

臺北醫學大學 102 學年度碩士班暨碩士在職專班入學考試

基礎生物化學試題

本試題第 1 頁；共 6 頁

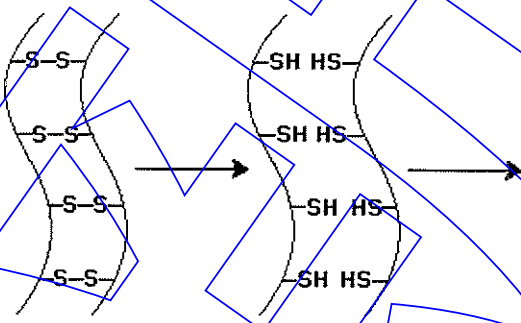
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注意
事項

- 一、本試題共 50 題，共計 100 分。
- 二、請將最適當的答案依題號作答於考試答案卷上。
- 三、試題答錯者不倒扣；題次號碼錯誤或不按順序或鉛筆作答，不予計分。

選擇題 (每題 2%，共 100%)

1. The three-dimensional structure of macromolecules is formed and maintained primarily through noncovalent interactions. Which of the following is not considered to be a noncovalent interaction?
carbon-carbon bonds
hydrogen bonds
hydrophobic interactions
ionic interactions
van der Waals interactions
2. The Henderson-Hasselbalch equation:
allows the graphic determination of the molecular weight of a weak acid from its pH alone.
does not explain the behavior of di- or tri-basic weak acids.
employs the same value for pK_a for all weak acids.
is equally useful with solutions of acetic acid and of hydrochloric acid.
relates the pH of a solution to the pK_a and the concentrations of acid and conjugate base.
3. At pH 7.0, converting a proline to hydroxyproline will have what effect on the overall charge of the protein containing it?
It will become more negative.
It will become more positive.
It will stay the same.
There is not enough information to answer the question.
The answer depends on the salt concentration.
4. In the α helix the hydrogen bonds:
are roughly parallel to the axis of the helix.
are roughly perpendicular to the axis of the helix.
occur mainly between electronegative atoms of the R groups.
occur only between some of the amino acids of the helix.
occur only near the amino and carboxyl termini of the helix.
5. The α -keratin chains indicated by the diagram below have undergone one chemical step. To alter the shape of the α -keratin chains — as in hair waving — what subsequent steps are required?



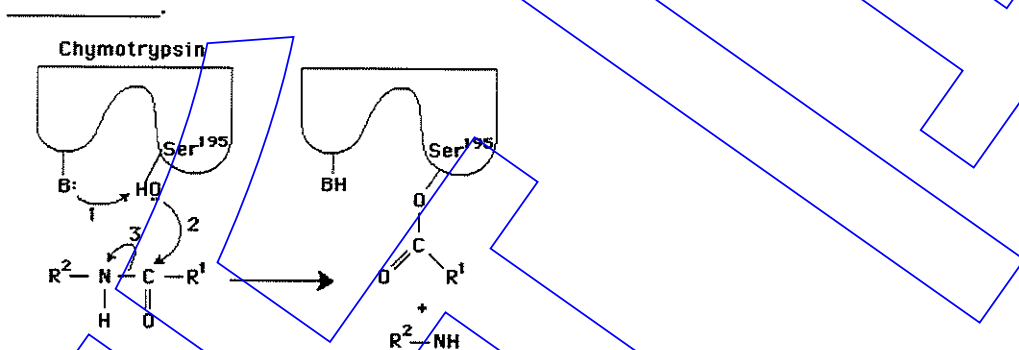
- Chemical oxidation and then shape remodeling
 - Chemical reduction and then chemical oxidation
 - Chemical reduction and then shape remodeling
 - Shape remodeling and then chemical oxidation
 - Shape remodeling and then chemical reduction
6. Myoglobin and the subunits of hemoglobin have:

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- no obvious structural relationship.
 very different primary and tertiary structures.
 very similar primary and tertiary structures.
 very similar primary structures, but different tertiary structures.
 very similar tertiary structures, but different primary structures.
7. Carbon monoxide (CO) is toxic to humans because:
 it binds to myoglobin and causes it to denature.
 it is rapidly converted to toxic CO₂.
 it binds to the globin portion of hemoglobin and prevents the binding of O₂.
 it binds to the Fe in hemoglobin and prevents the binding of O₂.
 it binds to the heme portion of hemoglobin and causes heme to unbind from hemoglobin.
8. The fundamental cause of sickle cell disease is a change in the structure of:
 blood. capillaries.
 hemoglobin. red cells.
 the heart.
9. Which of the following parts of the IgG molecule are *not* involved in binding to an antigen?
 Fab Fc
 Heavy chain Light chain
 Variable domain
10. During muscle contraction, hydrolysis of ATP results in a change in the:
 conformation of actin. conformation of myosin.
 structure of the myofibrils. structure of the sarcoplasmic reticulum.
 structure of the Z disk.
11. In the following diagram of the first step in the reaction catalyzed by the protease chymotrypsin, the process of general base catalysis is illustrated by the number _____, and the process of covalent catalysis is illustrated by the number _____



1; 2

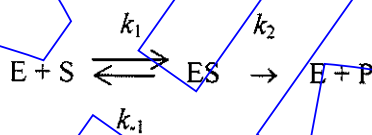
2; 3

3; 2

1; 3

2; 1

12. Michaelis and Menten assumed that the overall reaction for an enzyme-catalyzed reaction could be written as



Using this reaction, the rate of breakdown of the enzyme-substrate complex can be described by the expression:

$k_1 ([E] - [ES])$.

