國立清華大學 102 學年度碩士班考試入學試題

系所班組別：生醫工程與環境科學系 甲組（分子生醫工程組）

考試科目（代碼）：普通生物學 (2205)

　*請在【答案卷】作答

I. 單選題: (15%; 3 points/question)

1. The biological system of classification catalogs names of the millions of organisms living on earth. Taxonomists place organisms into various classification categories. Which of the following taxa order (from the more-inclusive (largest) to less-inclusive) is CORRECT?
(A) Domain→Kingdom→Division→·····→Genus→Species
(B) Species→Domain→Division→·····→Kingdom→Genus
(C) Domain→Division→Kingdom→·····→Species→Genus
(D) Division→Genus→Species→·····→Kingdom→Domain
(E) Species→Genus→Division→·····→Kingdom→Domain

2. Which of the following index can be used to fully justify whether a biochemical reaction is a spontaneous reaction?
A) temperature
C) ΔH
B) ΔG
D) Kd
E) TΔS

3. In mammalian cells, cell respiration includes the following stages EXCEPT:
(A) Calvin cycle
(B) Kreb Cycle
(C) Glycolysis
(D) Electron transport system

4. Which of the following statement is WRONG?
(A) Connective tissues are usually composed of living cells surrounded by nonliving matrices.
(B) Cartilage and bone are epithelial tissues that form skeleton.
(C) Adipose tissue stores fat.
(D) Blood is connective tissue that transports materials around the body.
(E) Muscle tissues are highly contractile.

5. The genotype of a particular pea plant is AaBb, corresponding to a phenotype of tall and yellow. How many different types of gametes are expected to be produced by this individual regarding to this phenotype?
A) 4
B) 8
C) 2
D) 1
E) 5

II. 問答題 Q&A:

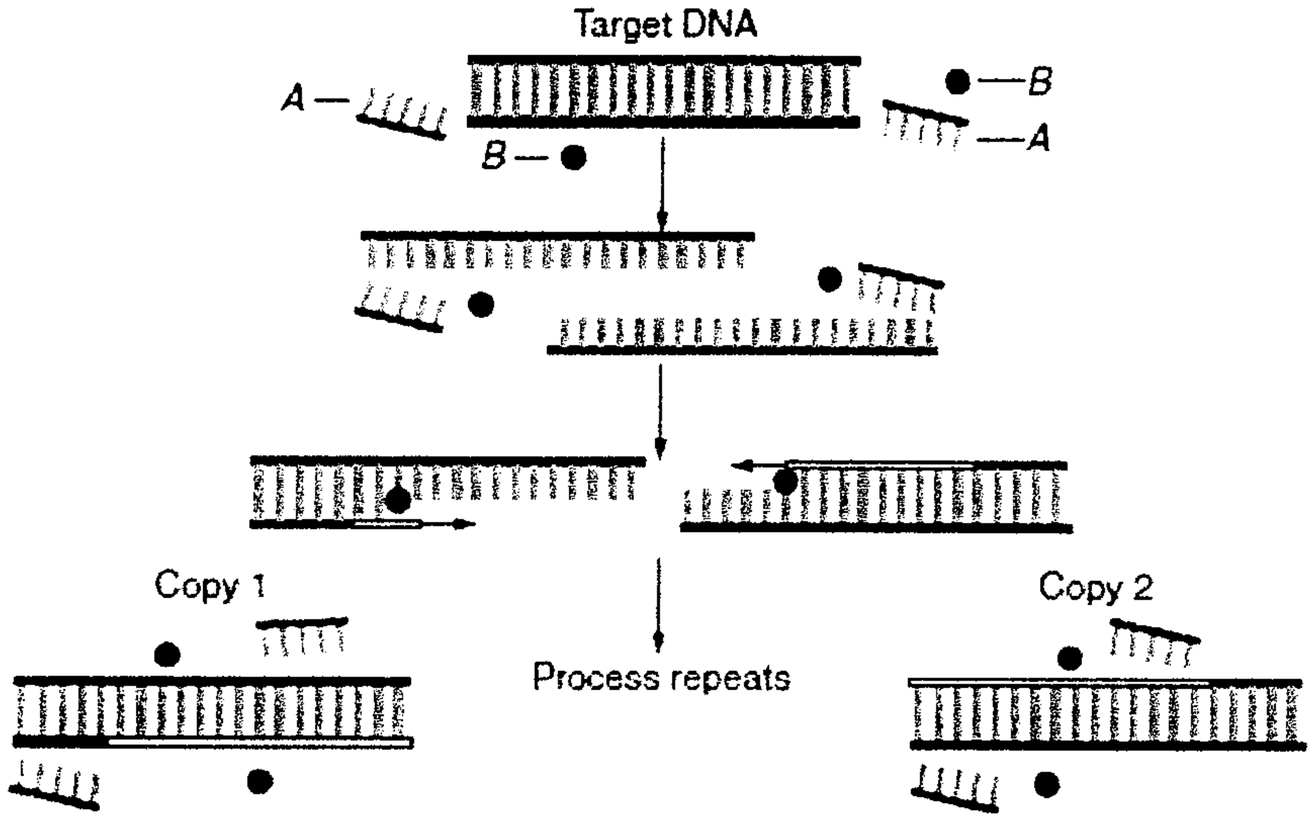
1. Explain how children with different ABO and Rhesus blood groups could be the offspring of the same parents. Use diagrams to support your answer. (5%)

