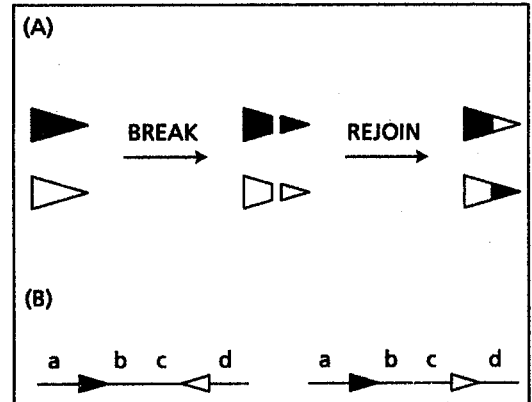
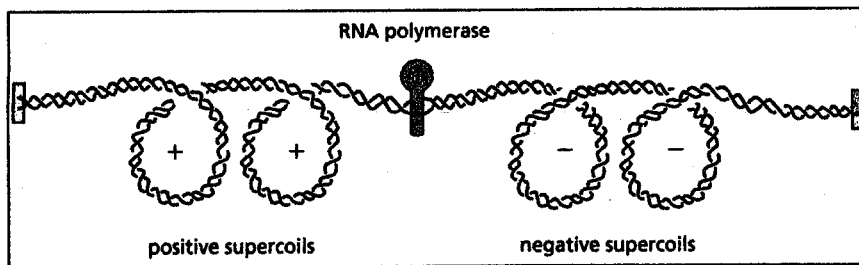


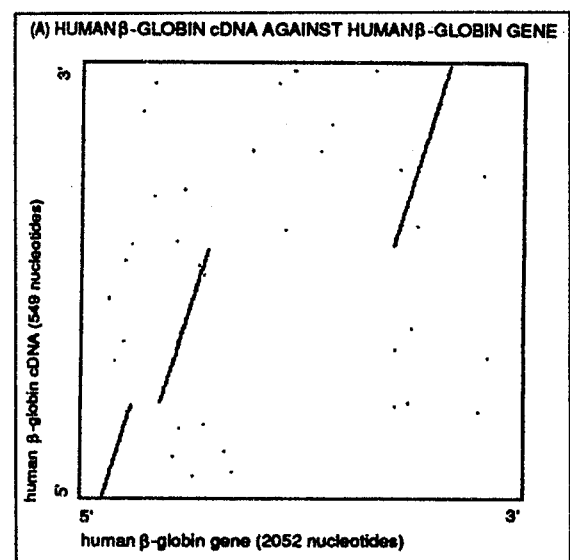
1. Cre recombinase is a site-specific enzyme that catalyzes recombination between two LoxP DNA recognition sequences. Cre recombinase pairs two LoxP sites in the same orientation, breaks both duplexes at the same point in the LoxP sites, and joins the ends with new partners so that each LoxP site is regenerated, as shown schematically in Fig. A. Based on this mechanism, predict the arrangement of sequences that will be generated by Cre-mediated site-specific recombination for each of the two DNAs shown in Fig. B. (4%)



2. (1) In which direction along the template must the RNA polymerase in Figure below be moving to have generated the supercoiled structures that are shown? (2%)  
 (2) Would you expect supercoils to be generated if the RNA polymerase were free to rotate about the axis of the DNA as it progressed along the template? (2%)

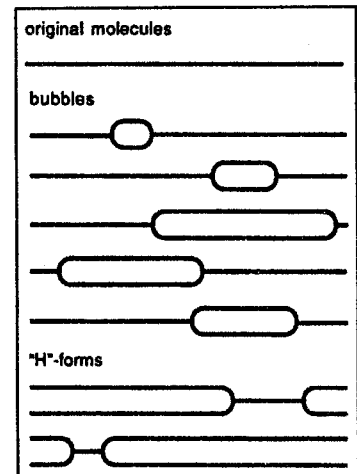


3. A very useful graphic method for comparing nucleotide sequences is the so-called diagonal plot. An example of this method is illustrated in Figure below, where the human  $\beta$ -globin gene is compared to the human cDNA for  $\beta$ -globin. These plots are generated by comparing blocks of sequence, in this case blocks of 11 nucleotides at a time. If 9 or more of the nucleotides match, a dot is placed on the diagram at the coordinates corresponding to the blocks being compared. A comparison of all possible blocks generates diagrams, such as the ones shown here, in which sequence homologies show up as diagonal lines. From the comparison of the human  $\beta$ -globin gene with the human  $\beta$ -globin cDNA deduce the positions of exons and introns in the  $\beta$ -globin gene. (4%)



