國立成功大學

113學年度碩士班招生考試試題

編　號：250

系　所：生物化學暨分子生物學研究所

科　目：生物化學

日　期：0202

節　次：第 1 節

備　註：不可使用計算機

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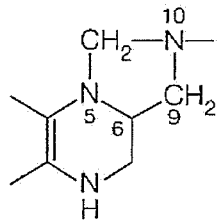
一、簡答題（50 分，分數如題標示）

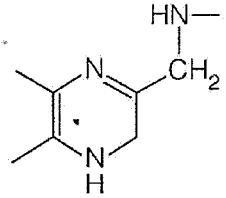
1. Fluorouracil, also known as 5FU, is developed as a prodrug for chemotherapy. Please describe: (1) what is the definition of prodrug? (2%); (2) what is the mechanism of action of 5FU? (4%)

2. Please describe how thymidine triphosphate (dTTP) is synthesized from ribonucleotide diphosphate. Focus on the species of ribonucleotide diphosphate, the necessary enzyme and coenzyme for transferring the methyl group. (6%)

3. Which folate structure is responsible for the following biological functions? Please select from the structure listed below. (5%)



A



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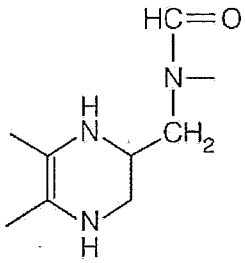

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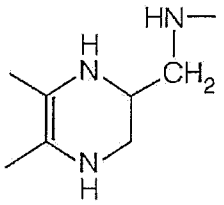

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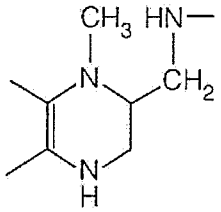
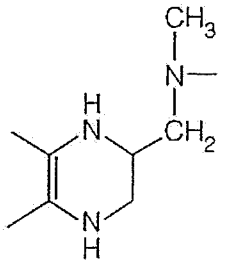


E



F

a. Is the substrate for the enzyme that is inhibited by methotrexate and trimethoprim?
b. Is used in the conversion of serine to glycine?
c. Transfer its one-carbon substitute to a B12 coenzyme?
d. Is used in purine nucleotide synthesis?
e. Has the most highly oxidized one-carbon substituent?

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4. Please describe (1) urea cycle in sufficient detail (5%) and (2) how the ammonia in muscle is transported to the liver for urea synthesis? (3%)

5. Name two amino acid residues that are positively charged at pH 7.4. (2%) According to your answer, name two types of non-covalent interaction that these residues can mediate. (2%)

6. Name two amino acid residues with C-beta branching (2%). Explain why these C-beta branched residues would exhibit smaller allowed regions in the Ramachandran plot. (3%)

7. Some proteins exhibit positive cooperativity as they interact with their ligands. Please describe the term "positive cooperativity" in this context. (5%)

8. Fumarase catalyzes the chemical reaction that converts fumarate to S-malate. The kcat for fumarase is 800 s-1. When [Etotal] is 30 nM and [fumarate] is 20 μM, the observed V0 for fumarase is 19.2 μM s-1. Calculate Km for the substrate fumarate. (5%) Note that in the Michaelis-Menten kinetics, Vmax = kcat[Etotal].

9. Explain why we would normally apply sodium dodecyl-sulfate (SDS) (3%) and 2-mercaptoethanol (a reducing agent) (3%) to the protein sample during SDS-polyacrylamide gel electrophoresis (SDS-PAGE)?

二、問答題（50 分，分數如題標示）

10. Describe the physiological roles and biochemical functions of glycogenin. (10%)

11. Describe the differences of Epinephrine in the regulation of carbohydrate metabolism, specifically for glucose and glycogen, in muscle than in liver. (10%)

12. Describe the function, activity, and regulation of glucokinase in maintain glucose homeostasis in humans. (10%)

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13. Describe why metabolic enzymes tend to form multienzyme complexes, such as respirasomes, in cells. (10%)

14. Describe the detailed biochemical reaction, including the enzyme, cofactors, standard free energy, regulations, of the only enzyme that is not located specifically in the matrix of mitochondria in the citric acid cycle. (10%)