※ 注意：請於答案卷上依序作答，並應註明作答之題號。

Single choice
Two points for each question

1. Polar molecules differ from nonpolar molecules in that polar molecules:
   A) are strongly positive or negative.
   B) are soluble in water.
   C) contain hydrogen bonds, while nonpolar molecules contain covalent bonds.
   D) usually contain only carbon and hydrogen.

2. How many surrounding water molecules can form hydrogen bond with one water molecule ?
   A) 2
   B) 3
   C) 4
   D) 5

3. Which of the folloeing molecule can be chracterized as an amphipathic molecule ?
   A) amino acids
   B) fatty acids
   C) nucleic acids
   D) glucose

4. Which of the following statement is correct?
   A) Peptide bond is an ester bond.
   B) Peptide bond is an anhydride bond.
   C) Nucleotide bond is an ester bond.
   D) Nucleotide bond s an anhydride bond.

5. Which of the following statement about structural polarity is correct?
   A) The structural polarity of a protein is due to its component amino acid has optic isomers.
   B) Nucleic acid does not have structural polarity.
   C) The way of peptide bond formation renders protein's structural polarity.
   D) Nucleic acid has structural polarity because of hydrogen bond between bases.

6. For a chemical reaction $A + B \leftrightarrow C + D$, the change of its free energy $\Delta G = (G_C + G_D) - (G_A + G_B)$ and the change of standard free energy $\Delta G^o = (G_C{}^o + G_D{}^o) - (G_A{}^o + G_B{}^o)$ which of the following statement is correct?
   A) $\Delta G$ is a constant at fixed temperature.
   B) $A + B \rightarrow C + D$ is energetically favorable only when $\Delta G^o$ is negative.
   C) $A + B \rightarrow C + D$ is energetically favorable only when $\Delta G$ is negative.
   D) All of the above

7. If the chemical reaction of the above question is an enzyme catalysis reaction, which of the following statement is correct?
   A) $\Delta G$ increase after enzyme catalysis
   B) $\Delta G^o$ decrease after enzyme catalysis
   C) Equilibrium constant decrease
   D) None of the above

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8.The lower value of Michaelis-Menten constant ($K_m$) for an enzyme means:
A) The affinity between enzyme and substrate is weaker.
B) The affinity between enzyme and substrate is stronger.
C) Its maximal reaction velocity ($V_{max}$) is larger.
D) Its maximal reaction velocity ($V_{max}$) is smaller.

9. Disulfide bond can be characterized as a/an:
A) ionic bond
B) covalent bond
C) hydrogen bond
D) van der Waals interaction

10.Which of the following has the largest energy change in water solution?
A) covalent bond
B) ionic bond
C) hydrogen bond
D) van der Waals forces

11.Regulation of binding-site (outside enzyme's catalytic site) by protein phosphorylation is:
A) allosteric modulation
B) irreversible
C) non-covalent modulation
D) all of the above

12. When $C^{14}$ labeled acetyl CoA enter citric acid cycle, on which cycles the radioactivity will be detected?
A) 1th
B) 2nd
C) 3rd
D) 4th

13.How many trips through beta oxidation would a 18-carbon fatty acid need to be completely metabolized?
A) 9
B) 8
C) 7
D) 6

14. If fermentation process defect in a cell, which of the following product will accumulate during **anaerobic** glycolysis ?
A) fructose 1,6 biposphate
B) glyceraldehyde-3-phosphate
C) phosphoenolpyruvate
D) pyruvate

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15. Which of the following activated carrier molecules **cannot** use to carrier the chemical energy during oxidation in Krab's cycle?
A) NADH
B) ATP
C) GTP
D) $FADH_2$

16. Which of the following statement about the protein secondary structure is correct?
A) The hydrogen bond of α helix is formed between every fourth side chain residues.
B) The hydrogen bond of β sheet is formed between peptide bond and side chain residue.
C) The hydrogen bond of α helix is formed between every fourth peptide bond.
D) The hydrogen bond of β sheet is formed between parallel side chain residues.

17. Which amino acid residue on the polypeptide chain is the site for **ubiquitination**?
A) tyrosine
B) serine
C) aspatic acid
D) lysine

18. Which of the following statement about SDS-PAGE (sodium dodecyl sulfate polyacrylamide-gel elelectrophoresis) for protein analysis is correct?
A) The applied electric field must be from positive to negative.
B) The applied electric field must be from negative to positive.
C) The direction of applied electric field does not matter.
D) The direction of applied electric field is determined by the charge properties on protein molecules.

19. Which of the following statement about DNA replication is correct?
A) The direction of leading strand DNA synthesis is 5' to 3', but for lagging strand, it is 3' to 5.
B) The template for lagging strand must be 5' to 3' DNA strand.
C) The direction of lagging strand DNA synthesis is opposite to that of replication fork.
D) All of the above

20. Which of the following statement is correct?
A) The encoding information of protein on DNA is continuous.
B) Transcription always starts at AUG codon.
C) Translation always starts at the beginning end of mRNA.
D) None of the above

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21. Which of the following molecule has anticodon?
    A) mRNA
    B) rRNA
    C) tRNA .
    D) snRNA

22. What is the protein responsible for the folding of some proteins into their proper conformation?
    A) RNA polymerase
    B) RNA helicase
    C) chaperones
    D) signal peptidase

23. Why thymine instead of uracil on DNA molecule?
    A) A-T pairing is more stable.
    B) The information content is different between DNA and RNA.
    C) Cytosine will become uracil when spontaneous deamination occur.
    D) Protect DNA from UV damage.

