

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, 每題二分, 答錯倒扣0.5分)

1. The pK values for histidine are 1.8, 6.0 and 9.2
The PI is
 - A. 3.9
 - B. 5.5
 - C. 6.0
 - D. 7.6
 - E. 9.2
2. Land animals can cool themselves by surface evaporation with minimum expenditure of body fluid. This is due mainly to which of the following properties of water?
 - A. High heat capacity
 - B. High heat of fusion
 - C. High heat of evaporation
 - D. High density of water
 - E. High dielectric constant
3. In proteins under normal physiological conditions (near pH=7), the side chains of which two amino acids are almost entirely positively charged?
 - A. Glutamic acid and lysine
 - B. Arginine and histidine
 - C. Tyrosine and serine
 - D. Lysine and arginine
 - E. Proline and cysteine
4. The most important buffer in extracellular fluid is
 - A. phosphate
 - B. protein
 - C. bicarbonate
 - D. chloride
 - E. sulfate
5. Proteins may be separated according to size by
 - A. ion-exchange chromatography
 - B. molecular exclusion chromatography
 - C. affinity chromatography
 - D. reverse-phase high performance liquid chromatography
 - E. isoelectric focusing
6. When protein subunits combine to form a quaternary structure, all of the following interactions may arise EXCEPT
 - A. hydrogen bonding
 - B. hydrophobic interaction
 - C. electrostatic bonding
 - D. van der waals forces
 - E. peptide bond formation
7. Which of the following has quaternary structure?
 - A. Cytochrome C
 - B. Myoglobin
 - C. Insulin
 - D. Hemoglobin
 - E. Immunoglobulin G

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8. Denaturation of proteins
- A. results from the disruption of their primary structure.
 - B. is always reversible.
 - C. is caused by heating or exposure to extremes of pH.
 - D. refers to the cleavage of peptide bonds by strong acid.
 - E. refers to the cleavage of disulfide bonds by detergents.
9. When the difference between pH and pK' ($pH-pK'$) is 2, the ratio of concentration of conjugate base to conjugate acid is
- A. 0.01
 - B. 0.1
 - C. 10
 - D. 100
 - E. 1000
10. Can exist as four optically active isomers.
- A. isoleucine
 - B. glycine
 - C. cystine
 - D. glutamine
 - E. glutamic acid
11. Triacylglycerols:
- A. are stored as hydrated molecules.
 - B. are generally negatively charged molecules at physiological pH.
 - C. in the average individual, represent sufficient energy to sustain life for several weeks.
 - D. yield about the same amount of ATP on complete oxidation as would an equivalent weight of glycogen.
12. Fatty acids occurring in humans most commonly:
- A. are not straight chain.
 - B. have double bonds present in trans configuration.
 - C. contain an even number of carbon atoms.
 - D. do not contain more than 16 carbon atoms.
13. A deficiency of carnitine might be expected to interfere with
- A. β -oxidation
 - B. ketone body formation from acetyl CoA.
 - C. palmitate synthesis.
 - D. uptake of fatty acids into cells from the blood.
14. β oxidation of fatty acids:
- A. is controlled primarily by allosteric effectors.
 - B. has the potential to generate ATP even if acetyl CoA is not subsequently oxidized.
 - C. can not use odd-chain and unsaturated fatty acid as substrates.
 - D. uses $NADP^+$.
15. Polyunsaturated fatty acids:
- A. can not be synthesized by humans.
 - B. are important in determining fluidity of membranes.
 - C. have no known functions other than as membrane components.
 - D. are not susceptible to autooxidation.

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16. Sphingomyelins differ from the other sphingolipids in that they are:
- not based on a ceramide core.
 - acidic rather than neutral at physiological PH.
 - not amphipathic
 - the only types that are phospholipids.
17. The direct effect of cAMP in the protein kinase A pathway is to:
- activate adenylate cyclase
 - phosphorylate certain cellular proteins.
 - phosphorylate protein kinase A.
 - dissociate regulatory subunits from protein kinase.
18. Activation of phospholipase C initiates a sequence of events including all of the following EXCEPT:
- release of inositol 4,5-bisphosphate from a phospholipid.
 - increase in intracellular Ca^{+2} concentration.
 - release of diacylglycerol from a phospholipid.
 - activation of protein kinase C.
19. With the anterior pituitary hormones, TSH, LH, and FSH
- the α subunits are all different
 - the β subunit alone can bind to the receptor.
 - the β subunits are specially recognized by the receptor.
 - intracellular receptors bind these hormones.
20. Receptors for steroid hormones are found in the
- cytoplasm & nucleus.
 - cell membrane
 - ribosomes
 - golgi apparatus

二. 選擇題 (複選, 每題二分, 答錯倒扣0.5分)

Answer questions 21-24 according to the following key.

