

I、單選題（每題 2 分，共 50 分）

1. Proteins can be phosphorylated, which rapidly changes the activity of proteins. When this happens, the phosphate is often added to which amino acid?
 - A. serine
 - B. arginine
 - C. valine
 - D. cysteine
2. Eight histone proteins bind together to produce the histone “beads” that are found in chromosomes. The interaction of these histones with each other is an example of what level of protein structure?
 - A. primary
 - B. secondary
 - C. tertiary
 - D. quaternary
3. Mucus is mostly sugar subunits attached to a small protein core. It is thus a:
 - A. glycoprotein.
 - B. proteoglycan.
 - C. lipoprotein.
 - D. glycolipid.
4. Which technique separates biomolecules primarily by charges on the molecule?
 - A. X-ray crystallography
 - B. SDS-PAGE
 - C. gel filtration
 - D. ion exchange chromatography
5. Which of the following is NOT true of enzymes?
 - A. Enzymes increase the equilibrium ratio of products over reactants.
 - B. Enzymes influence the rate at which a reaction comes to equilibrium, but not its direction.
 - C. Enzymes tend to lower the energy of activation for reactions.
 - D. Enzymes stabilize the transition state such that it can be formed more easily.
6. Which of the following statements is FALSE regarding phospholipids in cell membrane?
 - A. contain charged groups
 - B. form a matrix for integration of proteins
 - C. spontaneously form bilayers in water
 - D. are soluble in the cytoplasm

7. The ΔG° for reactions A and B are -10 kcal/mole and -5 kcal/mole, respectively. What is the CORRECT statement concerning these reactions under standard condition?
- Neither reaction will proceed without the addition of free energy.
 - The equilibrium constant K_{eq} for these reactions are 10^{-10} and 10^{-5} , respectively.
 - Reaction rates cannot be deduced from these data.
 - The rate of reaction A will exceed the rate of reaction B.
8. Signal transduction cascades are produced by molecular assemblies of which of the following components?
- Enzymes
 - Regulatory proteins
 - Receptors
 - Transmembrane channels
9. Facilitated diffusion:
- can transport a solute against a concentration gradient.
 - is not subject to competitive inhibition.
 - displays no specificity.
 - displays saturation kinetics.
10. All of the following statements about integral membrane proteins are true EXCEPT
- They are associated with lipid in the membrane.
 - They are amphipathic.
 - They are symmetrically distributed within the membrane.
 - They are only removed from the membrane by drastic treatments.
11. What is not correct regarding the glycogen phosphorylase in glycolysis?
- It converts glycogen into glucose-1-phosphate.
 - It is regulated by the hormone glucagons in liver.
 - It is regulated through allosteric mechanism by glucose.
 - It can be controlled by irreversible phosphorylation.
12. β -Oxidation of fatty acids has four basic steps. What is not the intermediate or end product in the β -oxidation of palmitoyl-CoA?
- $FADH_2$ and NADH
 - L- β -hydroxyacyl-CoA
 - β -ketoacyl-CoA and acetyl-CoA
 - malonyl-CoA

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13. What is not the intermediate or end product in citric acid cycle?
- A. α -ketoglutarate and NADH
 - B. CO_2 and citrate
 - C. CO_2 and acetate
 - D. succinate, succinyl-CoA and oxaloacetate
14. What is not correct regarding mitochondria and chloroplasts?
- A. Mitochondria contain their own genome.
 - B. Chloroplasts contain their own genome.
 - C. Both mitochondria and chloroplasts are probably from bacteria with endosymbiosis.
 - D. The topology of proton movement is from stroma to thylakoid lumen for ATP synthesis in chloroplasts.
15. What is not correct regarding pyruvate dehydrogenase complex?
- A. It reversibly converts pyruvate into acetyl-CoA.
 - B. It consists of three enzymes: pyruvate dehydrogenase, dihydrolipoyl transacetylase, and dihydrolipoyl dehydrogenase.
 - C. It requires five different cofactors: thiamine pyrophosphate, flavin adenine dinucleotide, coenzyme A, nicotiamide adenine dinucleotide, and lipoate.
 - D. It locates in mitochondria of eukaryotic cells.
16. Sequential reactions in gluconeogenesis are starting from _____.
- A. pyruvate
 - B. oxaloacetate
 - C. phosphoenolpyruvate
 - D. glucose
17. Which organelle contains the enzyme that can convert glycolate to glyoxylate?
- A. chloroplast
 - B. mitochondrion
 - C. peroxisome
 - D. lysosome
18. How many ATPs are required for one N_2 in biological nitrogen fixation?
- A. 16
 - B. 20
 - C. 24
 - D. 28

(背面仍有題目,請繼續作答)