$k_2 [ES]$.

$k_{-1} [ES]$.

$k_1 ([E] - [ES])[S]$.

$k_{-1} [ES] + k_2 [ES]$.

13. A metabolic pathway proceeds according to the scheme $R \rightarrow S \rightarrow T \rightarrow U \rightarrow V \rightarrow W$. A regulatory enzyme, X, catalyzes the

- first reaction in the pathway. Which of the following is most likely correct for this pathway?
- Either metabolite U or V is likely to be a positive modulator, increasing the activity of X.
 - The first product, S, is probably the primary negative modulator of X, leading to feedback inhibition.
 - The last product, W, is likely to be a negative modulator of X, leading to feedback inhibition.
 - The last product, W, is likely to be a positive modulator, increasing the activity of X.
 - The last reaction will be catalyzed by a second regulatory enzyme.
14. The basic structure of a proteoglycan consists of a core protein and a:
- glycolipid.
 - glycosaminoglycan.
 - lectin.
 - lipopolysaccharide.
 - peptidoglycan.
15. The biochemical property of lectins that is the basis for most of their biological effects is their ability to bind to:
- amphipathic molecules.
 - hydrophobic molecules.
 - specific lipids.
 - specific oligosaccharides.
 - specific peptides.
16. In the Watson-Crick model for the DNA double helix (B form), the A-T and G-C base pairs share which one of the following properties?
- The distance between the two glycosidic (base-sugar) bonds is the same in both base pairs, within a few tenths of an angstrom.
 - The molecular weights of the two base pairs are identical.
 - The number of hydrogen bonds formed between the two bases of the base pair is the same.
 - The plane of neither base pair is perpendicular to the axis of the helix.
 - The proton-binding groups in both base pairs are in their charged or ionized form.
17. A common cloning strategy for introducing foreign genes into plants with *Agrobacterium* employs all the following features except:
- a selectable antibiotic marker such as kanamycin resistance.
 - a shuttle vector with 25 bp T-DNA repeats flanking the foreign gene of choice.
 - a Ti plasmid lacking its T-DNA segment.
 - active *vir* gene products from the altered Ti plasmid.
 - an ability to induce crown gall formation in infected leaves.
18. Which of the following is not true of sterols?
- Cholesterol is a sterol that is commonly found in mammals.
 - They are commonly found in bacterial membranes.
 - They are more common in plasma membranes than in intracellular membranes (mitochondria, lysosomes, etc.).
 - They are precursors of steroid hormones.
 - They have a structure that includes four fused rings.
19. Which of these is a general feature of the lipid bilayer in all biological membranes?
- Individual lipid molecules are free to diffuse laterally in the surface of the bilayer.
 - Individual lipid molecules in one face (monolayer) of the bilayer readily diffuse (flip-flop) to the other monolayer.
 - Polar, but uncharged, compounds readily diffuse across the bilayer.
 - The bilayer is stabilized by covalent bonds between neighboring phospholipid molecules.
 - The polar head groups face inward toward the inside of the bilayer.
20. When a bacterium such as *E. coli* is shifted from a warmer growth temperature to a cooler growth temperature, it

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- compensates by:
- increasing its metabolic rate to generate more heat.
 - putting longer-chain fatty acids into its membranes.
 - putting more unsaturated fatty acids into its membranes.
 - shifting from aerobic to anaerobic metabolism.
 - synthesizing thicker membranes to insulate the cell.
21. Membrane fusion leading to neurotransmitter release requires the action of:
- cadherins.
 - selectins.
 - flipases.
 - tSNARE and vSNARE.
 - none of the above.
22. Which of these statements about facilitated diffusion across a membrane is true?
- A specific membrane protein lowers the activation energy for movement of the solute through the membrane.
 - It can increase the size of a transmembrane concentration gradient of the diffusing solute.
 - It is impeded by the solubility of the transported solute in the nonpolar interior of the lipid bilayer.
 - It is responsible for the transport of gases such as O_2 , N_2 , and CH_4 across biological membranes.
 - The rate is not saturable by the transported substrate.
23. The ion channel that opens in response to acetylcholine is an example of a _____ signal transduction system.
- G protein
 - ligand-gated
 - receptor-enzyme
 - serpentine receptor
 - voltage-gated
24. Cyclin-dependent protein kinases can regulate the progression of cells through the cell cycle by phosphorylation of proteins such as:
- insulin.
 - myoglobin.
 - myosin.
 - retinal rod and cone proteins.
 - all of the above.
25. When a muscle is stimulated to contract aerobically, less lactic acid is formed than when it contracts anaerobically because:
- glycolysis does not occur to significant extent under aerobic conditions.
 - muscle is metabolically less active under aerobic than anaerobic conditions.
 - the lactic acid generated is rapidly incorporated into lipids under aerobic conditions.
 - under aerobic conditions in muscle, the major energy-yielding pathway is the pentose phosphate pathway, which does not produce lactate.
 - under aerobic conditions, most of the pyruvate generated as a result of glycolysis is oxidized by the citric acid cycle rather than reduced to lactate.
26. Photosynthesis is an _____ process because the free energy of the products is _____ the free energy of the reactants.
- endergonic; greater than
 - endergonic; less than
 - exergonic; greater than
 - exergonic; less than
27. In a pair of coupled reactions, if the favorable reaction releases more energy than the amount required by the unfavorable reaction, the excess energy is:
- reabsorbed by the favorable reaction to be used later.
 - released as heat and used to maintain body temperature.
 - used by the unfavorable reaction to create more products than normally expected.
 - used to produce reduced coenzymes.
28. In the first step of the citric acid cycle, acetyl-S-CoA reacts with _____ to produce _____, which is isomerized to

