

第一大題選擇題(1-18)每題 2 分，請用 2B 鉛筆作答於答案卡，並先詳閱答案卡上之「畫記說明」。

- At a pH of 5, all amino acids have at least \_\_\_\_\_ charged group(s) and at most, \_\_\_\_\_ charged group(s).
  - 0; 1
  - 1; 1
  - 1; 2
  - 2; 2
  - 2; 3
- Which of the following amino acids is incorporated into proteins during ribosomal protein synthesis?
  - sarcosine
  - ornithine
  - 4-hydroxyproline
  - phosphoserine
  - selenocysteine
- Given the following peptide, what pair of protease enzymes would be able to produce three smaller peptides?  
Gly-Ser-Ala-His-Phe-Pro-Asn-Ala-Val-Glu-Cys-Ala-Ser
  - chymotrypsin and thrombin
  - trypsin and chymotrypsin
  - thermolysin and chymotrypsin
  - trypsin and thermolysin
  - none of the above
- The peptide hormone insulin is composed of two peptide held together primarily by what mechanism?
  - disulfide bonds between cysteine residues
  - charge-charge interactions between acidic and basic amino acids
  - extensive hydrogen bonding due to the relatively high serine and glutamine content
  - hydrophobic interactions
  - an amide bond formed from the R-groups of a glutamic acid residue and a lysine residue
- In the sequence of cytochrome *c*, the presence of cysteine at position 17 in hundreds of different species indicates that this particular amino acid is \_\_\_\_\_.
  - conserved
  - mutated
  - homologous
  - variable
  - none of the above
- Which of the following statements regarding structural proteins is true?
  - silk fibroin is made from a repeat of three amino acids where each third amino acid is Gly
  - $\alpha$ -keratin is composed of peptides that contain mostly  $\alpha$ -helical structure with the exception of short

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- sequences where the peptide folds back on itself
- C) collagen has its own helical structure where three individual peptides are wound around each other in a left-handed helix
- D) generally speaking, structural proteins are soluble in water
- E) none of the above
7. Of the following proteins that aid in the folding process, which is exclusively involved in the interconversion of *cis* and *trans* bonds?
- A) prolyl isomerase
- B) protein disulfide isomerase
- C) Hsp60
- D) Hsp70
- E) GroEl-ES complex
8. Which of the following occurs when hemoglobin switches from the T (deoxy) state to the R (oxy) state?
- A) the heme group goes from a slightly puckered conformation to a flat conformation
- B) the ferrous ion is pulled into the plane of the heme group
- C) the F8 (proximal) histidine rotates about 8° to better align with the ferrous ion
- D) movement of the F8 histidine causes a shift in the F helix, thus weakening interactions with other subunits
- E) all of the above
9. In sickle cell hemoglobin, a Glu is mutated to a \_\_\_\_\_. This causes the formation of \_\_\_\_\_ between hemoglobin molecules, ultimately forming large aggregates.
- A) Arg; salt bridges
- B) Cys; disulfide bonds
- C) Val; hydrophobic interactions
- D) Pro; disrupted  $\alpha$ -helix, resulting in several H-bonds and salt bridges
- E) none of the above
10. Why do individuals who are heterozygous for sickle cell anemia have a resistance to malaria?
- A) formation of hemoglobin aggregates makes red blood cells impervious to parasitic infection
- B) shortened life span of red blood cells does not allow sufficient time for the parasite to mature in the red blood cell
- C) diminished blood flow to the skin as a result of sickled red blood cells blocking capillaries prevents mosquitoes from actually transferring the malaria parasite to individuals
- D) sickle cell hemoglobin fibers have both decreased O<sub>2</sub> and CO<sub>2</sub> carrying capacity; since CO<sub>2</sub> is a mosquito attractant, diminished CO<sub>2</sub> exhalation does not attract mosquitoes
- E) none of the above
11. Which of the following is an example of a storage polysaccharide made by animals?
- A) cellulose
- B) amylopectin

- C) collagen  
D) glycogen
12. Which of the carbohydrate molecules are non-reducing agents?  
A) Glucose  
B) Maltose  
C) Fructose  
D) Sucrose
13. The enzymes of the TCA cycle in a eukaryotic cell are located in the  
A) nucleus  
B) lysosomal bodies  
C) plasma membrane  
D) mitochondria
14. Which of the following enzyme does not take part in the TCA cycle?  
A) Citrate synthase  
B) Malate dehydrogenase  
C) Aconitase  
D) Pyruvate dehydrogenase
15. The first intermediate in TCA cycle is  
A) Succinate  
B) Malate  
C) Fumerate  
D) Citrate
16. The regulation of the glycolytic pathway involves  
A) feedback inhibition by ATP.  
B) allosteric inhibition by ATP.  
C) allosteric stimulation by ADP.  
D) All three are correct.
17. Which of the following statements about starch and glycogen is FALSE?  
A) Amylopectin and glycogen contain many ( $\alpha 1 \rightarrow 6$ ) branches.  
B) Both serve primarily as structural elements in cell walls.  
C) Both are homopolymers of glucose.  
D) Glycogen is more extensively branched than starch.
18. Which of the following substrates in the citric acid cycle is not coupled to the production of NADH?  
A) Malate  
B) Succinate  
C) alpha--Ketoglutarate  
D) Pyruvate

第二大題：非選擇題(19-28)，請於試卷內之「非選擇題作答區」標明題號依序作答。

19. Which one of the following reaction schemes is most likely catalyzed by a “transferase”? Why? (4 points)

- (A)  $A + \text{NAD}^+ \leftrightarrow B + \text{NADH}$
- (B)  $A + \text{ATP} \leftrightarrow B + \text{ADP}$
- (C)  $A \leftrightarrow B + C$
- (D)  $A \leftrightarrow B$
- (E)  $A + \text{H}_2\text{O} \leftrightarrow B + C$

20. Based on your understanding of the Michaelis-Menton equation, please discuss the condition where the Michaelis constant ( $K_m$ ) may be used as a measure for the stability of the enzyme-substrate (ES) complex. (6 points).

