

國立中央大學九十學年度碩士班研究生入學試題卷

所別: 生命科學系 不分組 科目: 生物化學 共 2 頁 第 1 頁

Total: 100%

- (8%) Animals cannot undergo net synthesis of carbohydrate from acetyl-CoA, but the carbons of acetyl-CoA can be incorporated into glucose and amino acids.
 - Present pathways by which this could come about.
 - How come plants can undergo net synthesis of carbohydrate from fat via acetyl-CoA?
- (4%) The crocodile can remain under water without breathing for up to 1 hr. It is found that the crocodile hemoglobin preferentially binds HCO_3^- and does not bind BPG, which helps the crocodile to utilize almost 100% of the O_2 in its blood. Explain why?
- (6%) How many high-energy phosphates are generated or consumed in
 - converting 1 mole of glucose to lactate?
 - converting 2 moles of lactate to glucose?
- (4%) A general practice of feeding whisky to patients rescued from cold or wet condition is counterproductive. Explain why?
- (6%) During glycolysis, two energy-rich compounds drive the synthesis of ATP at the substrate level.
 - What are the names of the two energy-rich compounds?
 - Draw the chemical structures for these two compounds.
 - What enzymes catalyze these two steps of reactions?
- (8%) Please specify the molecular functions of the following compounds:
 - Cordycepin (3'-deoxyadenosine)
 - Puromycin
 - 2,4-Dinitrophenol (DNP)
 - Fluoroacetate
- (4%) Describe the unique primary, secondary, and tertiary structure of collagen.
- (4%) Suppose ribulose-5-phosphate, labeled with ^{14}C in carbon 1, is used as the substrate in dark reactions. In which carbon of 3PG will the label appear?
- (9%) Define the following terms:
 - prion
 - catalytic antibody
 - chaperone
- (6%) Draw the chemical structures of the two amino acids that account for most of the UV absorbance by proteins at 280 nm.

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11. (6%) Histidine often plays an important role in enzymatic catalysis involving proton transfer
- Why?
 - What are the pKa values of its three ionizing groups?

12. (9%) Calculate K_m , V_{max} , and k_{cat} from the following data:

[S] (μM)	V_o ($\text{mM} \cdot \text{s}^{-1}$)
0.1	0.34
0.2	0.53
0.4	0.74
0.8	0.91
1.6	1.04

The enzyme concentration is $1 \mu\text{M}$.

13. (4%) DNA is generally more stable in alkaline solution than RNA. Explain why.
14. (4%) Why do *E. coli* cells with a defective lacZ gene fail to show galactoside permease activity after the addition of lactose in the absence of glucose?
15. (6%) Deoxycytidylate residues in DNA undergo deamination fairly readily.
- What is the product of dCMP deamination?
 - What would be the genetic consequences if this deaminated site were not repaired?
 - What is the repair mechanism for such a mutation in *E. coli*?
16. (4%) Why are triacylglycerols a more efficient form of stored energy than glycogen?
17. (4%) Describe the mechanism of how soap removes grease.
18. (4%) Calculate the metabolic energy yield from oxidation of palmitic acid, taking into account the energy needed to activate and transport the fatty acid.