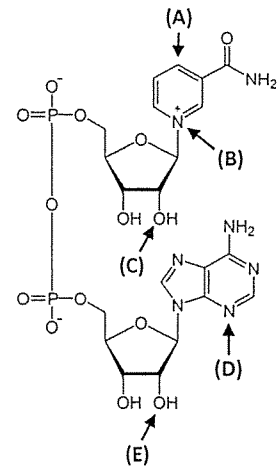


- The fluorescence of green fluorescent protein (GFP) is derived from the chemical bond rearrangement and oxidation of the sequence Ser-Tyr-Gly. Please draw the molecular structure of Ser-Tyr-Gly. (3 points)
- A graduate student discovered a novel peptide (Met-Ser-Cys-Arg-Tyr-Trp-Asp-Asn-Gly-Glu-Gln-Pro-Lys-Phe-Leu-Thr-Val) which can be modified by several types of post-translational modifications. Please answer the following questions.
 - What kind(s) of the residue(s) in this novel peptide can possibly be modified by phosphorylation? (1 point)
 - What kind(s) of the residue(s) in this novel peptide can possibly be modified by ubiquitination? (1 point)
 - What kind(s) of the residue(s) in this novel peptide can possibly be modified by O-linked glycosylation? (1 point)
 - What kind(s) of the residue(s) in this novel peptide can possibly be modified by N-linked glycosylation? (1 point)
 - What kind(s) of the residue(s) in this novel peptide can possibly be modified by disulfide bond? (1 point)
 - When this peptide is fully hydrolyzed by HCl into free amino acids, which amino acid has the highest absorbance at 280 nm? (1 point)
 - When this peptide is fully hydrolyzed by HCl into free amino acids, which amino acid can obtain bright yellow ninhydrin products? (1 point)
- The schematic molecular structure of nicotinamide adenine dinucleotide (NAD^+) is provided as below. Please answer the following questions.

- One NAD^+ can accept _____ electron(s) to become an NADH. Please fill in the number in the sentence above. (1 point)
- Among (A) (B) (C) (D) (E) indicated on NAD^+ , which site can accept electron(s) to become NADH? (1 point)
- Among (A) (B) (C) (D) (E) indicated on NAD^+ , which site can accept a phosphate group to become NADP^+ ? (1 point)
- NADH can be distinguished from NAD^+ by analyzing them with a spectrophotometer at _____ nm. (1 point)



- Many enzymes or proteins are activated by specific proteolytic cleavage. Please answer the following questions.
 - Which enzyme is in charge of the specific proteolytic cleavage of prothrombin? (1 point)
 - Which enzyme is in charge of the specific proteolytic cleavage of trypsinogen? (1 point)
 - Which enzyme is in charge of the specific proteolytic cleavage of chymotrypsinogen? (1 point)
 - Which enzyme is in charge of the specific proteolytic cleavage of fibrinogen? (1 point)
 - What kind of amino acid is the major active site found in the enzymes mentioned above? (1 point)

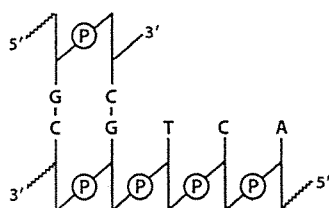
5. Some coenzymes that serve as transient carriers of specific atoms or functional groups in the biochemical reactions. Which coenzyme is the transient carrier of the specific group listed below?
 - a) Amino groups (1 point)
 - b) One-carbon groups (1 point)
 - c) Aldehydes (1 point)
 - d) CO₂ (1 point)

6. Please briefly describe the “lock and key” model and the “induced fit” model for enzyme-substrate interactions. (4 points)

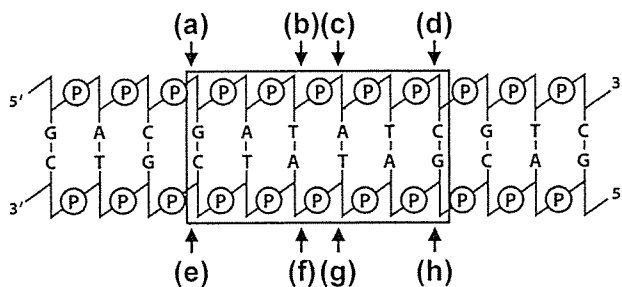
7. Consider a process in which a ligand (L) binds reversibly to a site in the protein (P). This process can be simply formulated as shown below. θ is designated as the fraction of the occupied binding sites over the total binding sites in the protein. Please answer the following questions.