21. Name three molecular mechanisms by which enzyme activity may be regulated, and provide one example for each of the mechanism. (6 points)

22. How dietary lipids are digested, absorbed and transported to the liver? (8 points)

23. (a) Please give a genetic example and a non-genetic example that can cause elevation of plasma total-cholesterol and LDL-cholesterol levels. (b) Please give 2 methods to reduce the levels of total- cholesterol and LDL-cholesterol in these cases. (8 points)

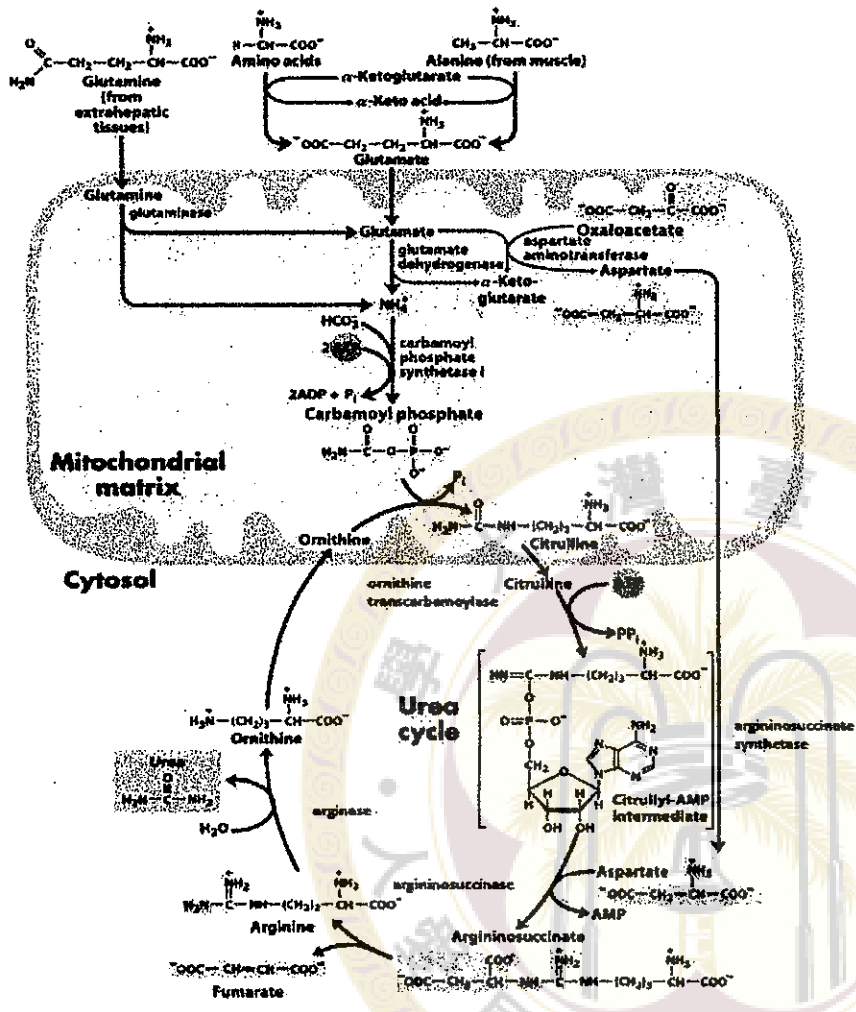
24. How insulin regulates glycogen metabolism? (4 points)

25. What is the Chemiosmotic Model of oxidative phosphorylation proposed by Peter Mitchell? (4 points)

26. What reaction of the pentose phosphate pathway releases a  $\text{CO}_2$ ? (4 points)

27. Please list four important functions of methionine in biological role and metabolism? (4 points)

28. The following diagram depicts amino acid degradation pathway leading to urea production. Answer the following questions. (16 points)



- The nitrogen waste of the amino acids in the muscle is delivered to the \_\_\_\_\_ (an organ) for degradation in the form of \_\_\_\_\_.
- Two amino acids that deliver nitrogen waste the organ for urea production are \_\_\_\_\_ and \_\_\_\_\_.
- The nitrogen waste to enter the urea cycle is \_\_\_\_\_.
- Argininosuccinic aciduria means \_\_\_\_\_, which is due to defect in \_\_\_\_\_.
- An increased  $K_m$  of argininosuccinate synthetase for citrulline will cause \_\_\_\_\_.
- Argininosuccinate receives two nitrogen wastes, one from glutamine/glutamate and the other from \_\_\_\_\_.
- Does it take energy to produce urea? Yes or No.
- Starvation will increase or decrease or not change protein degradation rate.
- High protein diet will increase or decrease or not change protein degradation rate.
- A protein rich meal will increase the level of glutamate, which is converted to \_\_\_\_\_, a metabolite that activates carbamoyl phosphate synthetase I to enhance the urea cycle.
- (3 points) Each urea cycle consumes one molecule of aspartate. Aspartate must be regenerated to allow the urea cycle to continue. How is it regenerated to keep the urea cycle going?