

所別：生命科學系碩士班 不分組 科目：生物化學

總分 100 分

一. 單選題(每題 3 分; 共 13 題)

- How many high-energy phosphates are generated in converting 1 mole of glucose to lactate?
(a) 1 mole (b) 2 moles (c) 4 moles (d) 12 moles (e) 36 moles (f) 38 moles
- Which of the following enzymes is **not** involved in the pentose phosphate pathway?
(a) Glucose-6-phosphate dehydrogenase (b) 6-phosphogluconate dehydrogenase (c) Transaldolase
(d) succinate dehydrogenase (e) transketolase (f) phosphopentose epimerase
- Which of the following compounds is an inhibitor of protein translation?
(a) Cordycepin (b) Puromycin (c) 2,4-Dinitrophenol (DNP)
(d) Fluoroacetate (e) Ethidium bromide (f) Acetyl-CoA
- Please choose the amino acids that account for most of the UV absorbance at 280 nm by proteins.
(a) Trp and Tyr (b) Met and Cys (c) Arg and Lys (d) Glu and Asp (e) Asn and Gln (f) Ser and Thr
- Which of the following descriptions regarding the secondary structures of polypeptides is **incorrect**?
(a) Antiparallel β sheet has 2 residues per turn (b) Parallel β sheet has 2 residues per turn (c) α helix has 10 residues per turn (d) α helix has a pitch of 0.54 nm/turn (e) Silkworm fibroin contains mostly antiparallel β sheets (f) Approximately every four amino acids in α -keratin has a nonpolar, hydrophobic side chain.
- Which of the following descriptions about Hb (hemoglobin) is **incorrect**?
(a) People who move to high altitudes have a higher concentration of BPG in the blood (b) Heavy smokers have a higher concentration of BPG in the blood (c) HbF has a much higher affinity for BPG than does HbA (d) HbF has an $\alpha_2\gamma_2$ structure (e) CO_2 can reduce the binding affinity of Hb for O_2 (f) The efficiency of O_2 unloading increases greatly as the pH drops.
- Which of the following descriptions regarding monosaccharides is **incorrect**?
(a) D-Threose and L-Threose are enantiomers (b) D-Threose and D-Erythrose are diastereomers (c) α -D-Glucopyranose and β -D-Glucopyranose are anomers (d) The chair form and boat form of β -D-Glucopyranose are two configurational isomers of Glucose (e) Only the β anomers of D-ribofuranose are involved in DNA structure (f) Anomers differ in configuration only at carbon 1.
- Please choose the **incorrect** one from the following descriptions about the Michaelis-Menten rate equation.
(a) K_M measures the substrate concentration at which the reaction rate is $V_{\max}/2$ (b) k_{cat} is the turnover number that measures the rate of the catalytic process (c) The ratio k_{cat}/K_M is a convenient measure of enzyme efficiency (d) The most convenient ways to determine K_M and k_{cat} are via Lineweaver-Burk plots (e) A competitive inhibitor increases the apparent K_{cat} (f) A noncompetitive inhibitor reduces the apparent V_{\max} .
- Choose the **incorrect** one from the following descriptions
(a) The active sites of serine proteases commonly have the residues Asp, His, and Ser (b) One distinguished feature about serine protease is that a "pocket" close to the active site serine gives each of the enzymes its specificity (c) In chymotrypsin the pocket is wider and is lined with hydrophilic residues (d) In trypsin the pocket is deep and narrow, with a negatively charged carboxylate at its bottom (e) A key to the mechanism of serine protease catalysis lies in the stability of two tetrahedral intermediate states (f) Diisopropyl fluorophosphate is an irreversible inhibitor for serine proteases.
- Please choose the **incorrect** one from the following descriptions about nucleic acids.
(a) RNA is labile in both acidic and alkaline solutions (b) Most DNA is in the B form (c) RNA-RNA and DNA-RNA helices are A form (d) Z-DNA is a right-hand helix with alternate purine/pyrimidine bases (e) The Meselson-Stahl experiment proves DNA replicates semiconservatively (f) The *E. coli* genome contains about 4,600,000 base pairs.

