.

5. Cholesterol is transported in the blood mainly by

- A. chylomicra.
- B. albumin.
- C. VLDL.
- D. LDL.
- E. HDL.

6. α -D-Glucose

- A. is an acetal in the ring form.
- B. has three asymmetric carbon atoms.
- C. is an epimer of α -D-mannose.
- D. is an anomer of β -D-galactose.
- E. none of the above.

7. Sucrose

- A. can undergo mutarotation.
- B. is not a reducing sugar because carbon 1 of the fructose residue forms a glycoside with glucose.
- C. is a reducing sugar because carbon 1 of the glucose residue is free.
- D. contains glucose and galactose.
- E. none of the above.

8. The free energy change for a given reaction

- A. can determine how rapidly the reaction will proceed.
- B. is altered by the presence of an enzyme which catalyzes the reaction.
- C. is dependent on the concentration of the reactants and products.
- D. is one when the reaction is at equilibrium.
- E. none of the above.

9. The side chain cleavage of cholesterol is a rate limiting step in steroid biosynthesis. Where is the side chain cleavage enzyme located?
- A. Cell membrane.
 - B. Cytosol.
 - C. Mitochondria.
 - D. Nucleus.
 - E. none of above.
10. Receptors for steroid hormone are mainly located
- A. on cell membrane.
 - B. in cytosol.
 - C. in nucleus.
 - D. on mitochondrial membrane.
 - E. none of above.
11. Peptide hormones carry out their function by stimulating the phosphorylation of a
- A. specific protein.
 - B. nucleic acid.
 - C. lipid molecule.
 - D. carbohydrate molecule.
 - E. nonspecific enzyme.
12. Which carbon of the androgen molecule is involved in the aromatizing reaction that is a necessary step for the formation of estrogen?
- A. C-16.
 - B. C-17.
 - C. C-18.
 - D. C-19.
 - E. C-20.
13. AMV reverse transcriptase require a template of
- A. DNA.
 - B. RNA.
 - C. both DNA and RNA.
 - D. either DNA or RNA.
 - E. none of the above.
14. Which of the following substances increases the T_m of duplex DNA?
- A. Formamide
 - B. NaCl
 - C. Distilled water
 - D. Urea
 - E. Methanol
15. Which of the following enzymes can be used to distinguish between the single-stranded linear and single-stranded circular DNA
- A. Pancreas deoxyribonuclease (DNase I)
 - B. Thymus deoxyribonuclease (DNase II)
 - C. DNA polymerase I
 - D. DNA polymerase III
 - E. Venom phosphodiesterase

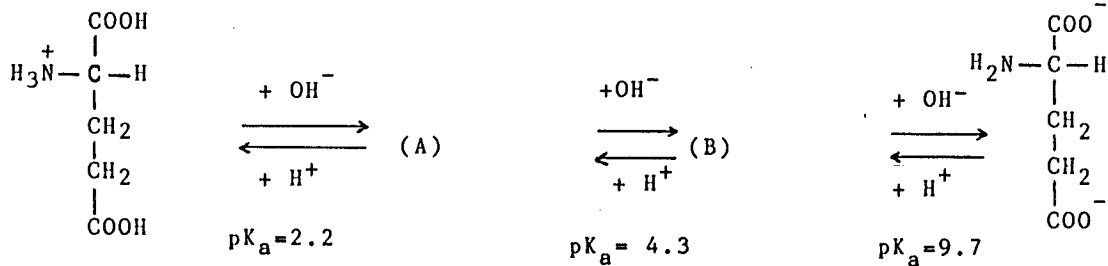
二. 選擇題 (均為單選, 每題 2 分, 答錯倒扣 0.5 分)

16. Which of the following statements about messenger RNA is INCORRECT?
mRNA
- A. binds amino acids for incorporation into protein.
 - B. is bound by ribosome.
 - C. has a poly(A) tail consisting of 10 to 20 nucleotide.
 - D. is the precursor for transfer RNA.
 - E. has a 7-methylguanosine at the 5'-end of the chain.
17. An INCORRECT statement associated with the Z-form structure of DNA is
- A. the strands of the double helix are antiparallel.
 - B. only a single groove in the helix.
 - C. 12 base pairs-per turn of the helix.
 - D. the helix formed by the two polynucleotide chain is right handed.
 - E. the centers of the bases are 3.7Å apart and produce a complete turn of a helix with a pitch of 45Å.
18. What region is common to most prokaryotic promoters?
- A. TATA box
 - B. CAAT box
 - C. Pribnow box
 - D. Homeo box
 - E. High G-C content
19. Which of the following statements about the repressor of the lac operon is INCORRECT?
- A. It is the gene product of the regulator gene.
 - B. It binds to the operator region of the DNA of the lac operon.
 - C. It blocks the transcription of structural genes.
 - D. It combines with allolactose, and the combination will not bind to the operator.
 - E. It binds allolactose, preventing the sugar derivative from activating transcription.
20. Which enzyme is defective in human disease SERODERMA PIGMENTOSUM?
- A. DNA polymerase I
 - B. Photoreactivating enzyme
 - C. DNA ligase
 - D. Base-N-glycosylase
 - E. Endonuclease
21. The biosynthesis of heme requires:
- A. Succinyl CoA, propionic acid and ferric ion.
 - B. Glycine, succinyl CoA and ferric ion.
 - C. Alanine, succinyl CoA and ferrous ion.
 - D. Glycine, propionyl CoA and ferrous ion.
 - E. Glycine, succinyl CoA and ferrous ion.

