國立清華大學 105 學年度碩士班考試入學試題

系所班組別：生命科學院甲組、乙組、醫學生物科技學程

考試科目（代碼）：生物化學(0401、0501、0701)

Part 1 單選題 (每題二分，共四十分，答錯不倒扣。請在【答案卡】作答)

1. What is the overall net charge of the peptide "DGAKER" at pH 7.0? (A) +2, (B) +1, (C) 0, (D) -2, (E) -1.

2. The large negative free energy change of ATP on hydrolysis is due to : (A) Destabilization due to Electrostatic repulsion, (B) Stabilization of products by ionization and resonance, (C) Entropy factors arising from hydrolysis and ionization, (D) free energy change ~35kJ/mol, (E) all of the above.

3. The structure of tetramic hemoglobin belongs to: (A) primary structure, (B) secondary structure, (C) tertiary structure, (D) quaternary structure, (E) NONE.

4. Insulin is a polypeptide hormone that contains two short polypeptide chains linked by two interstrand disulfide bonds. The most logical order of events to perform in order to sequence this protein would be:
   a: The peptides are reduced with mercaptoethanol.
   b: The peptides are sequenced using Edman chemistry.
   c: The peptides are separated by chromatography techniques.
   d: The peptides are alkylated with iodoacetamide.
   (A) c, a, d, b, (B)c, b, a, d, (C)a, b, c, d, (D)a, c, d, b, (E)a, d, c, b.

5. The conformation of a protein means all EXCEPT: (A) the overall three-dimentional structure of the protein, (B) done by rotating the single bond along the peptide backbone, (C) the result of amino acid side-chain interactions, (D) done by breaking and reforming covalent bonds, (E) None, all are true.

6. The CO_2 is primarily a product of (A) glycolysis, (B) lactate fermentation, (C) citric acid cycle, (D) oxidative phosphorylation, (E) gluconeogenesis.

7. Arrange the following reactions in order of increasing number of ATP production: (i) anaerobic catabolism of glucose; (ii) aerobic catabolism of glucose; (iii) aerobic catabolism of acetate; (iv) aerobic catabolism of palmitate. (A) i<ii<iii<iv, (B) i<iii<ii<iv, (C) i<iv<iii<ii, (D) iv<iii<ii<i, (E) ii<i<iii<iv.

8. Which of the following Intermediates of citric acid cycle is the precursor of glutamate? (A) α-Ketoglutarate, (B) succinyl-CoA, (C) oxaloacetate, (D) fumarate, (E) malate.

9. Enzymes of the citric acid cycle are located in the matrix of mitochondria EXCEPT (A) citrate synthase, (B) aconitase, (C) isocitrate dehydrogenase, (D) succinate dehydrogenase, (E) fumarase.

10. The primary form of carbohydrates transported from the site of photosynthesis to other parts of plant is (A) glucose, (B) sucrose, (C) fructose, (D) glyceraldehyde-3-phosophate, (E) malic acid.

11. 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.

12. All are substrates for gluconeogenesis EXCEPT: (A) glycerol, (B) lactate, (C) fatty acid, (D) pyruvate, (E) most amino acids.

13. The product of β-oxidation, acetyl-CoA, can be used for all EXCEPT: (A) synthesis of ketone bodies, (B) synthesis of amino acids, (C) catabolism in the TCA cycle, (D) synthesis of glucose, (E) none of the above.

14. The main source(s) of NADPH for fatty acid biosynthesis is (are): (A) TCA cycle, (B) oxidative phosphorylation, (C) malic enzyme and the pentose phosphate pathway, (D) the conversion of OAA to malate by malate dehydrogenase, (E) glycolysis.

15. Insulin in the bloodstream is a response to increased blood glucose, and: (A) stimulates gluconeogenesis, (B) inhibits glycolysis, (C) stimulates glycogen synthesis in muscle and liver, (D) stimulates glycogen breakdown in liver, (E) inhibits phosphoprotein phosphatase-1.

16. Nitrifying bacteria obtain their chemical energy from: (A) the reduction of NO_3^- to NH_4^+, (B) the formation of NH_4^+ from N_2 gas, (C) the oxidation of NH_4^+ to N_2, (D) the oxidation of NH_4^+ to NO_3^-, (E) the formation of NO_2^- from NO_3^-.

17. Control over nitrogenase activity is accomplished by which of the following ?: (A) ATP serves as an allosteric activator, (B) AMP serves as an allosteric inhibitor, (C) NH_4^+ prevents expression of the genes that encode nitrogenase, (D) phosphorylation prevents activity, (E) none of the above.

18. Glutamine synthetase (GS) belongs to what class of enzymes? (A) isomerases, (B) oxidoreductase, (C) ligase, (D) lyase, (E) transferase.

19. Ornithine serves three metabolically important roles, but is not found in proteins. What is one of the important roles of ornithine? (A) precursor in the synthesis of aspartate, (B) an intermediate in the urea cycle, (C) formation of ornithine from serine, (D) it condenses with aspartate to form argininosuccinate, (E) it is derived from glutamate-5-phosphate.

20. The reaction, ATP + AMP → 2ADP, is catalyzed by: (A) adenylate phosphorylase, (B) AMP-phosphotransferase, (C) ADP mutase, (D) adenylate kinase, (E) none are true.

Part 2 問答題 (每題十五分，共六十分。請在【答案卷】務必依序作答)

1. Please list three kinds of the most typical post-translation modification on protein and explain it in detail. **(15%)**

2. What changes are caused in the various steps of oxidative phosphorylation when mitochondria are treated with the following compounds: (1) KCN; (2) 2,4-dinitrophenol; (3) oligomycin. **(15%)**

3. Please plot the structure of arachidonic acid (C20:4Δ6). Please depict how arachidonic acid is synthesized from linoleic acid (C18:2Δ6) in mammals. Please describe your answer including "Δ5 desaturase", "Δ6 desaturase", and "elongation". Please define the structure of each intermediate. **(15%)**

4. Please compare the carbamoyl-phosphate synthetase I and II according to their substrates; intracellular locations; involved pathways; key reactions? **(15%)**

	CPS I	CPS II
Substrate	(A1)	(A2)
Intracellular Location	(B1)	(B2)
Involved pathway	(C1)	(C2)
key reactions	(D1)	(D2)