

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，答案錯倒扣0.5分)

1. Although both enzymes and inorganic catalysts can catalyze chemical reactions, but they are different because enzymes:
  - A. decrease the activation energy of the reaction.
  - B. could not affect the equilibrium point of the reaction.
  - C. form complex with the reactants.
  - D. have specificity toward a single reactant.
  - E. are not utilized in the reaction.
  
2. Both water and glucose contain -OH group which can be phosphorylated with ATP catalyzed by hexokinase. However, glucose is much more reactive than water, why?
  - A. Glucose has more -OH groups per molecule than does water.
  - B. Glucose binds better to the enzyme and induces a conformational change in hexokinase that brings active site into position.
  - C. Water normally will not reach the active site because it is hydrophobic.
  - D. Water and ATP compete for the enzyme.
  - E. Glucose is bigger than water.
  
3. A molecule inhibits enzyme activity by binding to a site other than the catalytic site is called:
  - A. a competitive inhibitor.
  - B. an allosteric inhibitor.
  - C. a stereospecific agent.
  - D. a noncompetitive inhibitor.
  - E. a transition-state analog.

4. The  $K_m$  for the following set of data is \_\_\_\_\_

	Substrate concentration ( $\mu\text{M}$ ),	Initial velocity ( $\mu\text{mol}/\text{min}$ )
A.	1	25
B.	2	49
C.	8	178
D.	50	320
E.	100	350
	1000	355
	5000	352

5. The  $\Delta G^\circ$  for reaction  $A \rightarrow B$  is  $-30\text{kJ}/\text{mol}$ . The reaction is started with 20 mmol of A; no B is initially present. After 24 hours, analysis reveals the presence of 4 mmol of B, 16 mmol of A. Which is the most likely explanation?
- A. A and B have reached equilibrium concentrations.
  - B. Formation of B is thermodynamically unfavorable.
  - C. The result described is impossible, given the fact that  $\Delta G^\circ$  is  $-30\text{kJ}/\text{mol}$ .
  - D. B formation is kinetically slow; equilibrium has not been reached by 24 hours.
  - E. An enzyme has shifted the equilibrium toward A.
6. If the equilibrium constant for the reaction ( $A+B \rightarrow C+D$ ) is a large number, what will be the standard free energy change for the reaction?
- A. A small, negative value.
  - B. A large, negative value.
  - C. A small, positive value.
  - D. A large, positive value.
  - E. zero.

7. Oxidation-reduction reactions always involve:
- A. transfer of hydrogens.
  - B. formation of water.
  - C. mitochondria.
  - D. transfer of electrons.
  - E. transfer of oxygens.
8. The conversion of one mole of fructose-1,6-bisphosphate to two moles of pyruvate by the glycolytic pathway results in a net formation of:
- A. one mole of NAD<sup>+</sup> and two moles of ATP.
  - B. one mole of NADH and one mole of ATP.
  - C. two moles of NADH and two moles of ATP.
  - D. two moles of NADH and four moles of ATP.
  - E. two moles of NAD<sup>+</sup> and four moles of ATP.
9. If fructose labeled with <sup>14</sup>C at C-1 were metabolized in the liver, the first radioactive pyruvate formed would be labeled in:
- A. C-1.
  - B. C-2.
  - C. C-3.
  - D. C-1 and C-3.
  - E. C-1, C-2, and C-3.
10. Epinephrine triggers an increase rate of glycogen breakdown in muscle by causing:
- A. activation of hexokinase.
  - B. activation of phosphofructokinase-1.
  - C. conversion of glycogen phosphorylase b to glycogen phosphorylase a.
  - D. the pasteur effect.
  - E. none of the above.

