

科目：生物化學 適用：應化系

編號：495

考生注意：

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2. 答案必須寫在答案卷上，否則不予計分。
3. 限用藍、黑色筆作答；試題須隨卷繳回。

本試題

共 9 頁

第 / 頁

## 第一部分、選擇題：(80%，每小題 2%)

1. An example of a glycerophospholipid that is involved in cell signaling is:  
A) arachidonic acid.  
B) ceramide.  
C) phosphatidylinositol.  
D) testosterone.  
E) vitamin A (retinol).
2. Which of the following best describes the cholesterol molecule?  
A) Amphipathic  
B) Nonpolar, charged  
C) Nonpolar, uncharged  
D) Polar, charged  
E) Polar, uncharged
3. The PCR reaction mixture does *not* include:  
A) all four deoxynucleoside triphosphates.  
B) DNA containing the sequence to be amplified.  
C) DNA ligase.  
D) heat-stable DNA polymerase.  
E) oligonucleotide primer(s).
4. Based on Chargaff's rules, which of the following are possible base compositions for double-stranded DNA?  

|    | %A                 | %G | %C | %T | %U |
|----|--------------------|----|----|----|----|
| A) | 45                 | 45 | 5  | 5  | 0  |
| B) | 20                 | 20 | 20 | 20 | 20 |
| C) | 35                 | 15 | 35 | 15 | 0  |
| D) | All of the above.  |    |    |    |    |
| E) | None of the above. |    |    |    |    |
5. The shape of a protein is influenced by the \_\_\_\_\_ of the amino acids present.  
A) side chains  
B) amino groups  
C) carboxyl groups  
D) a and b  
E) a, b and c

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本試題  
共 9 頁  
第 2 頁

6. An enzyme that does not have its ligand or prosthetic group bound, is said to be in the \_\_\_\_\_ form.
- A) proto-enzyme
  - B) apoenzyme
  - C) holoenzyme
  - D) zymogen
  - E) none of the above
7. The number of substrate molecules converted to product in a given unit of time by a single enzyme molecule at saturation is referred to as the:
- A) dissociation constant.
  - B) half-saturation constant.
  - C) maximum velocity.
  - D) Michaelis-Menten number.
  - E) turnover number.
8. Which of the following is *not* a reducing sugar?
- A) Fructose
  - B) Glucose
  - C) Glyceraldehyde
  - D) Ribose
  - E) Sucrose
9. Which of the following is a heteropolysaccharide?
- A) Cellulose
  - B) Chitin
  - C) Glycogen
  - D) Hyaluronate
  - E) Starch
10. A \_\_\_\_\_ is used during all three of the following processes: DNA replication, DNA repair, and joining vector DNA and donor DNA.
- A) polymerase
  - B) restriction enzyme
  - C) ligase
  - D) cloning vector
  - E) selectable marker

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本試題

共 9 頁

第 3 頁

11. When double-stranded DNA is heated at neutral pH, which change does *not* occur?

- A) The absorption of ultraviolet (260 nm) light increases.
- B) The covalent N-glycosidic bond between the base and the pentose breaks.
- C) The helical structure unwinds.
- D) The hydrogen bonds between A and T break.
- E) The viscosity of the solution decreases.

12. In living cells, nucleotides and their derivatives can serve as:

- A) carriers of metabolic energy.
- B) enzyme cofactors.
- C) intracellular signals.
- D) precursors for nucleic acid synthesis.
- E) all of the above.

13. Proteins with charges can be separated by \_\_\_\_\_ chromatography.

- A) exclusion
- B) size
- C) affinity
- D) ion exchange
- E) gel filtration

14. Fluorouracil inhibits DNA synthesis by decreasing the cell's supply of dTMP through which of the following actions?

- A) activation of uracil phosphoribosyltransferase
- B) inhibition of thymidylate synthase
- C) inhibition of ribonucleotide reductase
- D) inhibition of thymidine kinase
- E) activation of uridine phosphorylase

15. Topoisomerases can:

- A) change the linking number ( $Lk$ ) of a DNA molecule.
- B) change the number of base pairs in a DNA molecule.
- C) change the number of nucleotides in a DNA molecule.
- D) convert D isomers of nucleotides to L isomers.
- E) interconvert DNA and RNA.