見背面

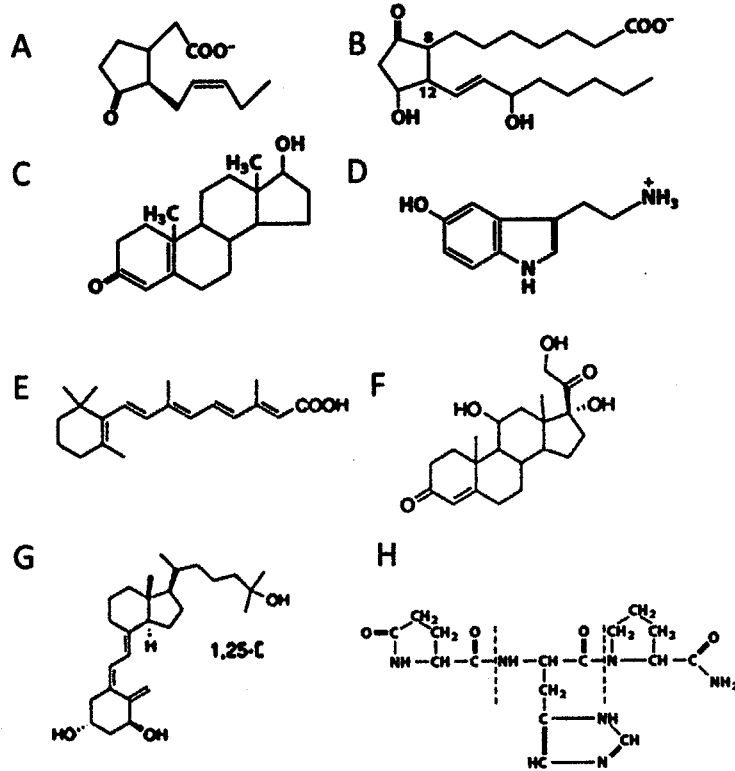
4. Dr. J is studying a new species of circular, double strand DNA virus. He would like to locate the origin of this virus. He isolated replicating molecules, digested these molecules with a single-cut restriction enzyme, and observed these digested molecules under electron microscope. Below show the DNA molecules Dr. J observed.
- (1) How many replication origins do this virus have? (2%)
- (2) Is replication unidirectional or bi-directional? (2%)



5. How many kinds of membrane proteins do you know? Think about multiple ways by which proteins interact with membranes. (8%)
6. How does the TCA cycle help the urea cycle? Think about how the urea cycle may stop if there were not the TCA cycle. (8%)
7. Explain how homopolysaccharides of glucose can have either helical or planar structures. (4%)
8. What is the effect of increased concentration of  $\text{CO}_2$  on the binding of oxygen to hemoglobin? Briefly describe the mechanism of this effect. (4%)
9. List three (or more) ways to denature proteins. (3%)
10. Circle **all** of the metabolic processes that occur in **organisms** that perform oxygenic photosynthesis. (5%)
- Glycolysis
  - Citric acid Cycle
  - Oxidative phosphorylation
  - Calvin Cycle
  - Cyclic photophosphorylation
  - Non-cyclic photophosphorylation.

接次頁

11. Based on the biochemical structures of hormones, answer the questions as follows:



(1) Which hormones are ligands of nuclear receptors? (2%)

- A) ABDH
- B) CEFH
- C) CF
- D) ABCDEFGH

(2) Which hormone is an eicosanoid hormone? Please pick one. (2%)

(3) Which hormones are derivatives of cholesterol? (2%)

- A) ABE
- B) CFG
- C) AB
- D) CF
- E) CDEFG

(4) Which hormones are vitamin derivatives? (2%)

單選題： 12-14

12. What is a ligand? (2%)

- A) small membrane-bound protein generating important signals within the cell
- B) An enzyme that hydrolyzes GTP to GDP
- C) A molecule that attaches to a receptor, triggering changes within the cell
- D) An intracellular signaling molecule influencing the production of cyclic AMP

見背面

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13. In the scenario of adrenaline interaction with its G-protein coupled receptor, which of the following functions as a second messenger? (2%)

- A) GTP
- B) Cyclic AMP
- C) Adenylate cyclase
- D) The alpha subunit

14. In which type of cell are ligand-gated ion channels most commonly found? (2%)

- A) Cells that are terminally differentiated
- B) Cells that produce large proteins
- C) Cells that need to respond quickly to external stimuli
- D) Cells that respond to mechanic forces

填充題：15-17

15. All G-protein coupled receptors are \_\_\_\_\_ membrane-spanning receptors. (2%)

16. \_\_\_\_\_ (enzyme) converts ATP into cAMP. (2%)

17. Phosphatidylinositol 4,5-bisphosphate (PIP<sub>2</sub>) is cleaved into \_\_\_\_\_ and \_\_\_\_\_.(2%)

18. What is cholesterol? Please discuss the importance of cholesterol in the body? (8 %)

19. What are the major functions of adipose tissues in the body? (8 %)

20. Please give four examples of different protein post-translational modification and please specify the modification can happen on what amino-acid residue. (8 %)

21. Please explain the functional role of following molecules in protein translation. (8 %)

- (I) Aminoacyl-tRNA synthetase.
- (II) Elongation factor EF-Tu and EF-Ts.
- (III) Poly(A) binding protein (PAB).
- (IV) Elongation factor EF-G.

試題隨卷繳回