11. Which of the following is not required for the oxidative decarboxylation of pyruvate to form acetyl-CoA?
- NAD<sup>+</sup>.
  - lipoic acid.
  - ATP.
  - CoA-SH.
  - FAD.
12. Oxidation of one mole of acetyl-CoA via the citric acid cycle results in :
- production of one mole of citrate.
  - consumption of one mole of oxaloacetate.
  - production of 7 moles of ATP.
  - production of 2 moles of CO<sub>2</sub>.
  - production of one mole of succinate.
13. Entry of acetyl-CoA into the citric acid cycle is decreased when:
- the ratio of [ATP] / [ADP] is high.
  - [AMP] is high.
  - the ratio of [NAD<sup>+</sup>] / [NADH] is high.
  - NADH is rapidly oxidized through the respiratory chain.
  - none of the above.
14. Free fatty acids in the bloodstream are:
- bound to hemoglobin.
  - present at levels that are independent of epinephrine.
  - carried by the protein serum albumin.
  - freely soluble in the aqueous phase of the blood.
  - bound to a nonprotein component.
15. Transport of fatty acids from the cytoplasm to the mitochondrial matrix requires:
- ATP, coenzyme A, and hexokinase.
  - ATP, carnitine, and coenzyme A.
  - carnitine, coenzyme A, and hexokinase.
  - ATP, carnitine, and pyruvate dehydrogenase.
  - ATP, coenzyme A, and pyruvate dehydrogenase.



16. The removal of two carbon units from a long chain fatty acid by  $\beta$ -oxidation will result in the net formation of:
- A. 1 FADH<sub>2</sub> and 1 NADH.
  - B. 2 FADH<sub>2</sub> and 2 NADH.
  - C. 1 FADH<sub>2</sub> and 1 NADPH.
  - D. 2 FADH<sub>2</sub>, 2 NADH and 1 ATP.
  - E. 1 FADH<sub>2</sub>, 1 NADH and 1 ATP.
17. In which of the following reactions the pyridoxal phosphate is involved as a cofactor?
- A. Methylation.
  - B. Acetylation.
  - C. Reduction.
  - D. Desulfuration.
  - E. Transamination.
18. If a person's urine contains unusually high concentrations of urea, which of the following diets has he or she probably been eating recently?
- A. very high carbohydrate, very low protein.
  - B. very low carbohydrate, very high protein.
  - C. very high fat, very low protein.
  - D. very high fat, high carbohydrate, no protein.
  - E. very high fat, high carbohydrate, low protein.
19. An enzyme used in both glycolysis and gluconeogenesis is:
- A. hexokinase.
  - B. glucose-6-phosphatase.
  - C. 3-phosphoglycerate kinase.
  - D. phosphofructokinase-1.
  - E. pyruvate kinase.

20. Which of the following compounds cannot serve as the starting material for the synthesis of glucose via gluconeogenesis?
- A. glycerol.
  - B.  $\alpha$ -ketoglutarate.
  - C. acetate.
  - D. oxaloacetate.
  - E. lactate.
21. Which of the following is true of glycogen synthesis and breakdown?
- A. Synthesis is catalyzed by the same enzyme that catalyzes breakdown.
  - B. The immediate product of glycogen breakdown is free glucose.
  - C. Phosphorylation activates the enzyme responsible for breakdown, and inactivates the synthetic enzymes.
  - D. Under normal circumstances glycogen synthesis and glycogen breakdown occur simultaneously and at high rates.
  - E. The glycogen molecule "grows" at its reducing end.
22. Glucagon (in liver) and epinephrine (in muscle):
- A. activate glycogen phosphorylase and inactivate glycogen synthase.
  - B. inhibit glycogen synthesis and activate glycogenolysis.
  - C. act by raising the concentration of cyclic AMP.
  - D. oppose the effects of insulin on these tissues.
  - E. do all of the above.
23. The rate-limiting step in fatty acid synthesis is:
- A. formation of acetyl-CoA from acetate.
  - B. the reaction catalyzed by acetyl-CoA carboxylase.
  - C. condensation of acetyl-CoA and malonyl-CoA.
  - D. the reduction of acetoacetyl group to a  $\beta$ -hydroxybutyryl group.
  - E. formation of malonyl-CoA from malonate and coenzyme A.