19. Conversion of phosphatidylethanolamine to phosphatidylcholine in mammals occurs only in _____.
- liver
 - heart
 - kidney
 - brain
20. Which amino acid cannot be produced by the metabolic precursor of pyruvate?
- alanine
 - valine
 - leucine
 - isoleucine
21. Which enzyme catalyzes changes of the linking number of DNA?
- topoisomerase
 - protease
 - DNase
 - RNase
22. Which polymerase plays an important role to produce mRNAs for the synthesis of viral proteins and the mRNAs are replicated from viral RNA genome in host cells?
- RNA-dependent RNA polymerase
 - DNA-dependent RNA polymerase
 - DNA-dependent DNA polymerase
 - none of the above
23. Which substrate is cleaved by ribozyme?
- RNA
 - DNA
 - lipid
 - protein
24. Where is the binding site in DNA for transcription activators in eukaryotic cells?
- promoter
 - enhancer
 - operon
 - none of the above

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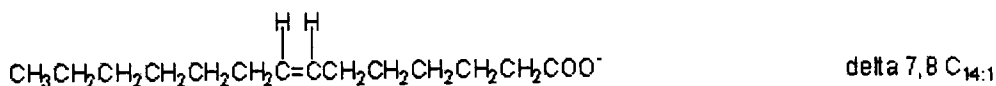
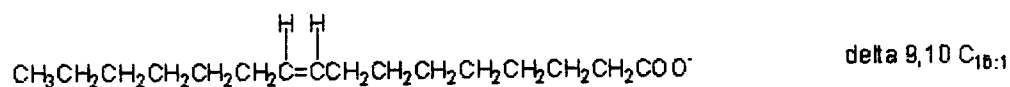
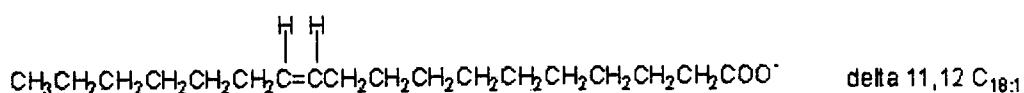
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25. Which technique can be used to create an altered form of a protein with a specific amino acid change by altering one or more specific nucleotides in a cloned gene?
- site-directed mutagenesis
 - deletion
 - gene amplification
 - DNA recombination

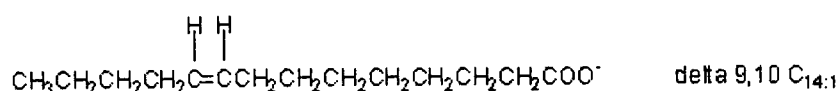
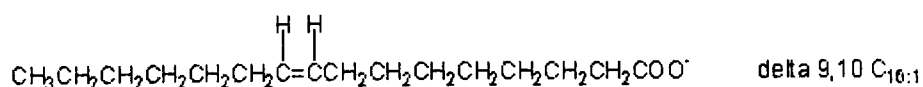
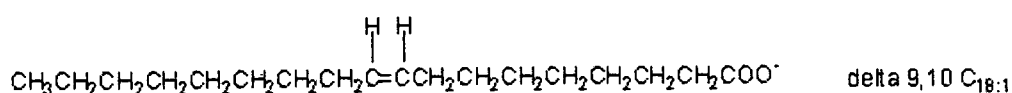
II、簡答題 (每題 5 分, 共 50 分)

- Can you make a buffer out of just HCl and NaOH? Why?
- You are recovering cells from tissues by digestion with an enzyme called collagenase. For the reproducibility and consistency of your experimental procedure and results, what is the best unit to describe the amount of enzyme used for disrupting same amount of tissues at different time? Why?
- Bacteria such as *E. coli* synthesize monounsaturated fatty acids via an anaerobic pathway while animals and yeasts synthesize monounsaturated fatty acids via an aerobic pathway. Below are several unsaturated fatty acids isolated from *E. coli* and mammalian liver. What can be concluded about the formation of the double bond in the two different pathways from structures given?

E. coli



Mammalian liver



(背面仍有題目, 請繼續作答)

4. The addition of NaCl to a protein solution typically has little effect on the folding transition curve as measured by T_m . Conversely, the addition of NaCl has a large effect on the T_m of double-stranded DNA.
 - a) How is the T_m for DNA affected by high salt?
 - b) Briefly explain the difference of the behavior between protein and DNA affected by salts.

5. Where do the urea cycle and citric acid cycle occur, respectively? How are the urea cycle and citric acid cycle linked? Please describe or draw it.

6. What is the binding-change model for ATP synthase in oxidative phosphorylation and photophosphorylation?

7. What and how products are produced from one turn of the Calvin cycle. Please describe briefly.

8. Please draw and explain the important structural elements of a yeast chromosome.

9. Please describe the expression of a functional gene at transcriptional and translational level in detail.

10. What is functional genomics? How to apply this technique to discover new drugs?