- a) Please give the definitions of k_d . (1 point)
 - b) Please define the association constant K_a by using k_a and k_d . (1 point)
 - c) Please define the dissociation constant K_d by using K_a . (1 point)
 - d) Please give the definition of K_d by using θ and $[L]$. (2 points)
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8. What is the substrate which is required for initiation of the reaction indicated below? (1 point)

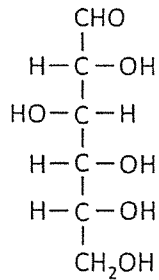


9. The restriction enzyme *EcoRV* can recognize the specific sequence GATATC and provide a blunt end digestion. Among the covalent bonds of (a) (b) (c) (d) (e) (f) (g) (h), which bond(s) can be digested by *EcoRV*? (2 points)



10. Please draw the molecular structure of β -D-galactopyranosyl-(1 \rightarrow 4)- α -D-glucopyranose. (2 points)

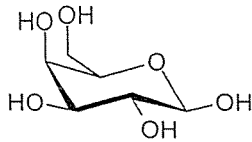
11. The molecular structure of D-glucose in the Fisher projection format is shown as below. Please draw the molecular structures of D-mannose and D-fructose in the Fisher projection format. (2 points)



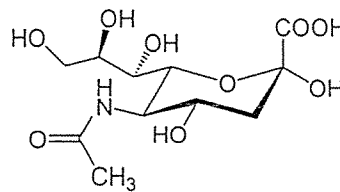
D-Glucose

12. The molecular structures of galactose and N-acetylneuraminic acid are shown as below. Please draw the α -2, 3-linked and α -2, 6-linked conjugations, composed by these two sugars, and point out which one can be recognized by the human influenza virus. (3 points)

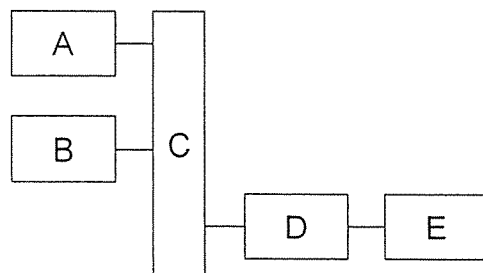
Galactose



N-Acetylneuraminic acid



13. Which type of fatty acid contains a double bond (C=C) at the third carbon atom from the distal end of the fatty acid? (1 point)
14. The diagram shows a simple illustration of the molecular structure of phosphatidylcholine. Please answer which molecules should be filled in the positions of C, D and E. (3 points)



15. Regarding the signal transduction pathway, how does binding of epinephrine initiate the cAMP production? Discuss briefly in terms of receptor structure and functions. (4 points)

見背面

16. What is metabolomics? What are the principal tools for metabolomic analyses? (4 points)
17. Please describe how sucrose is synthesized in plants (5 points) and how it is catabolized in mammals. (5 points)
18. Please compare the “Q cycle” in mitochondria and in chloroplasts (6 points)
19. Please briefly describe the role of vitamin B₁₂ in the metabolism of odd-number fatty acids. (3 points)
20. How is the Calvin cycle regulated? (5 points)
21. How are triacylglycerols mobilized from the adipose tissues? (5 points)
22. How is the urea cycle linked to the citric acid cycle? (5 points)
23. Name one amino acid whose oxidation proceeds via the intermediates shown:
 - a) pyruvate (1 point)
 - b) fumarate (1 point)
 - c) acetoacetyl CoA (1 point)
24. List the precursor(s) of the following molecules synthesized in cells:
 - a) Nitric oxide (1 point)
 - b) Pyrimidine ring (2 points)
 - c) Heme (2 points)
 - d) Prostaglandins (1 point)
 - e) Progesterone (1 point)
 - f) Glycogen (1 point)
 - g) Starch (1 point)

試題隨卷繳回