

注意：請將答案寫在答案紙上

1. Concerning the properties of proteins in solution: (6%)
 - a. Solubilizing a protein by increasing the ionic strength of a solution is termed _____. Precipitating a protein at high ionic strength is termed _____.
 - b. DEAE-cellulose is a(n) _____ exchanger. CM-cellulose is a(n) _____ exchanger.
 - c. An nucleophile is an electron-pair _____. An electrophile is an electron-pair _____.
2. Answer the following with true or false. If false, explain why. (5%)
 - a. The initial rate of an enzyme-catalyzed reaction is independent of substrate concentration.
 - b. At saturating levels of substrate, the rate of an enzyme-catalyzed reaction is proportional to the enzyme concentration.
 - c. The Michaelis constant K_m equals the substrate concentration at which $v = V_{max}/2$.
 - d. The K_m for a regulatory enzyme varies with enzyme concentration.
 - e. The rate of an enzyme-catalyzed reaction in the presence of a rate-limiting concentration of substrate decreases with time.
3. The ϵ -amino group of Lys has a pK_a of 10.5. (8%)
 - a. What fraction of these groups will be protonated (i.e., $-NH_3^+$ rather than $-NH_2$) in a dilute solution of Lys at $pH = 9.5$?
 - b. At $pH = 11.0$?
4. Chemotrophs depend on the breakdown of fuel molecules, such as lipids, polysaccharides and proteins, from their surroundings to provide energy and precursors for biosynthesis. Briefly describe the four major stages of the catabolic pathways for generating energy and reducing power to the ultimate formation of ATP in chemotrophic cells. (8%)
5. During DNA replication: (10%)
 - a. Each Okazaki fragment is synthesized with a short stretch of _____ linked to its _____ end.
 - b. DNA chain growth of all Okazaki fragments occurs in the _____ direction.
 - c. The 3' --- 5' exonuclease activity of DNA polymerase III serves a _____ function.

- d. Synthesis of the _____ strand is _____ and in the same direction as the movement of the replication fork; synthesis of the _____ strand is _____ and opposite to the direction of fork movement.
- e. Whereas bacterial chromosome replication occurs at only two sites at any time, _____ DNA synthesis may take place simultaneously at many sites on the bacterial chromosome.
- f. _____ enzyme is needed to provide swivels for rotation of one parental strand around the other so as to relieve the twist generated ahead of the replication fork.
6. You want to clone a gene that is expressed in liver and is suspected to be involved in a drug response. Both a human genomic DNA library and a liver cDNA library are available to you. which would you choose and why? (4%)
7. The following amino acid sequence represents part of protein. The normal sequence and four mutant forms are shown. By referring to the enclosed table of genetic code, determine the double-stranded sequence of the corresponding section the normal gene. Which strand is the strand that RNA polymerase "reads"? What would the sequence of the resulting mRNA be? What kind of mutation is each mutant protein most likely to represent? (9%)

Normal -lys-arg-his-his-tyr-leu-
 Mutant 1 -lys-arg-his-his-cys-leu-
 Mutant 2 -lys-arg-ile-ile-ile-
 Mutant 3 -lys-glu-thr-ser-leu-ser-

The Genetic Code					
FIRST POSITION (5' END)	SECOND POSITION				THIRD POSITION (3' END)
	U	C	A	G	
U	Phe	Ser	Tyr	Cys	U
	Phe	Ser	Tyr	Cys	C
	Leu	Ser	Stop	Stop	A
	Leu	Ser	Stop	Trp	G
C	Leu	Pro	His	Arg	U
	Leu	Pro	His	Arg	C
	Leu	Pro	Gln	Arg	A
	Leu	Pro	Gln	Arg	G
A	Ile	Thr	Asn	Ser	U
	Ile	Thr	Asn	Ser	C
	Ile	Thr	Lys	Arg	A
	Met	Thr	Lys	Arg	G
G	Val	Ala	Asp	Gly	U
	Val	Ala	Asp	Gly	C
	Val	Ala	Glu	Gly	A
	Val	Ala	Glu	Gly	G

Note: Given the position of the bases in a codon, it is possible to find the corresponding amino acid. For example, the codon (5') AUG (3') on mRNA specifies methionine, whereas CAU specifies histidine. UAA, UAG, and UGA are termination signals. AUG is part of the initiation signal, and it codes for internal methionines as well.

8. Describe the phospholipase A₂ and phospholipase C pathways in signal transduction of cells. (10%)
9. Describe the biosynthesis of angiotensin II. (10%)
10. High serum level of low density lipoprotein (LDL) is a risk factor of atherosclerosis, explain the biosynthesis of LDL and its metabolism. (10%)
11. The biological functions of hormones are mediated through receptors in cells. The receptors could be located either in membrane or in cytosolic fraction. Give each hormone one example to explain it. (10%)
12. Thrombin and plasmin are two major proteases in thrombosis and fibrinolysis. Describe the biosynthesis of their formation and their physiological role in fibrinolysis. (10%)