24. In comparing fatty acid synthesis with  $\beta$ -oxidation of fatty acids, which of the following statements is incorrect?
- A. Fatty acid degradation is catalyzed by cytosolic enzymes; fatty acid synthesis by mitochondrial enzymes.
  - B. A thioester derivative of crotonic acid( trans-2-butenoic acid) is an intermediate in the synthetic path, but not in the degradative path.
  - C. A thioester derivative of D- $\beta$ -hydroxybutyrate is an intermediate in synthetic path, not in the degradative path.
  - D. The condensation of two moles of acetyl-CoA in the presence of a crude extracts is more rapid in bicarbonate buffer than in phosphate buffer at the same pH; the cleavage of acetoacetyl-CoA proceeds equally well in either buffer.
  - E. fatty acid biosynthesis uses exclusively NADPH, whereas  $\beta$ -oxidation uses exclusively  $\text{NAD}^+$ .
25. All glycerol-containing phospholipids are synthesized from:
- A. mevalonate.
  - B. gangliosides.
  - C. ceramide.
  - D. phosphatidic acid.
  - E. glycerol.
26. Which of the following amino acids is not essential in the diet of humans?
- A. lysine.
  - B. phenylalanine
  - C. valine.
  - D. threonine.
  - E. proline.
27. The hormones epinephrine and norepinephrine are derived biosynthetically from:
- A. tyrosine.
  - B. histidine.
  - C. tryptophan.
  - D. arginine.
  - E. isoleucine.

28. An energy source generally not used by brain tissue is:
- A. fatty acids.
  - B. glucose.
  - C. ketone bodies.
  - D. amino acids.
  - E. all of the above are used as fuels.
29. In skeletal muscle:
- A. large quantities of triacylglycerol are stored as fuel.
  - B. phosphocreatine can substitute for ATP as the source of energy for muscle contraction.
  - C. stored muscle glycogen can be converted to glucose and released to replenish blood glucose.
  - D. at rest, fatty acids are the preferred fuel.
  - E. at rest, ketone bodies are the preferred fuel.
30. When blood glucose is abnormally high, the pancreas releases:
- A. insulin.
  - B. glucagon.
  - C. epinephrine.
  - D. trypsin.
  - E. glucose.
31. When inositol-1,4,5-triphosphate ( $IP_3$ ) binds to its specific intracellular receptor:
- A. a phospholipase in the plasma membrane is activated.
  - B.  $Ca^{++}$  is released from the endoplasmic reticulum into the cytosol.
  - C. GTP replaces GDP on a Gs protein.
  - D. the intracellular concentration of cAMP rises.
  - E. there is no intracellular receptor for  $IP_3$ .
32. All of the oxidative steps of the citric acid cycle are linked to the reduction of  $NAD^+$  except:
- A. isocitrate dehydrogenase.
  - B. malate dehydrogenase.



- C.  $\alpha$ -ketoglutarate dehydrogenase complex.  
D. succinate dehydrogenase.  
E. all of the above are linked to the reduction of  $\text{NAD}^+$ .
33. In eukaryotic cells, the enzymes of glycolysis are in the \_\_\_\_\_, and the enzymes of the citric acid cycle are in the \_\_\_\_\_.
- A. inner mitochondrial membrane; mitochondrial matrix.  
B. cytosol; mitochondrial matrix.  
C. mitochondrial matrix; cytosol.  
D. cytosol; inner mitochondrial membrane.  
E. inner mitochondrial membrane; cytosol.
34. Which of the following statements about energy conservation in the mitochondrion is CORRECT.
- A. for oxidative phosphorylation to occur, it is not essential to have a closed membranous structure with an inside and an outside.  
B. The yield of ATP per mole of oxidizable substrate is constant regardless of which substrate is oxidized.  
C. Any drug that inhibits the ATP synthase will not inhibit the flow of electrons down the chain of carriers.  
D. Uncouplers (such as dinitrophenol) have exactly the same effect on electron transfer as inhibitors such as cyanide; both block further electron transfer to oxygen.  
E. All of the above are correct.
35. The enzyme system for adding double bonds to saturated fatty acids requires all of the following EXCEPT:
- A. molecular oxygen.  
B. cytochrome  $b_5$   
C. ATP.  
D. NADPH.  
E. a mixed-function oxidase.

B. Short-answers questions.(10% each)

1. Compare the efficiency of energy production in diabetic patients and in normal person.
2. Acetyl-CoA labeled with  $^{14}\text{C}$  in both of its acetate carbons atoms is incubated with unlabeled oxaloacetate and a crude tissue preparation capable of carrying out the reactions of the citric acid cycle. Trace the  $^{14}\text{C}$  label in oxaloacetate molecule after one turn of the cycle.
3. What is respiratory control in mitochondria? What is the purpose of this control mechanism?