2. The table shows parts of DNA sequences.

	DNA Sequence
Original DNA	AAC TCG GTC AAT ATG
Mutation 1	AAC TCC GTC AAT ATG
Mutation 2	AAC TCG GTA ATA TGC

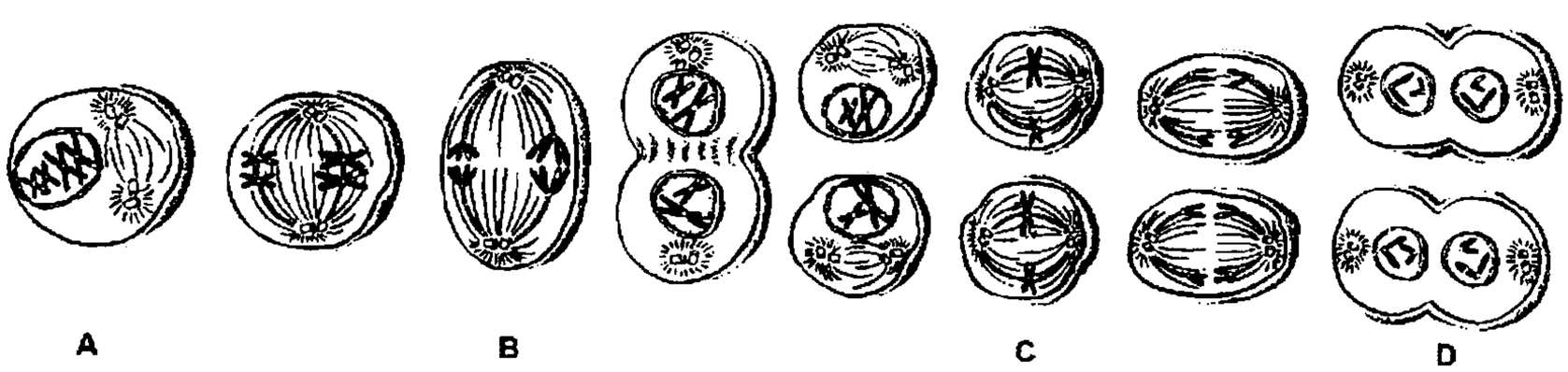
(1) What types of mutations are Mutation 1 and Mutation 2? Clearly indicate in your answer which is Mutation 1 and which is Mutation 2. (5%)
(2) Please describe what is the effect of Mutation 1. (5%)

3.



(1) What are represented by the components labeled A and B? (5%)
(2) How do you distinguish the recombinant DNA is successfully to deliver a target gene into plasmid from empty plasmid? (5%)
(3) What is the difference between a nucleus of an egg cell and that of a somatic (body) cell of an animal? (5%)

4.