24. What is the protein that is **not** involved in DNA repair?
    A) DNA polymerase
    B) DNA ligase
    C) Sliding clamp of DNA polymerase
    D) Primase

25. Which of the following statement about mRNA splicing is correct?
    A) Two phosphoryl transfer reactions in splicing need two NTP.
    B) Two phosphoryl transfer reactions in splicing are catalyzed by mRNA itself.
    C) Cutting the 3' end of intron forms the lariat structure of mRNA.
    D) All of the above

26. What nuclease is responsible for proofreading during DNA replication?
    A) 5' to 3' exonuclease
    B) 3' to 5' exonuclease
    C) 5' to 3' endonuclease
    D) 3' to 5' endonuclease

27. Experiment by Meselson and Stahl proved DNA replication is semiconservative.Bacteria incubed in a solution containg $N^{15}$ (H) many generations until all DNA strand have $N^{15}$ (H-H) labelling, then change to $N^{14}$(L) solution three more generations, what is the ratio of H-H, H-L, L-L DNA in CsCl gradient centrifugation?
    A) 0:1:3
    B) 0:1:4
    C) 1:1:3
    D) 1:1:4

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28. The sequence of two DNA fragments are as following:
A: 5'-ATGGGGATCGGTAAACCCAG-3'
B: 5'-GGATAAATTTCGGATCGTAG-3'
In the same solution, compare the melting temperature of double strand. Which of the following is your predication?
A) A > B
B) A < B
C) A = B
D) Cannot predict

29. In the Oswald Avery seminal discovery, it is the DNA from S strain pathogenic bacteria that carry heritable information to R strain nonpathogenic bacteria. This kind of genetic variation belongs to which of the following category?
A) transformation
B) transduction
C) conjugation
D) transposition

30. Fredrik Sanger developed the dideoxy method for DNA sequencing. What is the principle that Sanger based on?
A) replication
B) transcription
C) restriction enzyme mapping
D) hybridization

31. Which of the following statements correctly characterizes membrane proteins?
A) Protein can be removed entirely from the membrane by mild extraction methods.
B) Content is constant in cells with different functions.
C) Polypeptide chains can extend across the lipid bilayer once or multiple times.
D) Membrane protein includes integral proteins associated with the extracellular surface.

32. When hydrogen ions are pumped from the mitochondrial matrix, across the inner membrane, and into the intermembrane space, the result is:
A) the formation of ATP.
B) the creation of a proton gradient.
C) the restoration of the $Na^+$-$K^+$ balance the membrane.
D) the lowering of pH in the mitochondrial matrix.

33. All the following statements are true in regard to mitochondria **except:**
A) mitochondrial proteins are synthesized primarily by the nuclear genome
B) the similarities of mitochondria and bacteria have led to the view that mitochondria evolved from bacteria
C) mitochondrial genes follow normal Mendelian inheritance
D) mitochondria are formed exclusively by division of preexisting mitochondria

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34 Gamma-tubulin is a component of:
A) microvilli
B) gap junction
C) centrosome
D) mitochondria

35. The centromere is composed of:
A) RNA
B) DNA
C) amino acids
D) extracellular matrix proteins

36. Which of the following is **not** a motor protein?
A) ankyrin
B) cytoplasmic dynein
C) myosin
D) kinesin

37. Integrins are:
A) cytoskeletal proteins.
B) receptors for extracellular matrix proteins.
C) intracellular signaling molecules.
D) nuclear matrix proteins.

38. Which of the following protein is **not** in the core of nucleosome?
A) H1 histone
B) H2 histone
C) H3 histone
D) H4 histone

39. Which of the following is a ketoses?
A) glucose
B) fructose
C) ribose
D) galatose

40. Which of the following amino acid found in proteins that can be converted by treatment with strong base into another amino acid found in proteins?
A) leucine
B) serine
C) asparagin
D) arginine

41. Cynogen bromide cleaves peptide bonds whose carbonyl function is contributed by a/an:
A) lysine residue
B) phenylalanine residue
C) methionine residue
D) glycine residue

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42. Which of the following method is a protein separation procedure based on molecular size?
A) molecular- exclusion chromatography
B) isoelectric focusing
C) solvent fractionation
D) ion-exchange chromatography

43. Which of the following is the precursor for biosynthesis of cholesterol?
A) acetic acid
B) oxaloacetatic acid
C) malic acid
D) citric acid

44. Which of the following phospholipid in the inner site of plasma membrane is involved in receptor mediated signal transduction?
A) phosphatidylethanoamine
B) phosphotidylcholine
C) phosphotidylserine
D) phosphotidylinositol

45. Which of the following coenzyme is involved in carboxylation by carboxylase?
A) pyridoxine
B) biotin
C) tetrahydrofolic acid
D) thiamin

46. Which of the following vitamin is soluble in water?
A) vitamin A
B) vitamin C
C) vitamin D
D) vitamin E

47. Which of the following enzyme convert hydrogen peroxide into water?
A) superoxide dismutase
B) oxgenase
C) catalase
D) peroxidase

48. Which of the following is responsible for mitochondria entry of electrons from cytosol NADH?
A) hydrogen transporter
B) $Ca^{2+}$-$H^{+}$ antiporter
C) pyruvate dehydrogenase
D) malate-aspatate shuttle

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49. During biosynthesis of purine, which of the following amino acid is one of the precursor molecule?
A) aspatic acid
B) glutamic acid
C) histidine
D) arginine

50. Which of the following is the methyl group donor for various metyltransferases ?
A) methionine
B) methyl-$FH_4$
C) S-adenosylmethionine
D) N-formalmethionine