

Graduate Entrance Examination of Biochemistry
for Pharmacological Students

I. Fill in the following blanks (2% for each blank) 注意：請把答案寫在答案紙上

1. Cells obtain energy by the oxidation of biological molecules. Oxidation in a broader sense refers to the ① of electrons, and reduction means the ② of electrons.
2. In basic chemical kinetics, a critical amount of energy is needed for a reactant to reach a transition state, from which the reactant is converted into a lower energy configuration. The energy required is called ③, and in a living cell, ④ acts to lower this energy barrier.
3. A macromolecular chain preserves its sequence or structure by covalent bonds and some weak, noncovalent bonds. The noncovalent bonds are usually classified into three types: ⑤ bond, ⑥ bonds, and ⑦ bonds.
4. Paper chromatography and thin-layer chromatography are in principle ⑧ chromatography, where the molecules in the sample become separated according to their relative solubilities in solvents used.
5. Solubilizing a protein by increasing the ionic strength of a solution is termed ⑨. Precipitating a protein at high ionic strength is termed ⑩.
6. Cells and organelles must be capable of rapidly transporting hydrophilic solutes across the hydrophobic membrane barrier that bounds them. This process can occur by ⑪, whose kinetics of movement across the membrane obeys ⑫ law, or by ⑬, whose kinetics are described by the ⑭ equation.
7. The Na⁺/K⁺-ATPase active transport pump, by moving three ⑮ out and only two ⑯ inward in each pumping cycle, contributes significantly to a voltage difference across the plasma membrane.
8. Nucleic acid hybridization takes place between any two complementary single-stranded nucleic acids that are annealed at T_m - 25°C for prolonged periods of time. Two frequent applications of such technique in molecular biology are ⑰ and ⑱, which allow studying the presence of specific sequences or level of expression of various genes.
9. A ⑲ value for the standard free energy change indicates that a chemical reaction is nonspontaneous, whereas a ⑳ value suggests a spontaneous reaction.

(背面仍有題目,請繼續作答)

II. Assay Questions

1. Briefly describe three stages by which food molecules are broken down to give ATP and waster products (4%).
2. Please describe briefly the principles underlying protein separation by (a) SDS polyacrylamide gel electrophoresis and by (b) isoelectric focusing. (6%).
3. Ouabain specifically inhibits the Na^+K^+ ATPase activity of animal tissue but is not known to inhibit any other enzyme. When ouabain is added in graded concentrations to thin slices of living kidney tissue, it inhibits oxygen consumption by 66%. Explain the basis of this observation. What does it tell us about the use of respiratory energy by kidney tissue? (6%)
4. Briefly explain the following terms:
 - a) integral proteins and peripheral proteins (2%)
 - b) mRNA and RNA splicing (2%)
 - c) repressor and operon (2%)
 - c) allosteric enzymes (2%)
 - d) conjugated proteins and prosthetic group (2%)
5. How a living cell senses the changes of the extracellular environment (6%)

(背面仍有題目,請繼續作答)

III. Choose one of the best answer (2% for each question)

1. Which of the following is not amphipathic
 - a) cholesterol
 - b) oleic acid
 - c) succinate
 - d) phosphatidyl choline
 - e) sodium dodecylsulfate

2. Membrane lipids in a lipid bilayer are held together primarily by
 - a) hydrophobic forces
 - b) electrostatic forces
 - c) hydrogen bonds
 - d) covalent bonds
 - e) all of above

3. Phospholipids that have an ether linkage are
 - a) phosphatidic acid
 - b) ceramide
 - c) phosphatidyl inositol
 - d) platelet-activating factor
 - e) shingomyelin

4. Which of the following is not characteristic of the plasma membrane in a eukaryotic cell?
 - a) cell-cell interaction
 - b) energy transduction
 - c) signal transduction
 - d) transcription
 - e) endocytosis

5. The activity of the product of the ras oncogene - referred to as the p21^{ras} protein - depends on its association with the plasma membrane. Its prenylation, which is essential for membrane association, occurs at what type of residue in the protein?
 - a) glycine
 - b) methionine
 - c) cysteine

(背面仍有題目,請繼續作答)

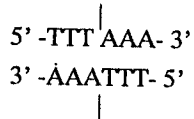
- d) tyrosine
e) threonine
6. Which of the following molecules is a disaccharide?
a) fructose
b) galactose
c) lactose
d) glucose
e) arabinose
7. Which of the following structure is a hemiketal ?
- a) $\begin{array}{c} \text{OR} \\ | \\ \text{R}-\text{C}-\text{R} \\ | \\ \text{OR} \end{array}$ b) $\begin{array}{c} \text{OR} \\ | \\ \text{H}-\text{C}-\text{R} \\ | \\ \text{OH} \end{array}$
- c) $\begin{array}{c} \text{OR} \\ | \\ \text{R}-\text{C}-\text{OH} \\ | \\ \text{OR} \end{array}$ d) $\begin{array}{c} \text{OR} \\ | \\ \text{R}-\text{C}-\text{OH} \\ | \\ \text{R} \end{array}$
- e) $\begin{array}{c} \text{OR} \\ | \\ \text{R}-\text{C}-\text{OR} \\ | \\ \text{R} \end{array}$
8. The amino acid residues directly in the sugar-protein linkage in glycoproteins are
a) gly, ser, and thr
b) ser, thr, and tyr
c) asn, ser, and thr
d) gln, ser, and tyr
e) lys, his, and glu
9. Which one of the following nucleotide fragments has not been found inside any biological organism?
a) 5'-AAAAAAAAA-3'
3'-TTTTTTT-5'
b) 5'-ATATATATATAT-3'
5'-TATATATATATA-3'
c) 5'-GAGCCCCAGTACCAGCC-3'
3'-CUCGGGGUCAUGGUCGG-5'

(背面仍有題目,請繼續作答)

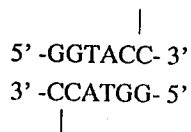
- d) 5' -AUCGUAACACCUCCA- 3'
e) 5' -AUCGUAACACCUCCA- 3'
3' - UAGCAUUGUGGAGGU- 5'

10. Which one of these restriction endonucleases will produce "sticky" ends that have a recessed 5' end? The cleavage site (the phosphodiester backbone) is marked with a vertical line between the nucleotides.

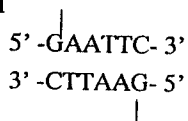
a) Dra I



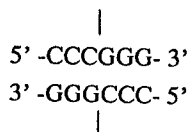
b) Kpn I



c) EcoR I



d) Sma I



11. How many ATP (and/or GTP) molecules does gluconeogenesis directly consume?

- a) 2
b) 4
c) 6
d) 8
e) 10

12. Pyruvate carboxylase requires the coenzyme

- a) biotin
b) TPP
c) pyridoxal-5'-phosphate
d) lipoic acid
e) FAD

(背面仍有題目,請繼續作答)

13. The two molecules of CO₂ that are produced in the TCA cycle are derived directly from
- a) the carboxyl carbons from the acetyl group that entered the cycle in this round
 - b) the carboxyl groups in oxaloacetate
 - c) the non-carboxyl groups in oxaloacetate
 - d) the methyl carbon in the acetyl group that entered the cycle in this round
 - e) a and d
14. What is the requirement for a template strand in DNA replication?
- a) it serves as a guide in determining the next nucleotide to be added since Watson-Crick base pairing is adhered to
 - b) it serves as the starting point for the new DNA strand
 - c) it increases the processivity of the DNA polymerase
 - d) it is essential for the 3'-5' exonuclease activity
 - e) it is required for DNA recombination