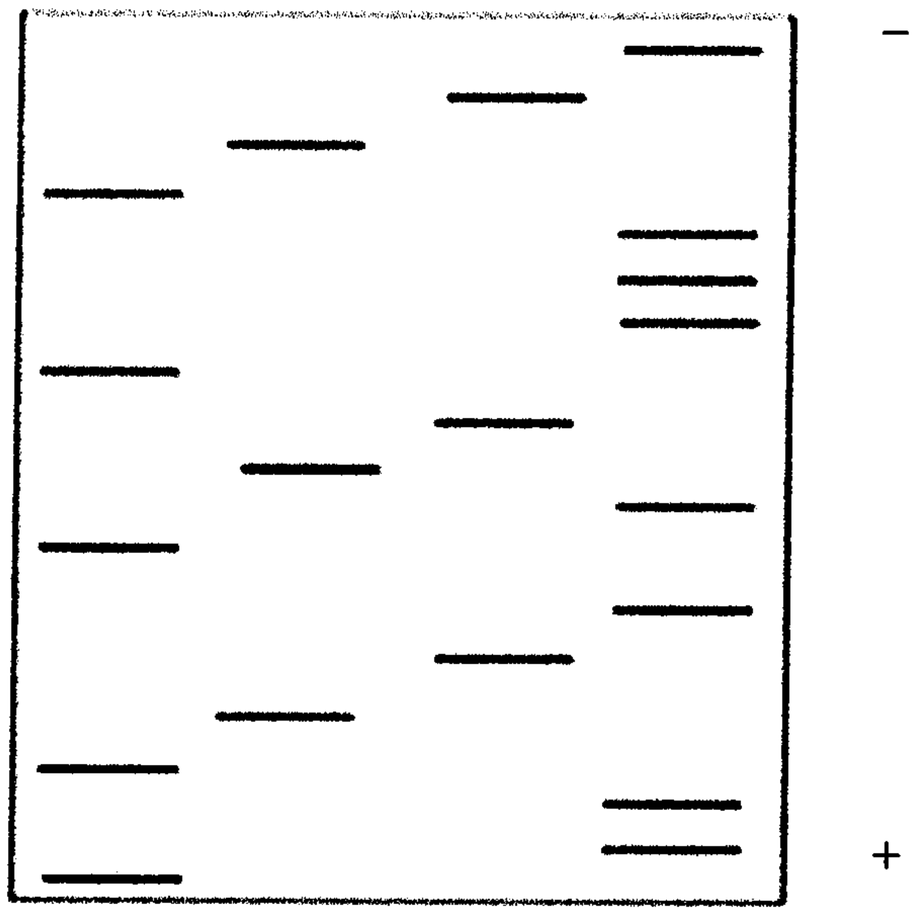
(1) What are the processes respectively shown above in label A, B and C? (5%)
(2) What is the difference between anaphase I and anaphase II? Why is the difference significant? (5%)

5.

(1) Please explain automatically rapid DNA sequencing by four deoxynucleotides tagged with a different color. (5%)

(2) The following figure is the result of Sanger ddNTP chain termination sequencing. What is the sequence of the **template DNA**? (5%)

ddATP ddTTP ddGTP ddCTP



6. Some organelles in a eukaryotic cell including mitochondria and chloroplast are generally believed to be originated from prokaryotic organisms. In 1967, this hypothesis was furthered studied by Lynn Margulis with the theory of "symbiosis". Please describe at least 2 experimental observations to support the "symbiosis" theory. (5%)

7. iPSCs (induced pluripotent stem cells) were created by Dr. Shinya Yamanaka, who received the Nobel Prize for Physiology or Medicine in 2012. (1) What are iPSCs? (4%) (2) Describe at least two potential applications of iPSCs in biomedical sciences (6%).

8. Please compare the differences between autocrine, paracrine and endocrine (5%).

9. How the nerve signal triggers the contraction of skeletal muscle? (5%)

10. (1) What are genetically-modified (GM) crops? (4%) (2) What would be the benefits and potential concerns of GM crops? (Please provide one example for each case.) (6%)