I. 選擇題 (單選。每題 2 分。共 60 分):

1. Which statement concerning the nature of nucleic acid is **correct**?
   (A) The building blocks of nucleic acids contain hexoses.
   (B) The nitrogen-containing bases are connected to the riboses through N-glycosidic linkage.
   (C) Hydrogen bonding is not involved in the higher order structures.
   (D) RNA cannot serve as the carrier of genetic information.
   (E) Nucleic acids are usually positively charged at normal, physiological pH.
2. To prepare a 30 % sucrose solution, you should
   (A) add 30 g of sucrose into 100 ml of pure water;
   (B) add 100 ml of pure water into 30 g of sucrose;
   (C) add 30 g of sucrose in 60 ml of pure water, and bring the final volume to 100 ml with pure water after the sucrose is fully dissolved;
   (D) add 15 g of sucrose in 35 ml of pure water, and bring the final volume to 50 ml with pure water before the sucrose is fully dissolved;
   (E) add 15 g of sucrose into glucose, 15 g of fructose into 100 ml of pure water.
3. Please choose the **correct** statement regarding energy changes of a reaction:
   (A) A reaction that has $\Delta G^{0'} < 0$ is considered a spontaneous reaction.
   (B) For a reaction at equilibrium under standard conditions, $\Delta G > 0$.
   (C) A reaction that requires an input of energy to proceed as written has a negative $\Delta G^{0'}$.
   (D) $\Delta G^{0'}$ of a reaction can be raised or lowered by enzymes as needed.
   (E) None of the above.
4. Which of the following items is not considered as a biological macro-molecule?
   (A) DNA
   (B) RNA
   (C) Protein
   (D) Cellulose
   (E) *Escherichia coli*
5. Which of the following roles is **NOT** played by water in living cells?
   (A) a medium for metabolic reactions;
   (B) an organic solvent;
   (C) a regulator of pH and temperature;
   (D) a solvent and reactant molecule;
   (E) none of the above.
6. Which of the following chemical groups is attached to the central carbon atom of an α-Amino acid?
   (A) phosphate
   (B) carbamyl
   (C) carboxyl
   (D) methyl
   (E) hydroxyl
7. Which of the following statements about ATP is **incorrect**?
   (A) ATP has the lowest phosphoryl group transfer potential among all cellular phosphorylated molecules;
   (B) ATP is not one of the building blocks of DNA molecules.
   (C) ATP has lower phosphoryl group transfter potential than that of phosphoenolpyruvate (PEP)
   (D) ATP has a phosphoryl transfer potential that is intermediate among the biologically important phosphorylated molecules
   (E) ATP plays important roles in many biological reaction.

背面有題，請繼續作答。

8. The transcription and replication of DNA are different because:
   (A) ribonucleotides, rather than deoxyribonucleotides, are the monomeric building blocks for replication.
   (B) the double-stranded structure of DNA is not opened during transcription.
   (C).DNA polymerase is responsible for transcription.
   (D) the directions of polymerization of transcription and replication are different;
   (E) none of above.
9. Which class of bond directly participates in the recognition between of primers and templates in the replication of DNAs?
   (A) Hydrogen bomb
   (B) Disulfide bond
   (C) Atomic bomb
   (D) Covalent bonds
   (E) Hydrogen bonds.
10. Which of the following is required by an RNA polymerase to synthesize mRNA?
   (A) Translation initiation factors
   (B) tRNA
   (C) rRNA
   (D) deoxyribonucleotides.
   (E) DNA templates
11. The Edman Degradation technique is very useful in determining:
   (A) the N-terminal sequences of a nucleic acid.
   (B) the C-terminal sequences of a protein.
   (C) the tertiary structure of a protein
   (D) the N-terminal sequences of a polypeptide
   (E) the primary structure of a nucleic acid.
12. Which one of the following items belongs to the category of amino acids with negatively charged R-groups at pH 7?
   (A) Alanine
   (B) Aspartic acid
   (C) Lysine
   (D) Proline
   (E) Glycine
13. If you could mutate the anticodon of the tRNAs specific for glutamic acid into that for lysine, then:
   (A) the anticodons of these mutant tRNAs would base pair with the codon specific for glutamic acid.
   (B) the mutant tRNAs would be charged with glutamic acids
   (C) the tRNA specific for lysine would base pair with the codon specific for glutamic acid
   (D) lysine would no longer be found in the synthesized protein in bacteria carrying the mutant tRNA
   (E) the mutant tRNAs would be charged with lysine.
14. Which of the following statements about enzymes is **false**?
   (A) A holoenzyme is an apoenzyme with all components, including coenzyme and cofactor.
   (B) Enzymes catalyze the reaction by lowering the activation energy barrier.
   (C) Enzymes can change the equilibrium position of a reaction.
   (D) Some RNA molecules could be used as enzymes.
   (E) None of the above.
15. The Shine-Dalgarno sequence is recognized by:
   (A) DNA polymerase
   (B) RNA polymerase

(C) Reverse transcriptase
(D) Prokaryotic ribosome subunit.
(E) Eukaryotic ribosome subunit.

