

本試題是否可以使用計算機：可使用，不可使用（請命題老師勾選）

**(A) Answer the following questions: (79%)**

1. Draw a diagram to show the metabolic pathway and regulation of glyoxylate cycle in plants, and describe the purposes and importance of this cycle. (13%)
2. What are helicases and topoisomerases? (4%)
3. What properties would you expect of a strain of *E. coli* that has a mutant allele (null or nonfunctional) of the *recA* gene? Explain. (3%)
4. A human gene was initially identified as having three exons and two introns. The exons are 456, 224, and 524 bp, while the introns are 2.3 kb and 4.6 kb.
  - (a) Draw this gene, showing the promoter, introns, exons, and transcription start and stop sites. (4%)
  - (b) Surprisingly, it is found that this gene encodes not one but two mRNAs that have only 224 nucleotides in common. The original mRNA is 1204 nucleotides, while the new mRNA is 2524 nucleotides. Use your drawing to show how it is possible for this one region of DNA to encode these two transcripts. (3%)
5. What evidence supports the view that ribosomal RNAs are a more important component of the ribosome than the ribosomal proteins? (4%)
6.
  - (a) Describe the basic structure of a nucleosome. (3%)
  - (b) Compare the organization of bacterial genes to that of eukaryotic genes. What are the major differences? (4%)
7. The formation of ketone bodies occur primarily in \_\_\_\_\_(organ)\_\_\_\_\_ (organelle). What are ketone bodies, and what role do they play in metabolism? (8%)
8. How are unsaturated fatty acids oxidized? (6%)
9. What is the metabolic fate of ammonium? (6%)
10. How are lipids transported throughout the body? (5%)
11. Are the individual members of a gene family necessarily coordinately regulated? (8%)
12. Dominant negative mutants of both Ras and Raf block growth factor-stimulated cell proliferation. The inhibitory effects of dominant negative Ras are overcome by expression of activated Raf. Would you expect activated Ras similarly to overcome the inhibitory effects of dominant negative Raf? How about activated MEK? (8%)

**(背面仍有題目,請繼續作答)**

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**(B) Multiple choices: (21%)**

1. The three aromatic amino acids \_\_\_\_\_, \_\_\_\_\_ and \_\_\_\_\_ absorb light strongly in the near-ultraviolet region of the spectrum at 289 nm. (2%)
  - a. Glycine, leucine, tyrosine
  - b. Phenylalanine, leucine, histidine
  - c. Tyrosine, tryptophan, phenylalanine
  - d. Lysine, tryptophan, arginine
  - e. Tyrosine, leucine, isoleucine
2. Gel filtration is a kind of chromatography methods for the separation of proteins, and the theory of separation is depend on the \_\_\_\_\_ of the proteins. (2%)
  - a. Size
  - b. Molecular weight
  - c. Charge
  - d. Hydrophobicity
  - e. 1,2,3 only
3. There are three types of mutation: 1) missense mutation, 2) nonsense mutation and 3) frameshift mutation. Only \_\_\_\_\_ result(s) in  $\beta$ -thalassemia. (2%)
  - a. 1
  - b. 2
  - c. 3
  - d. 1, 2 and 3
  - e. 2 and 3
4. According to the classification of protein enzymes, there are \_\_\_\_\_ major classes of enzymes, and isomerases belong to the No. \_\_\_\_\_ of enzyme classification. (2%)
  - a. 3 .... 4
  - b. 2 .... 5
  - c. 6 .... 2
  - d. 5 .... 6
  - e. 6 .... 5
5. Phosphofructokinase (PFK) is one of the enzyme for the regulation of glycolysis. The most significant inhibitors of PFK are \_\_\_\_\_ and \_\_\_\_\_. (2%)
  - a. Fructose-2,6 bisphosphate .... ATP
  - b. Fructose-2,6 bisphosphate .... GTP
  - c. ATP .... GTP
  - d. Citrate .... Acetyl-CoA

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- e. Citrate .... ATP
6. There are \_\_\_\_ different complexes in electron transport, and complex 1, complex 2 and complex 3 are connected by \_\_\_\_\_. (2%)
- 4 .... cytochrome C
  - 5 .... coenzyme Q
  - 5 .... cytochrome C
  - 6 .... cytochrome C
  - 6 ..... coenzyme Q
7. What is the primary function of the Calvin cycle? (3%)
- use ATP to release carbon dioxide
  - use NADPH to release carbon dioxide
  - split water and release oxygen
  - transport RuBP out of the chloroplast
  - synthesize simple sugars from carbon dioxide
8. CAM plants keep stomata closed in daytime, thus reducing loss of water. They can do this because they (3%)
- fix  $\text{CO}_2$  into organic acids during the night.
  - fix  $\text{CO}_2$  into sugars in the bundle-sheath cells.
  - fix  $\text{CO}_2$  into pyruvate in the mesophyll cells.
  - use the enzyme phosphofructokinase, which outcompetes rubisco for  $\text{CO}_2$ .
  - use photosystems I and II at night.
9. In mechanism, photophosphorylation is most similar to (3%)
- substrate-level phosphorylation in glycolysis.
  - Oxidative phosphorylation in cellular respiration.
  - the Calvin cycle.
  - Carbon fixation.
  - Reduction of  $\text{NADP}^+$ .