

請依題目順序,將答案寫在答案紙上。

一. 填充題 (每題二分)

1. The product of anaerobic glycolysis, lactate, is produced in the \_\_\_\_\_ tissue of animals.
2. The complete oxidation of pyruvate occurs in the \_\_\_\_\_.
3. In the presence of aldolase, D-glyceraldehyde-3-phosphate and dihydroxyacetone phosphate are converted to \_\_\_\_\_.
4. In the TCA cycle, oxidative decarboxylation of  $\alpha$ -ketoglutarate produces \_\_\_\_\_.
5. Unbranched fatty acids with an odd number of carbon atoms are usually converted, after  $\beta$ -oxidation, to \_\_\_\_\_.
6. Micelles are small, essentially spherical aggregates of lipid in which hydrophobic regions are on the inside and hydrophilic regions are on the outside. During digestion and absorption they are first observed in the \_\_\_\_\_.
7. An enzyme located on the outer mitochondrial membrane rather than the inner mitochondrial membrane is \_\_\_\_\_.
8. The transfer of ADP to ATP across the mitochondrial membrane involves a transfer of one ADP in for each ATP that comes out, this type of phenomena is called \_\_\_\_\_.
9. The formation of carbohydrates from non-carbohydrate precursors such as amino acids and lactic acid is called \_\_\_\_\_.
10. The reducing power for fatty acid synthesis comes from \_\_\_\_\_.
11. The intracellular location of fatty acid synthesis is the \_\_\_\_\_.

二. 選擇題 (每題二分)

12. Sodium phosphate or inorganic phosphate is picked up by the substance in one reaction of glycolysis and one reaction of the TCA cycle. The enzymes that catalyze those reactions are:
  - A. hexokinase and succinyl thiokinase
  - B. triose phosphate isomerase and succinic dehydrogenase
  - C. glyceraldehyde-3-phosphate dehydrogenase and succinyl thiokinase
  - D. pyruvate kinase and  $\alpha$ -ketoglutarate dehydrogenase
13. Riboflavin in a nucleotide form is involved in one reaction of the TCA cycle. The enzyme that catalyzes that reaction is:
  - A. succinyl thiokinase
  - B. malic dehydrogenase
  - C. succinic dehydrogenase
  - D. isocitric dehydrogenase
14. Thiamine is involved in two reactions in the mitochondria and one cytosol reaction. The substrates for those reactions are:
  - A. succinate and fumarate
  - B.  $\alpha$ -ketoglutarate and pyruvate
  - C. oxaloacetate and pyruvate
  - D. malate and oxaloacetate
15. Glucose-1-phosphate  $\rightarrow$  glucose-6-phosphate  $\Delta G^{\circ} = -1.7$  Kcal/mole  
Fructose-5-phosphate  $\rightarrow$  glucose-6-phosphate  $\Delta G^{\circ} = -0.4$  Kcal/mole  
Glucose-1-phosphate  $\rightarrow$  fructose-6-phosphate. What is the  $\Delta G^{\circ}$ ?
  - A. -2.1 Kcal/mole
  - B. -1.3 Kcal/mole
  - C. +1.3 Kcal/mole
  - D. +2.1 Kcal/mole

(背面仍有題目,請繼續作答)

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16. Which citric acid cycle intermediate is the immediate precursor to aspartate?
- A. pyruvate  
B. oxaloacetate  
C.  $\alpha$ -ketoglutarate  
D. isocitrate
17. After full metabolism of a fatty acid it was determined that the total "hydrogen value" (i.e., the hydrogen atoms lost in the reaction) was 104, 34 of which were removed by FAD dehydrogenases, and 70 of which were removed by NAD<sup>+</sup> dehydrogenases. If all of the hydrogen atoms received by the above systems were funneled into electron transport system, what will be the total energy yield in moles of ATP?
- A. 34  
B. 70  
C. 139  
D. 156
18. Pyruvate labeled with <sup>14</sup>C in carbon atom 2 is incubated with liver tissue. Which carbon atoms of  $\beta$ -hydroxy- $\beta$ -methyl-glutaryl CoA will become labeled rapidly?
- A. 1, 2  
B. 1, 3  
C. 1, 2, 3  
D. 1, 3, 4

三. 問答題 (19-25 題, 每題二分)

19. What is the main function of the glyoxylate cycle?
20. What is the enzyme that catalyzes the following reaction?  
 $\text{Pyruvate} + \text{CO}_2 + \text{ATP} \xrightarrow{\text{Acetyl CoA}} \text{oxalacetate} + \text{ADP} + \text{P}_i$
21. What is the enzyme that catalyzes the following reaction?  
 $\text{Oxaloacetate} + \text{GTP} \xrightarrow{\text{Mg}^{++}} \text{phosphoenopyruvate} + \text{CO}_2 + \text{GDP}$
22. Pyruvic acid labeled with the isotope <sup>14</sup>C in the carboxyl atom was injected into a rat. The rat was sacrificed 30 minutes later and some glycogen isolated from the liver. The glycogen was hydrolyzed to D-glucose by boiling in dilute HCl. Which carbon atoms of the resulting D-glucose would be most strongly labeled with <sup>14</sup>C?
23. How many high-energy phosphate bonds are required to add one glucose residue to a glycogen molecule in the liver starting from free glucose?
24. To form palmitic acid from eight mitochondrial acetyl CoA requires how many ATP?
25. A sample of L-alanine labeled with <sup>14</sup>C in the  $\beta$ -carbon atom is injected into a rat. The animal is sacrificed one hour later and a sample of palmitic acid isolated from the liver lipids. Which carbon atoms of the palmitic acid will be most strongly labeled?
26. Under optimal conditions for growth, an *E. coli* cell will divide around every 20 minutes.
- A. If no cells died, how long would it take a single *E. coli* cell, under optimal conditions in 10-liter culture flask, to reach its maximum cell density of  $10^{10}$  cells/ml (a "saturated" culture)? (5%)
- B. Assuming that optimal conditions could be maintained, how long would it take for the total volume of the cells alone to reach 1 km<sup>3</sup>? (10%)
27. What are the ionic strengths of 1.0 M solution of NaCl, (NH<sub>4</sub>)<sub>2</sub>SO<sub>4</sub>, and K<sub>3</sub>PO<sub>4</sub>? (6%)  
In which would a protein be expected to be most soluble; least soluble? (4%)

28. A peptide is specified by the following DNA antisense strand. Assume that translation starts after the first initiation codon.

5' - TCTGACTATTGAGCTCTCTGGCACATAGCA - 3'

- A. Based on the DNA antisense strand, please write down the correspondent mRNA sequence. (5%)
- B. Based on the mRNA sequence you have written down, please circle the initiation codon and stop codon for translation. (10%)
29. What would the effect of the following agents on the melting curve of an aqueous solution of duplex DNA? Explain
- A. Decreasing the ionic strength of the solution. (5%)
- B. Squirting the DNA solution, at high pressure, through a very narrow orifice. (5%)