16. In glycoproteins the carbohydrate is most often linked to threonine, asparagines, or \_\_\_\_\_

- A) serine

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本試題

共 9 頁

第 4 頁

- B) lysine
- C) valine
- D) aspartic acid
- E) tyrosine.

17. Which of the following is a DNA sequence?

- A) mediator
- B) Repressor
- C) Activator
- D) Inducer
- E) enhancer

18. In a nucleosome, the DNA is wrapped around

- A) polymerase molecules.
- B) ribosomes.
- C) histones.
- D) a thymine dimer.
- E) short tandem repeat

19. What is a genome?

- A) The complete complement of an organism's genes
- B) A specific set of polypeptides within each cell
- C) A specialized polymer of four different kinds of monomers
- D) A specific segment of DNA that is found within a prokaryotic chromosome
- E) An ordered display of chromosomes arranged from largest to smallest

20. A paleontologist has recovered a bit of tissue from the 400-year-old preserved skin of an extinct dodo (a bird). The researcher would like to compare a specific region of the DNA from the sample with DNA from living birds. Which of the following would be most useful for increasing the amount of dodo DNA available for testing?

- A) RFLP analysis
- B) polymerase chain reaction (PCR)
- C) electroporation
- D) gel electrophoresis
- E) Southern blotting

21. Which of the following DNA mutations is the most likely to be damaging to the protein it specifies?

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本試題  
共 9 頁  
第 5 頁

- A) a base-pair deletion  
B) a codon substitution  
C) a substitution in the last base of a codon  
D) a codon deletion  
E) a point mutation
22. Muscle cells differ from nerve cells mainly because they
- A) express different genes.  
B) contain different genes.  
C) use different genetic codes.  
D) have unique ribosomes.  
E) have different chromosomes.
23. RNA polymerase from *E. coli* (core enzyme alone) has all of the following properties *except* that it:
- A) can extend an RNA chain and initiate a new chain.  
B) is required for the synthesis of mRNA, rRNA, and tRNA in *E. coli*.  
C) produces an RNA polymer that begins with a 5'-triphosphate.  
D) recognizes specific start signals in DNA.  
E) requires all four ribonucleoside triphosphates and a DNA template.
24. If an inorganic ion such as  $Mg^{2+}$  is required for enzyme activity, it is usually described as a
- A) coenzyme  
B) prosthetic group  
C) holoenzyme  
D) cofactor  
E) apoenzyme
25. Posttranslational glycosylation of proteins is inhibited specifically by:
- A) chloramphenicol.  
B) cycloheximide.  
C) puromycin.  
D) streptomycin.  
E) tunicamycin.
26. Which one of the following antibiotics does not function by interfering with the translational process?
- A) Chloramphenicol  
B) Cycloheximide  
C) Penicillin

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本試題  
共 9 頁  
第 6 頁

- D) Puromycin
- E) Streptomycin

27. Protein structural motifs often have general functions in common. Which one of the following motifs is known to be involved in protein dimer formation, but not in direct protein-DNA interactions?

- A)  $\beta$ -barrel
- B) helix-turn-helix
- C) homeodomain
- D) leucine zipper
- E) zinc finger

28. Assuming that the average amino acid residue contributes 110 to the peptide molecular weight, what will be the minimum length of the mRNA encoding a protein of molecular weight 5,000?

- A) 133 nucleotides
- B) 460 nucleotides
- C) 1,400 nucleotides
- D) 5,000 nucleotides
- E) A minimum length cannot be determined from the data given.

29. Nucleosomes:

- A) are important features of chromosome organization in eukaryotes and bacteria.
- B) are composed of proteins rich in acidic amino acids, such as Asp and Glu.
- C) are composed of protein and RNA.
- D) bind DNA and alter its supercoiling.
- E) occur in chromatin at irregular intervals along the DNA molecule.

30. The protein \_\_\_\_ contains a structure with extended helical chains coiled into a triple helix, and the sequence contains stretches of repetitive amino acid sequences.

