

系所組別： 生命科學系甲組

考試科目： 生物化學

考試日期： 0308， 節次： 2

※ 考生請注意：本試題 可 不可 使用計算機

Part I

1. (10 points) Our growing understanding of how proteins fold allows researchers to make predictions about protein structure based on primary amino acid sequence data. Consider the following amino acid sequence Ile-Ala-His-Thr-Tyr-Gly-Pro-Phe-Glu-Ala-Ala-Met-Cys-Lys-Trp-Glu-Ala-Gln-Pro-Asp-Gly-Met-Glu-Cys-Ala-Phe-His-Arg

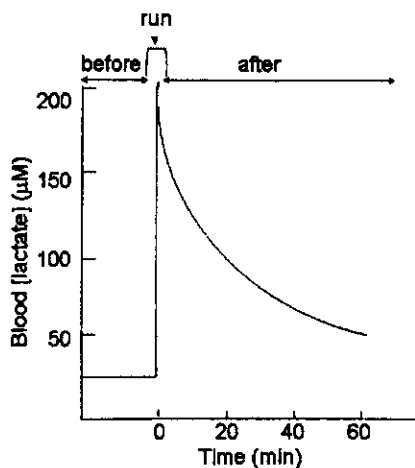
- (a) Where might bends or β turns occur?
- (b) Where might intrachain disulfide cross-linkages be formed?
- (c) Assuming that this sequence is part of a larger globular protein, indicate the probable location (the external surface or interior of the protein) of the following amino acid residues: Asp, Ile, Thr, Ala, Gln, Lys. Explain your reasoning.

(amino acid/hydrophathy index: Gly/-0.4; Ala/1.8; Pro/1.6; Val/4.2; Leu/3.8; Ile/4.5; Met/1.9; Phe/2.8; Tyr/-1.3; Trp/-0.9; Ser/-0.8; Thr/-0.7; Cys/2.5; Asn/-3.5; Gln/-3.5; Lys/-3.9; His/-3.2; Arg/-4.5; Asp/-3.5; Glu/-3.5)

2. (5 points) Suppose you have four forms of a protein, all with identical amino acid sequence but containing zero, one, two, or three oligosaccharide chains, each ending in single sialic acid residue. Draw the gel pattern you would expect when a mixture of these four glycoproteins is subjected to SDS polyacrylamide gel electrophoresis and stained for protein. Identify any band in your drawing.

3. (10 points) Signals carried by hormones must eventually be terminated. Describe several different mechanisms for signal termination.

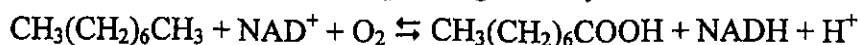
4. (10 points) The concentrations of lactate in blood plasma before, during, and after a 400 m sprint are shown in the graph.



- (a) what causes the rapid rise in lactate concentration?
- (b) what causes the decline in lactate concentration after completion of the sprint? Why does the decline occur more slowly than the increase?
- (c) what is the concentration of lactate(not zero)during the resting state?

5. (5 points) Although oxygen does not participate directly in the citric acid cycle, the cycle operates only when O_2 is present. Why?

6. (10 points) Some microorganisms of the genera *Nocardia* and *Pseudomonas* can grow in an environment where hydrocarbons are the only food source. These bacteria oxidize straight-chain aliphatic hydrocarbons, such as octane, to their corresponding carboxylic acids:



How could these bacteria be used to clean up oil spills? What would be some of the limiting factors to the efficiency of this process?

(背面仍有題目,請繼續作答)

系所組別： 生命科學系甲組

考試科目： 生物化學

考試日期： 0308，節次： 2

※ 考生請注意：本試題 可 不可 使用計算機**Part II**

1. What factors should one consider in expressing eukaryotic genes in prokaryotic cells? (9%)
2. What component of the nucleotide is responsible for the absorption of ultraviolet light? How is this technique important in the analysis of nucleic acids? (8%)
3. (A) Why are missense mutations less likely to result in proteins lacking normal function than frame shift mutations? (5%)
(B) Scientists at a company have just developed a new cleaning agent. Before the company goes further in developing the product they want to determine if it could be carcinogenic. Describe in some detail the initial test you would recommend they perform. (6%)
4. Explain the following terms and its function. (6%)
(A) ubiquitin
(B) peptide signal sequence
5. Choose the correct answer (only one answer) from each of the question. (16%)
 - 1) In what way do upstream activator sequences (UASs), regulatory sequences in yeast, differ from enhancers and silencers?
(A) UASs only function downstream.
(B) UASs only function upstream.
(C) enhancers only function downstream.
(D) UASs function in the middle of transcription units.
(E) UASs can only function in the 5'-3' direction.
 - 2) The sigma subunit of bacterial RNA polymerase
(A) binds to a bacterial gene's promoter.
(B) is composed of both polypeptide and RNA molecules.
(C) is required for RNA polymerization.
(D) is required for termination of transcription.
(E) is required for ribosomal binding.
 - 3) The advantage of RNAi over other functional genomic techniques is that
(A) RNAi does not affect any gene but the targeted one.
(B) other techniques cannot target single genes.
(C) other techniques cannot make specific mutagenic changes.
(D) RNAi introduces no mutations to the organism.
(E) all of the above.

系所組別： 生命科學系甲組

考試科目： 生物化學

考試日期：0308，節次：2

※ 考生請注意：本試題 可 不可 使用計算機

4) If mature eukaryotic mRNA is hybridized with its corresponding DNA coding strand (heteroduplex analysis) and visualized by electron microscopy, looping strands of nucleic acid are seen. What do these structures represent?

- (A) lariat structures.
- (B) inverted repeats.
- (C) introns.
- (D) exons.
- (E) overlapping genes.

5) Which of the following is true regarding gene expression?

- (A) only one gene can be present within a given DNA sequence.
- (B) mistakes in transcription are corrected by RNA polymerase.
- (C) the ribosome binding site lies at the 3' end of mRNA.
- (D) a change in genotype always results in a changed phenotype.
- (E) a second round of transcription can begin before the preceding transcript is completed.

6) A researcher found a method she could use to manipulate and quantify phosphorylation and methylation in embryonic cells in culture. One of her colleagues suggested she try increased methylation of C nucleotides in a mammalian system. Which of the following results would she most likely see?

- (A) increased chromatin condensation.
- (B) abnormalities of mouse embryos.
- (C) decreased chromatin condensation.
- (D) inactivation of the selected genes.
- (E) decreased binding of transcription factors.

7) Peptidyl transferase

- (A) is a polypeptide subunit of the small ribosomal subunit.
- (B) is not found in eukaryotes.
- (C) is a function of an rRNA in the large ribosomal subunit.
- (D) catalyzes the reaction that joins a tRNA to its amino acid.
- (E) is active during initiation of translation.

8) Attenuation in the *E. coli trp* operon

- (A) occurs when there are low concentrations of tryptophan.
- (B) is triggered by deletions in *trp*.
- (C) increases transcription of *trp*.
- (D) increases translation of *trp* mRNA.
- (E) results from the formation of *trp* mRNA secondary structures.

