

國立中央大學九十一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

1. Please specify the functions and action modes of the following compounds:
(a) Cordycepin (b) Nalidixic acid (c) Fluoroacetate (d) Antimycin A
(e) Chloramphenicol (f) Diisopropyl fluorophosphate (4% for each question)
2. An actively respiring bacterial culture is briefly incubated with [1-¹⁴C] glucose, and the glycolytic and TCA intermediates are isolated. Where is the ¹⁴C in each of the intermediates listed below? Consider only the initial incorporation of ¹⁴C, in the first pass of labeled glucose through the pathways.
(a) Glyceraldehyde 3-phosphate (3%) (b) Oxaloacetate (3%)
3. What is the ATP yield per mole of glucose metabolized to CO₂ in insect flight muscle, if the glycerophosphate shuttle is participated? Explain. (5%)
4. Plants and some microorganisms can undergo net synthesis of carbohydrate from fat via acetyl-CoA. Please answer the following questions:
(a) What is the fate of carboxyl-labeled acetate in the glyoxylate cycle? (4%)
(b) Which enzymes are unique to glyoxysome and are not present in mitochondrion? (4%)
5. Deoxycytidylate residues in DNA undergo deamination fairly readily.
(a) What is the product of dCMP deamination? (3%)
(b) What would be the genetic consequences if this deaminated site were not repaired? (3%)
(c) What is the repair mechanism for such a mutation in *E. coli*? (4%)
6. Draw the chemical structures of the following compounds:
(a) The two amino acids that account for most of the UV absorbance by proteins at 280 nm. (3%)
(b) The amino acid that lacks a center of asymmetry. (3%)
(c) β-D-galactopyranosyl (1→4) β-D-glucopyranose (3%)
(d) Cholesterol (3%)
(e) Glutathione (3%)
7. Bluebird migrates from Japan to Taiwan in the winter. This species must store enough energy for the long-range flying. Answer the following questions:
(a) What form of lipid energy is stored? (3%)
(b) Why is lipid, but not protein or glycogen, stored as the energy source? (3%)
(c) Which portion of this class of lipid can be converted to glucose in birds? (4%)

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8. The *E. coli* genome has around 4,000,000 base pairs and a superhelical density *in vivo* of about -0.06 . Assuming the DNA has 10.5 base pairs per turn, what is the expected (a) writhing number (3%), (b) linking number (3%), and (c) twist number? (2%)
9. Calculate the (a) K_m , (b) V_{max} , and (c) k_{cat} from the following data: (8%)

[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 $1 \mu\text{M}$.

[S]: initial substrate concentration.

V_o : initial rate

10. The fructose in honey is mainly in the β -D-pyranose form. This is one of the sweetest substances known. The β -D-fructofuranose is much less sweet.
- (a) Draw the chemical structure of β -D-fructopyranose. (2%)
- (b) Why is honey generally used for sweetening cold but not hot drinks? (2%)
- (c) Propose a biochemical mechanism to explain the observation in (b). (2%)