16. One of the codons of Leucine is CUU. Based on the wobble hypothesis, which of the following codon sets could also code for Leucine?
(A) UUU, AUU.
(B) CCC, CCU.
(C) CUG, CUA
(D) AUU, GUU
(E) UUU, UUA

17. Cell membranes are composed mainly of:
(A) polysaccharides.
(B) celluloses.
(C) lipids.
(D) nucleic acids.
(E) phenolic compounds.

18. The solution of a strong acid has:
(A) low pH and high concentration of protons;.
(B) high concentration of OH^-
(C) low concentration of H^+ and low pH
(D) high pH and low concentration of H^+.
(E) high pH and low concentration of hydroxide ions.

19. If you analyze a DNA fragment of 1.5 kbp by electrophoresis through a 1 % agarose gel in common TBE (Tris-borate-EDTA) buffer, pH 8.3. How would the DNA fragment migrate?
(A) The DNA fragment would move from North Pole to South Pole.
(B) From cathode to anode.
(C) From hydrophilic pole to hydrophobic pole.
(D) The DNA fragment would not move in the gel.
(E) From positive pole to negative pole.

20. Spectinomycin is an inhibitor of ribosome. Bacteria could not grow in media containing Spectinomycin because:
(A) the transcription is directly inhibited
(B) tRNA charging is directly inhibited.
(C) DNA replication is directly inhibited.
(D) RNA synthesis is directly inhibited.
(E) Protein synthesis is directly inhibited

21. The notions 5' and 3'refer to which of the following moieties of nucleic acids:
(A) the nitrogen number in the base.
(B) the carbon number in the base.
(C) the carbon number in the pentose.
(D) the carbon number in the phosphodiester bonds.
(E) the carbon number in the ribulose.

22. Which of the following statements about DNA replication is **false**?
(A) Recent molecular evidence supported the semi-conversation hypothesis.
(B) Primase synthesizes the RNA primers for the initiation of DNA replication.
(C) Helicase is involved in DNA replication.
(D) Topoisomerase is involved in untangling the newly-made DNA strands.

(E) None of the above.

23. Which of the following proteins would be expected to be highly water soluble?
(A) Proteins with high contents of amino acids with long chain hydrocarbons.
(B) Proteins containing lots of aromatic amino acids.
(C) Proteins with high contents of amino acids with methyl group.
(D) Proteins with high contents of amino acids with hydroxy group.
(E) Proteins containing many hydrophobic amino acids.

24. Biomembranes are **not** involved in which of the following functions:
(A) protein synthesis by ribosomes on rough ER
(B) signal transduction
(C) cellular compartmentalization
(D) Production of energy and reducing power
(E) None of the above.

25: The DNA template for a transcript with the sequence 5'-GCUCGAGGG-3' is:
(A) 5'-CGAGCTCCC-3'
(B) 5'-CCCUCGAGC-3'
(C) 5'-CCCTCGAGC-3'
(D) 3'-CCCTCGAGC-5'
(E) 5'-CGAGCUCCC-3'

26. Which of the following techniques cannot be used to purify proteins?
(A) Chromatography
(B) Electrophoresis
(C) Centrifugation.
(D) Electron Microscopy
(E) None of the above.

27. A solution of pH 5.0
(A) has 10 times more protons than a solution of pH 4.0 does.
(B) has 2 times more protons than a solution of pH 6.0 does.
(C) has 2 times more protons than a solution of pH 3.0 does.
(D) has 10 times more protons than a solution of pH 6.0 does
(E) has 2 times less protons than a solution of pH 4.0

28. If the genetic code were composed of two-letter combinations of nucleotides, such as AA, AC, etc., the maximum number of amino acids that could be specified would be:
(A) 20.
(B) 16.
(C) 2.
(D) 64.
(E) 8.

29. Which of the following interactions is not involved in the quaternary structures of proteins:
(A) Ionic interactions.
(B) Hydrophobic interactions.
(C) Van der Waals interactions.
(D) Disulfide bonds.
(E) None of the above.

30. What are the two major reactions in the metabolism of N-containing compound?
(A) Chemiosmotic coupling and oxidative phosphorylation
(B) Transamination and one-carbon transfer

(C) β-oxidation and glycolysis
(D) Reduction and oxidation
(E) Hydrolysis and isomerization.

II. 名詞解釋 (每題 5 分。共 40 分):

1. Michaelis-Menten Equation
2. small interfering RNA
3. Promoter (in the context of transcription)
4. Reverse transcription
5. Polymerase Chain Reaction
6. pK_a
7. Polyribosomes
8. Okazaki fragment