- A) triose phosphate isomerase
- B) hemoglobin
- C) collagen
- D) nuclease
- E) none of the above

31. A zwitterion

- A) is the result of the pH going above 7.

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本試題

共 9 頁

第 1 頁

- B) is the result of the pH going below 7.  
C) is the result of having a pH between 1 and 5.  
D) is the result of having both a positive and a negative charge.  
E) none of the above

32. The denaturing of a protein can be caused by

- A) heating.  
B) exposing to detergents.  
C) changing in pH.  
D) all of these will cause denaturation.  
E) none of the above

33. What type of proteases are linked to apoptosis?

- A) Caspases  
B) Collagenases  
C) Elastases  
D) Metalloprotease  
E) Serine proteases

34. Phosphate groups are usually added to enzymes by a \_\_\_\_\_ using \_\_\_\_\_.

- A) phosphorylase, ADP  
B) kinase, ADP  
C) synthase, creatine phosphate  
D) kinase, ATP  
E) one of the above

35. Provides structural rigidity to the plasma membrane.

- A) cholesterol  
B) palmitate  
C) arachidonate  
D) diacylglycerol  
E) oleate

36. Cooperative and homotropic allostery implies:

- A) Binding of an initial substrate induces a conformational change, increasing affinity of binding to the substrate at a second active site.  
B) Two domains bind a substrate with a synergistic effect.  
C) An activating domain binds to a protein and induces a conformational change altering substrate affinity.

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本試題  
共 9 頁  
第 8 頁

- D) a and b  
E) a, b and c

37. What is the result of the insertion or deletion of a nucleotide in the coding sequence of a gene by DNA polymerase during DNA replication? (5%)

- A) a frameshift mutation  
B) a mismatch mutation  
C) transversion  
D) transition  
E) suppression

38. Which of the following enzymes is NOT involved in DNA replication?

- A) deoxyribonuclease  
B) polymerase  
C) helicase  
D) primase  
E) None of the above

39. The nucleotide sequence that is complementary to 5'-TATAAA-3' is

- A) 5'-AAATAT-3'  
B) 5'-ATATTT-3'  
C) 5'-TTTATA-3'  
D) 5'-AAAUAU-3'  
E) 5'-AUAUUU-3'

40. RFLP is a:

- A) bacteriophage vector for cloning DNA.  
B) genetic disease.  
C) plasmid vector for cloning DNA.  
D) protein.  
E) variation in DNA base sequence.

第二部分、名詞解釋：(12% 每小題 3%)

41. Southern hybridization

42. polymerase chain reaction

43. Immunoprecipitation

44. Confocal microscope



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本試題

共 9 頁

第 9 頁

## 第三部分、簡答題：(8%，每小題 8%)

45. Please explain the meaning of the following article.

"Dengue virus (DV) infections cause mild dengue fever (DF) or severe life-threatening dengue hemorrhagic fever (DHF). The mechanisms that cause hemorrhage in DV infections remain poorly understood. Thrombomodulin (TM) is a glycoprotein expressed on the surface of vascular endothelial cells and plays an important role in the thrombin-mediated activation of protein C. Prior studies, the serum levels of soluble TM (sTM) and macrophage migration inhibitory factor (MIF) are significantly increased in DHF patients as compared to those in DF patients or normal controls. In this study, we investigated how MIF and sTM concentrations are enhanced in the plasma of DHF patients and the potential effect of MIF on coagulation through its influence on two factors, thrombomodulin (TM) and intercellular adhesion molecule-1 (ICAM-1) in endothelial cells and monocytes. Recombinant human macrophage migration inhibitory factor (rMIF) was used to treat monocytic THP-1 cells and endothelial HMEC-1 cells or primary HUVEC cells. Subsequent expression of TM and ICAM-1 was assessed by immunofluorescent staining and flow cytometry analysis. Additionally, co-incubation of THP-1 cells with various cell signaling pathway inhibitors was used to determine the pathways through which MIF mediated its effect. The data provided evidence that severe DV infections cause MIF expression and in turn stimulate monocytes or endothelial cells to express TM and ICAM-1 via the Erk, JNK MAPK and the PI3K signaling pathways, supporting the idea that MIF may play an important role as a regulator of coagulation."