- if 1,2, and 3 are correct.
 - if 1 and 3 are correct.
 - if 2 and 4 are correct.
 - if only 4 is correct
 - if all are correct.
21. When electrons pass from succinate through $FADH_2$ and the electron transport system to oxygen, which of the following statements is (are) true?
- P:O ratio is 2.
 - Coenzyme Q is involved.
 - Site I of ATP synthesis is bypassed.
 - NADH dehydrogenase is reduced and reoxidized.
22. Heparin is a
- glycolipid
 - high molecular weight, negatively charged proteoglycan.
 - a constituent of connective tissue ground substance.
 - polymer which contains repeating disaccharide of sulfated glucuronate and sulfated glucosamine.

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23. Which of the following sugars can undergo mutarotation in solution?

1. Fructose
2. Maltose
3. Glucose
4. Sucrose

24. Regarding to the mitochondrial electron transport chain, which of the following statements is (are) true?

1. Rotenone inhibits oxidative phosphorylation when the substrate is succinate but not pyruvate.
2. Azide inhibits electron transport and proton pumping at site 1.
3. Carbon monoxide inhibits electron transport and proton pumping at site 2.
4. Atractyloside inhibits the exchange of ATP and ADP across the inner mitochondrial membrane.

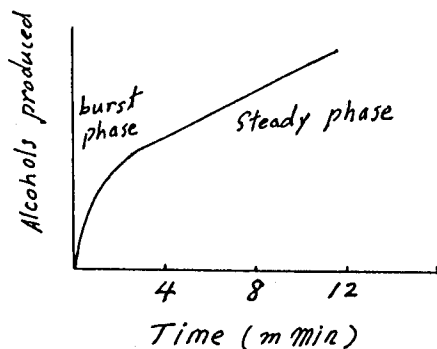
三. 簡答題

25. The normal concentrations of glucose-6-phosphate (G-6-P) and fructose-6-phosphate (F-6-P) in human erythrocytes are $1 \times 10^{-5} \text{M}$ and $1 \times 10^{-6} \text{M}$, respectively. If the free energy change (ΔG) for the reaction $\text{G-6-P} \rightarrow \text{F-6-P}$ is -1.0 Kcal/mol , calculate the standard free energy change (ΔG°) for this reaction. ($R=1.987 \text{ cal/mol.K}$, $T=310\text{K}$) (4%)

26. If the hydrolysis of ATP has $K'_{eq}=1 \times 10^5$, and the phosphorylation of glucose by P_i to form glucose-6-phosphate has $K'_{eq}=0.01$, calculate the K'_{eq} of the phosphorylation of glucose by ATP. (4%)

27. The addition of dinitrophenol to mitochondria increases the rate of substrate oxidation even in the absence of ADP. Give an explanation according to the chemiosmotic hypothesis. (4%)

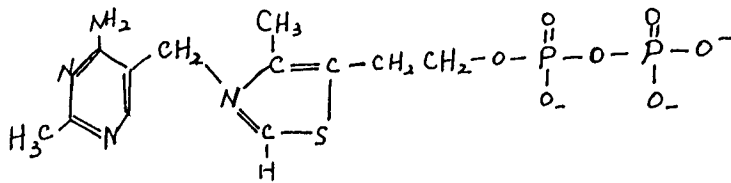
28. Two phases in the formation of alcohols following mixing a serine proteinase and an ester as substrate are observed in the following plot. Give a brief explanation for the two-phase reaction kinetics. (5%)



29. The urease catalyzes the hydrolysis of urea to ammonia plus carbon dioxide. At 21°C the uncatalyzed reaction has an activation energy of about 125 KJ/mol , whereas in the presence of urease this is lowered to about 51.7 kJ/mol . By what factor does urease increase the velocity of the reaction? $K = e^{-\frac{E_a}{RT}}$. R (gas constant) = $8.314 \text{ J mol}^{-1}\text{K}^{-1}$. (5%)

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30. Briefly describe the allosteric transitions of hemoglobin in reaction with oxygen molecules using concerted models of Monod, Wyman, and Changeux. (5%)
31. Describe the mechanism of action of thiamine pyrophosphate in pyruvate decarboxylase reaction. The structure of thiamine pyrophosphate is given as below. (5%)



32. How did the discovery of dimeric transcription factors help explain the functioning of enhancers, which are located some distance away from the genes they influenced? (3%)
33. As a general rule, RNA virus accumulate mutations at a more rapid rate than DNA virus, propose a hypothesis to explain this observation. (3%)
34. Describe the RNA sequence and transacting factors that are involved in slicing. (6%)
35. Describe the following terms: (8%)
- (A) DNA polymerase alpha
 - (B) DNA polymerase delta
 - (C) Autonomous replicating sequence
 - (D) telomere