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- _____ in the second step.
succinate; fumarate; malate
oxaloacetate; isocitrate; citrate
29. The metal that acts as an electron carrier in the cytochromes in the electron transport chain is:
magnesium. chromium. iron. cobalt.
succinate; malate; fumarate
oxaloacetate; citrate; isocitrate
30. All of the following chemicals **except** _____ provide protection against potentially harmful oxygen species.
beta-carotene catalase hydrogen peroxide vitamin C
31. The pain and cramps that occur during physical exhaustion are associated with the formation of excess:
lactate. pyruvate. acetyl-CoA. acetaldehyde.
32. The diseases identified as diabetes are primarily associated with a malfunction of the hormone:
glucagon. insulin. epinephrine. cortisone.
33. When a person is deprived of food, in which order does the body use the following sources to produce glucose?
I. protein breakdown to amino acids used for gluconeogenesis
II. conversion of glycogen to glucose
III. catabolism of lipids
I, II, III III, II, I II, I, III II, III, I
34. Which molecule is a **saturated** fatty acid?
lauric acid linoleic acid arachidonic acid butyric acid
35. The chemical makeup of oils is:
simple esters of long chain alcohols and fatty acids.
esters of glycerol with three identical saturated fatty acids.
esters of glycerol with three identical unsaturated fatty acids.
esters of glycerol with three predominantly unsaturated fatty acids.
36. In order for dietary lipids to be transported in an aqueous system, they are solubilized by:
lipoproteins. cholesterol. lipases. bile.
37. Which type of molecule is the major form for long term storage of chemical energy in the body?
carbohydrates proteins triglycerides steroids
38. When there are high concentrations of ketone bodies in the blood this is an indication of?
diabetes mellitus. starvation. All responses are correct.
a decrease in the pH of the blood.
39. Which of the following is a major function of nucleic acids?
storage and transfer of genetic information
catalysis of virtually all biochemical reactions
storage and intracellular transfer of energy
structural support in both plants and animals
40. Which of the following is a nitrogen base found in nucleic acids?
thymidine adenine guanosine pyridine
41. What is the difference between deoxyribose and ribose?
Deoxyribose is a D form, whereas ribose is an L form.
Deoxyribose has one less oxygen atom than does ribose.
Ribose is found in the straight chain structure, whereas deoxyribose is not.
Ribose is a monosaccharide, but deoxyribose is a polysaccharide.
42. One pair of nitrogen bases in DNA (deoxyribonucleic acid) is:

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- guanine and adenine. guanine and thymine. guanine and cytosine. guanine and uracil.
43. The process in which information from DNA is used to manufacture RNA (ribonucleic acid) is called:
mutation. replication. transcription. translation.
44. Which of the following represents the correct order in the flow of genetic information?
mRNA → DNA → proteins mRNA → tRNA → proteins
DNA → mRNA → proteins rRNA → mRNA → proteins
45. The function of the telomeres is:
protection of the DNA that actually codes useful information.
addition of nucleotides to the DNA molecule.
prevention of interaction between DNA and RNA.
initiation of replication of DNA.
46. A mutagen is:
an error in base sequence that is repeated in each replication or transcription of DNA.
something that causes an error in the nucleotide sequence in DNA.
something that causes abnormal growth in embryos.
something that causes abnormal and excessive cell division.
47. The use of prenatal DNA testing followed by an attempt to alter a specific gene to prevent an inherited disease would be classified as:
genetic engineering. bioinformatics. gene therapy. pharmacogenomics.
48. Which statement best summarizes the digestion of proteins?
Amine groups are removed from all amino acids.
All peptide linkages are hydrolyzed to produce a mixture of amino acids.
Proteins are denatured by stomach acid.
Amino acids are combined to produce proteins or enzymes.
49. When the amine group of glutamate is replaced with a carbonyl group, the process is called:
hydrolysis. oxidative deamination.
reductive deamination. oxidative decarboxylation.
50. Glucogenic amino acids can be converted into the following?
glucose fatty acids acetyl CoA ketone bodies