三. 簡答題

22. (2%) The dissociation of oxygen from oxyhemoglobin is affected by many factors. List four major factors.

23. (2%) The following equations represent the ionic forms of glutamic acid.



- (a) Fill in the ionic forms in A and B shown in the equations.
 (b) What is the isoelectric point of glutamic acid?

24. (3%) The molecular weight of a protein is found to be 85,000 daltons. Upon treatment with sodium dodecyl sulfate followed by gel electrophoresis, two bands are found, one with a molecular weight of 25,000 and another of 35,000 daltons. Treatment of the protein with 2-mercaptoethanol followed by gel electrophoresis in the presence of sodium dodecyl sulfate produced three bands with molecular weight of 25,000, 20,000 and 15,000 daltons. Propose a structure which is consistent with these data.

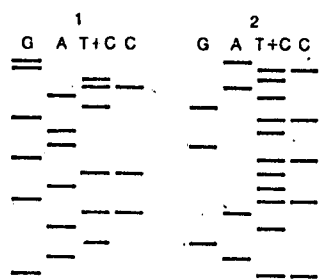
25. (2%) What type of mutation is induced by acridines?

26. (2%) If a DNA molecule contain 21%A, what percent G does it contain?

27. (3%) Indicate two features of SOS repair that distinguish it from all other repair system.

28. (4%) Ribonuclease has 104 amino acid residues in a single polypeptide chain and contains four disulfide bonds. This protein is completely unfolded by cleaving the four disulfide bonds followed by treatment with 8M urea. If the urea is now removed by dialysis and the disulfide cross-links allowed to reform under controlled conditions, 95-100% of the activity is recovered. This is considerably higher than the activities predicted if the disulfide bonds were formed by completely random pairing of the cystine residues. Provide an explanation for this observation.
29. (4%) Show how ATP is produced in the mitochondria for use in the cytosol assuming the chemiosmotic hypothesis.
30. (4%) Briefly describe the characteristics of the fluid mosaic model.
31. (4%) Predict the oxidation-reduction states of NAD, flavoproteins, ubiquinone, cytochrome b, cytochrome C₁, cytochrome C, and cytochrome aa₃ in respiring mitochondria after the addition of A) antimycin A, and B) cyanide.

32. (5%) Describe the steps required for sequencing a 17 base pair DNA duplex by the maxam-Gilbert procedure. If the figure below shows the data you have got, what are the complete sequences of the two complementary strands. (panels 1 and 2 correspond to the two complementary strands)



33. (5%) The intracellular concentration of inorganic phosphate is about $10^{-2}M$, the ATP/ADP ratio in the cell is about 10. Assuming that the ΔG° of ATP hydrolysis is -7.3 kcal/mol at $37^{\circ}C$ and $pH7.0$. Calculate the $\Delta G'$ of hydrolysis of ATP under these steady state conditions and explain in your own words what this value means. $R=1.987$ cal/k.mol.
34. (5%) Explain how the deficiency of Vitamin B_{12} will lead to a accompanying folate deficiency.
35. (6%) Describe with examples the type of bonding used in the primary, secondary and tertiary structure of a protein.
36. (6%) Explain briefly the molecular basis of the sickle cell anemia.
37. (6%) In response to effector metabolites, some regulatory enzymes alter their k_{cat} whereas others change their apparent K_M for substrate. Describe general metabolic situations in terms of substrate levels (concentration) for which
- the first type of regulatory enzyme clearly would be better suited than the second and
 - the second clearly would be better suited than the first.
38. (10%)
- For an enzyme that obeys simplex Michaelis-Menten kinetics, what is the V_{max} in μ moles/min if $v=40$ μ mol/min when $[S]=K_M$?
 - What is the K_M of this enzyme if $v=50$ μ mol/min when $[S]=2.5 \times 10^{-5}M$?
 - If I is a competitive inhibitor of the enzyme with a K_I of $4 \times 10^{-5}M$ what will be the value of v when $[S]=3 \times 10^{-5}M$ and $[I]=2.0 \times 10^{-5}M$.