(1) Please briefly explain or describe the terminology below

(a) **Chemotaxis (4%)**
(b) **Plasmid (4%)**
(c) **Quorum sensing (4%)**
(d) **Monod equation (4%)**
(e) **Polymerase chain reaction (4%)**

(2) Please compare the size of ribosomes present in Bacteria, Archaea, Eucarya, Chloroplast and Mitochondria. (10%)

(3) The bacteria have a chemically complex external covering, termed the cell envelope. It lies outside of the cytoplasm, and is composed of two main layers: the cell wall and the cell membrane.

(a) Please contrast (illustrate graphically) the cell envelope structures of gram-positive and gram-negative bacteria. (10%)

(b) Do you think that the property of cell envelope is an important consideration for bacteria to degrade the petroleum hydrocarbon? Why? (5%)

(4) Starch is a kind of carbohydrate consisting of a large number of glucose units joined by glycoside bonds. It can be hydrolyzed and metabolized by many chemoorganotrophs for growth. This is because high chemical energy can be conserved for the formation of ATP and NADH in the sugar catabolism. Please try your best to discuss how the aerobic bacteria metabolize starch and generate ATP with oxygen as the electron acceptor (20%).

(5) Sewage and industrial wastewater containing BOD and ammonia can be treated by biological treatment processes such as activated sludge system before discharging to the environment.

(a) Please describe the microbiological concept of how the "activated sludge system" clarifies the BOD in wastewater (hint: carbon and energy flow, microbial metabolism and growth) (10%)

(b) Please try to explain the reason why the effluent from activated sludge system contains nitrate. What are the possible microbial reactions and microbial populations involved in? (10%)

(背面仍有題目,請繼續作答)

(6) Below is the sequence of the coding-strand DNA that contains an open reading frame of a gene in the bacterial cell.

5'...ACTGCCCATGAGCGACCACTTGGGGCTCGGGGAATGGTAGAACG...3'

(a) What is an "open reading frame"? (5%)

(b) According to the DNA sequence, please give the RNA sequence after transcription (5%).

(c) Please give the chain of amino acids after further translation of the RNA sequence according to the Table of the genetic code below. (5%)

Table of the genetic code. The code is presented in RNA form. Codons run in the 5' to 3' direction.

First Position (5' End)*	Second Position U		Second Position C		Second Position A		Second Position G		Third Position (3' End)
U	UUU	Phe	UCU	Ser	UAU	Tyr	UGU	Cys	U
	UUC		UCC		UAC		UGC		C
	UUA	Leu	UCA		UAA	STOP	UGA	STOP	A
	UUG		UCG		UAG		UGG	Trp	G
C	CUU	Leu	CCU	Pro	CAU	His	CGU	Arg	U
	CUC		CCC		CAC		CGC		C
	CUA		CCA		CAA	Gln	CGA		A
	CUG		CCG		CAG		CGG		G
A	AUU	Ile	ACU	Thr	AAU	Asn	AGU	Ser	U
	AUC		ACC		AAC		AGC		C
	AUA		ACA		AAA	Lys	AGA	Arg	A
	AUG	Met	ACG		AAG		AGG		G
G	GUU	Val	GCU	Ala	GAU	Asp	GGU	Gly	U
	GUC		GCC		GAC		GGC		C
	GUA		GCA		GAA	Glu	GGA		A
	GUG		GCG		GAG		GGG		G