注意：背面有試題

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11. A DNA segment of 10,500 base pairs in the B form (10.5 bp/turn), with a superhelical density of about -0.06 . Which of the following descriptions is correct? (W = writing number; L = linking number; T = twist number)
- (a) $\Delta L = 0, \Delta W = 0, \Delta T = 0$ (b) $\Delta L = -60, \Delta W = -60, \Delta T = -60$ (c) $\Delta L = -60, \Delta W = 0, \Delta T = 0$ (d) $\Delta L = 0, \Delta W = -60, \Delta T = 0$
(e) $\Delta L = 0, \Delta W = 0, \Delta T = -60$ (f) $\Delta L = -60, \Delta W = -60, \Delta T = 0$.
12. Certain organisms can undergo net synthesis of carbohydrate from fat via the glyoxylate cycle. Please choose the incorrect one from the following descriptions.
- (a) The glyoxylate cycle produces only one CO_2 per cycle (b) The product of the cycle is transported to mitochondrion in the form of succinate (c) This cycle allows many microorganisms to metabolize acetate (d) Animal cells cannot normally carry out the net synthesis of carbohydrate from fat (e) This cycle needs two special enzymes, isocitrate lyase and malate synthase, that are not present in mitochondria (f) This cycle is particularly active during the development of seeds.
13. Determine the mRNA sequence transcribed from the following DNA segment: 5'-GCCATTTCCCGTTA-3'
- (a) 5'-CGGTAAAGGGAAT-3' (b) 5'-CGGUAAAAGGGCAAU-3' (c) 5'-TAACGGCAAATGGC-3'
(d) 5'-UAACGGCAAUAUGGC-3' (e) 5'-UAACGGGAAAUGGC-3' (f) 5'-GCCATTTCCCGTTA-3'

二. 簡答題 (6 題; 共 61 分)

1. Lipid metabolism.
- (a) Draw the general structure of triglyceride (also called triacylglycerol). (2%)
(b) How many ATPs are produced from the oxidation of oleic acid (18:0)? (4%)
(c) What are the major differences between β -oxidation and biosynthesis of fatty acids? (6%)
(d) Draw the structure of cholesterol. Indicate the rate-limiting enzyme in cholesterol biosynthesis. (4%)
2. Amino acid metabolism.
- (a) Which amino acids are the components of glutathione? (3%)
(b) Which amino acids is the precursor of nitric oxide? (2%)
(c) Which amino acids is the precursor of serotonin and melatonin? (2%)
(d) Which aromatic amino acids is the precursor for dopamine? (2%)
3. Nucleotide metabolism.
- (a) What is the enzyme that catalyzes dUMP into dTMP? (2%)
(b) What is the enzyme that catalyzes deoxythymidine to dTMP? (2%)
(c) What is the enzyme that catalyzes xanthine into uric acid? (2%)
4. Since the structure of DNA was discovered in 1953, it became clear how the hereditary information in cells is encoded in DNA's nucleotide sequences. Although the fundamental mechanisms by which cells decode and use this genetic information are similar, eukaryotic and prokaryotic cells do have differences in the steps for decoding their genomes. Please list the differences. (10%)
5. DNA in eukaryotic cells is highly condensed into chromosomes. Why do eukaryotic cells fold DNA in such higher levels of organization and what is the basic unit of eukaryotic chromosome structure? When eukaryotic cells express their genes, they have to reorganize chromosomes to allow access of proteins that are responsible for gene expression. What kinds of modifications on which proteins contribute to such steps and why? (10%)
6. Many enzymes and proteins participate in eukaryotic DNA synthesis. Please list all of them and describe their functions (10%)

參考用