國立臺灣海洋大學103學年度研究所碩士班招生考試試題

考試科目：生物化學

系所名稱：食品科學系碩士班生技組、食品科學系碩士班食科組

1. 答案以橫式由左至右書寫。2. 請依題號順序作答。

I. Choice questions (Please choose ONE appropriate answer, 2 points for each)

1. All are important reasons to phosphorylate glucose in the first step of glycolysis EXCEPT:
   A. the large positive free energy is important in getting the pathway started.
   B. glucose-6-phosphate has a negative charge preventing transport out of the cell.
   C. the concentration of free glucose in the cell is lowered favoring influx of glucose.
   D. phosphorylation keeps the glucose in the cell.
   E. regulatory control can be imposed only at a reaction not at equilibrium.

2. When acetyl-CoA levels exceed the _____ supply, allosteric activation of _____ by _____ raises the oxaloacetate (OAA) levels for condensation with acetyl-CoA to form _____
   A. Acetyl-CoA; pyruvate carboxylase; citrate; acetyl-CoA
   B. OAA; pyruvate carboxylase; acetyl-CoA; citrate
   C. OAA; citrate synthase; acetyl-CoA; isocitrate
   D. citrate; citrate synthase; acetyl-CoA; citrate
   E. malate; malate dehydrogenase; ATP; citrate

3. All of the following are characteristic of the coupling between glycolysis and the citric acid cycle EXCEPT:
   A. glycolysis feeds acetyl CoA, via pyruvate, to the citric acid cycle.
   B. citrate inhibits glucokinase to regulate glycolysis.
   C. citrate builds up when citric acid cycle reaches saturation.
   D. citric acid cycle directs electrons into electron transport chain for the purpose of ATP production.
   E. ATP production via citric acid cycle, electron transport, and oxidative phosphorylation inhibits glycolysis.

4. The pentose phosphate pathway is an important source of _____, and for _____, an essential precursor for ATP, NAD^+, FAD, CoA, DNA and RNA.
   A. ATP; NADH
   B. NADH; NADPH
   C. NADPH; ribose-5-phosphate
   D. ribose-5-phosphate; ATP
   E. all are true

5. Which of the following is an indispensable amino acid of adult?
   A. proline
   B. glutamine
   C. aspartate
   D. histidine
   E. glycine

6. Many of the enzymes of the Calvin cycle are also involved in _____ and _____; however, the glyceraldehyde-3-phosphate dehydrogenase of the Calvin cycle is specific for _____.
   A. glycolysis; pentose phosphate pathway; NADPH

B. citric acid cycle; pentose phosphate pathway; NADH
C. glycolysis; β-oxidation; $FADH_2$
D. fatty acid synthesis, gluconeogenesis; NADPH
E. none of the above

7. In plants and microorganisms, amino acid biosynthesis is a matter of synthesizing the appropriate _____ followed by transamination with _____.
A. acetyl-CoA derivatives; glutamine
B. α-ketoacid; glutamate
C. phospho-carbon skeleton; alanine
D. nitrogenous base; glutamate
E. none are true

8. The term ketogenic amino acids refers to amino acids:
A. that are precursors for glucose synthesis.
B. degraded to yield acetyl CoA or acetoacetate .
C. that can not be converted to fatty acids or ketone bodies.
D. degraded to yield succinyl-CoA, pyruvate, α-ketoglutarate, fumarate and oxaloacetate.
E. none of the above.

9. Thymidylate synthase synthesizes dTMP from _____ by _____ utilizing the coenzyme _____.
A. dCTP; carboxylation; biotin
B. dCMP; methylation; THF
C. dUMP; methylation; THF
D. dGMP; phosphorylation; ATP
E. dUMP; phosphorylation; ATP

10. Cellular levels of fructose-2,6-bisphosphate (F-2,6-BP) are controlled by the tandem enzyme _____ and _____.
A. fructokinase; F-2,6-BPase
B. PFK-2; PFK-1
C. PFK-1; F-2,6-BPase
D. F-2,6-BPase; PFK-2
E. PFK-2; fructokinase

II. Terminology 20 points (5 points for each)

1. Carnitine acyltransferase
2. AMP-activated protein kinase
3. Mitochondria-mediated apoptosis
4. Hypoxia inducible factor

III. 問答 10 points (5 points for each)

1. How does light drive the synthesis of ATP ?
2. Please explain the connecting links between the urea cycle and the TCA cycle.

IV.

1. Biomolecules interact with one another through molecular surfaces that are structurally complementary. How can various proteins interact with molecules as different as simple ions, hydrophobic lipids, polar but uncharged carbohydrates, and even nucleic acids? (3%)

2. Please define the high-energy phosphate compounds and list three examples of these compounds. (5%)

3. Please write out the full names of 6 common amino acids (in English) which have a hydrophobic side-chain. (6%)

4. The simple average molecular weight of the 20 common amino acids is 138, but most biochemists use 110 when estimating the number of amino acids in a protein of known molecular weight. Why do suppose this is? (Hint: there are two contributing factors to the answers. One of them will be apparent from a brief consideration of the amino acid compositions of common proteins) (6%)

5. A new protein of unknown structure has been purified. Gel filtration chromatography reveals that the negative protein has a molecular weight of 240,000. Chromatography in the presence of 6M guanidine hydrochloride and 10 mM β-mercaptoethanol yields peaks for proteins of M_r 34,000 and 26,000.Explain what can be determined about the structure of this protein from these data. (5%)

6. What is the system name for sucrose? Is sucrose a reducing sugar? Explain. (5%)

7. Please describe two fundamental chemical differences to distinguish DNA from RNA. Is there any biological importance for these two chemical differences? (6%)

8. What is directional cloning? How can you carry out a directional cloning experiment? (4%)

9. Please define the followings: (10%)
   a. reverse transcriptase
   b. specificity of an enzyme
   c. turnover number of an enzyme
   d. ribozymes
   e. specific acid-base catalysis