所別：生命科學系碩士班 科目：生物化學(含分子生物學)

一. 單選題(每題 3 分；共 17 題)

1. Which of the following compounds is an inhibitor of protein translation?
   (a) AZT (b) Chloramphenicol (c) novobiocin (d) Fluoroacetate (e) Cordycepin (f) IPTG
2. An actively respiring bacterial culture is briefly incubated with [1-^{14}C] glucose, and the glycolytic and TCA intermediates are isolated. Where is the ^{14}C in Glyceraldehyde 3-phosphate? Consider only the initial incorporation of ^{14}C, in the first pass of labeled glucose through the pathways.
   (a) C1 (b) C2 (c) C3 (d) C1 and C2 (e) C2 and C3 (f) C1 and C3
3. How many high-energy phosphates are generated in oxidizing 1 mole of NADH via DHAP/G3P shuttle?
   (a) 0 (b) 2 (c) 3 (d) 12 (e) 36 (f) 38
4. Please choose the amino acids that account for most of the UV absorbance at 280 nm by proteins.
   (a) Phe and His (b) Met and Cys (c) Trp and Tyr (d) Glu and Asp (e) Asn and Gln (f) Arg and Lys
5. 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 a pitch of 3.4 nm/turn (d) α helix has 3.6 residues per turn (e) Fibroin is a β sheet protein (f) α-Keratin is built on a coiled-coil α-helical structure.
6. Which of the following descriptions about Hb (hemoglobin) is **incorrect**?
   (a) Bisphosphoglycerate (BPG) acts as an allosteric effector of O_2 binding (b) Heavy smokers have a higher concentration of BPG in the blood (c) CO_2 reduces the binding affinity of Hb for O_2 (d) HbF has an $\alpha_2\gamma_2$ structure (e) HbF has a much higher affinity for BPG than does HbA (f) The efficiency of O_2 unloading increases as the pH drops.
7. Which of the following descriptions regarding carbohydrate is **incorrect**?
   (a) Sucrose is α-D-glucopyranosyl (1->2) β-D-fructofuranoside (b) Maltose has an α(1->4) linkage (c) Cellobiose is β-D-glucopyranosyl (1->4) β-D-glucopyranose (d) Lactose has one reducing and one nonreducing end (e) The glucose moiety in lactose exists exclusively in β configuration in solution (f) Sucrose is a nonreducing sugar.
8. 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}.
9. You wish to sequence a protein. Cleavage of the protein by trypsin and chymotrypsin yields the following fragments. What is the approximate molecular weight of this protein?

   Chymotrypsin:
   (1) Leu-His-Lys-Gln-Ala-Asn-Gln-Ser-Gly-Gly-Gly-Pro-Ser
   (2) Gln-Gln-Ala-Gln-His-Leu-Arg-Ala-Cys-Gln-Gln-Trp
   (3) Arg-Ile-Pro-Lys-Cys-Arg-Lys-Phe

   Trypsin:
   (1) Arg
   (2) Ala-Cys-Gln-Gln-Trp-Leu-His-Lys
   (3) Cys-Arg
   (4) Gln-Ala-Asn-Gln-Ser-Gly-Gly-Gly-Pro-Ser
   (5) Phe-Gln-Gln-Ala-Gln-His-Leu-Arg
   (6) Ile-Pro-Lys
   (7) Lys

   (a) 1 kD (b) 2 kD (c) 4 kD (d) 6 kD (e) 10 kD (f) None of the above
10. Please choose the **incorrect** one from the following descriptions about nucleic acids.
    (a) The *E. coli* genome contains about 4,600,000 bp (b) The *E. coli* genome contains about 4,200 genes (c) The average length of a gene in *E. coli* is ~ 100 bp (d) Most DNA is in the B form (e) RNA-RNA and DNA-RNA helices are A form (f) Z-DNA is a left-hand helix with alternate purine/pyrimidine bases.

11. A DNA segment of 1,050 base pairs in the B form, with a superhelical density of about –0.06. Which of the following descriptions is **correct**? (W = writhing number; L = linking number; T = twist number)
(a) $\Delta L = -6$, $\Delta W = -6$, $\Delta T = 0$ (b) $\Delta L = 0$, $\Delta W = 0$, $\Delta T = 0$ (c) $\Delta L = -6$, $\Delta W = -6$, $\Delta T = -6$ (d) $\Delta L = 0$, $\Delta W = -6$, $\Delta T = 0$ (e) $\Delta L = 0$, $\Delta W = 0$, $\Delta T = -6$ (f) $\Delta L = -6$, $\Delta W = 0$, $\Delta T = 0$.
12. Which scientist invented polymerase chain reaction (PCR)?
(a) K. B. Mullis (b) J. D. Watson and H. C. Crick (c) A. D. Hershey and M. Chase (d) S. B. Prusiner (e) G. N. Ramachandran (f) M. Meselson and F. Stahl.
13. Determine the mRNA sequence transcribed from the following DNA segment: 5'-GCCATTTCCCGTTA-3'
(a) 5'-CGGTAAAGGGAAT-3' (b) 5'-CGGUAAAGGGCAAU-3' (c) 5'-TAACGGCAAATGGC-3'
(d) 5'-UAACGGCAAAUGGC-3' (e) 5'-UAACGGGAAAUGGC-3' (f) 5'-GCCATTTCCCGTTA-3'
14. How many moles of ATP are produced from the oxidation of 1 mole of palmitic acid (16:0)? (a) 16 (b) 21 (c) 96 (d) 98 (e) 131 (f) None of the above
15. Which of the following compounds is **not** involved in the synthesis of the purine ring? (a) Aspartate (b) CO_2 (c) Glutamine (d) Glycine (e) 10-Formyl-tetrahydrofolate (f) Carbamoyl phosphate
16. Which amino acid is the precursor for dopamine? (a) Histidine (b) Tryptophan (c) Glycine (d) Glutamate (e) GABA (f) Tyrosine
17. Which enzyme is **not** directly involved in the catabolism of purine nucleotides to uric acid? (a) xanthine oxidase (b) Adenosine deaminase (c) Nucleotidase (d) PRPP amidotransferase (e) Purine nucleoside phosphorylase (f) Guanine deaminase

二. 解釋名詞(每題 3 分;共 5 題)

1. operon
2. ORF
3. promoter
4. helicase
5. cDNA

三. 問答題

1. Identify two features of a prokaryotic gene that would need to be modified in order to express the gene in eukaryotic cells, and briefly explain why modification would be necessary. (6 points)
2. Why do eukaryotes need telomeres, but prokaryotes do not? (5 points)
3. What is the difference between reverse transcriptase PCR and standard PCR? For what purpose would you use RT-PCR? (5 points)
4. Most mRNAs contain poly(A). You have sequenced the portions of the poly(A). (12 points)
   A. What is the purpose of poly(A)?
   B. What is the enzyme that adds AMP residences one at a time to mRNA precursor?
   C. What are the polyadenylation signals?
   D. Describe basic mechanisms of polyadenylation?
5. Describe a yeast two-hybrid screen for finding an unknown protein that interacts with a known protein.(6 points)