一、第一部份：(50%)

A. Choose the most appropriate answer for the following questions, 3 points each. (30%)

1. A scientist wants to examine the way the cells lining the respiratory tract use tiny hairs to move dirt and mucus away from the lungs. Which of the following instruments would be best, and why?
   a. a light microscope, because it allows observations of whole, live cells
   b. a transmission electron microscope, because it has high resolving power
   c. a transmission electron microscope, because it is capable of very high magnification
   d. a scanning electron microscope, because it can reveal structures on cell surface
   e. a scanning electron microscope, because it can be used to observe whole cells without slicing them

2. Insulin is a protein that is produced by pancreatic cells and secreted into the bloodstream. Which of the following choices best describes the route of insulin from its production to its exit from the cell?
   a. smooth ER, Golgi apparatus, transport vesicles, cell membrane
   b. rough ER, lysosomes, transport vesicles, cell membrane
   c. rough ER, Golgi apparatus, smooth ER, cell membrane
   d. rough ER, transport vesicles, cell membrane
   e. none of the above

3. When physicians perform an organ transplant, they choose a donor whose tissues match those of the recipient as closely as possible. Which of the following cell components is being matched?
   a. plasma membrane phospholipids
   b. plasma membrane proteins
   c. cell surface carbonhydrates
   d. plasma membrane cholesterols
   e. cytoskeletal elements

4. You are the director of research for a drug company. The following list of candidate drugs is brought to you. Which is the most likely to be worth developing as a cancer chemotherapy agent?
   a. a drug that causes cells to divide at a right angle from their usual orientation
   b. a drug that interferes with cellular respiration
   c. a drug that prevents sister chromatids from separating at anaphase
   d. a drug that prevents crossing over
   e. a drug that prevents tetrad formation

5. Sickle-cell anemia is caused by which of the following?
   a. heterozygous genes on homologous chromosomes
   b. the effects of alleles on several loci
   c. the action of a single allele when it is present on both homologous chromosomes
   d. both a and b are true
   e. none of the above

6. which of the following represents a way in which the existence of introns is thought to enhance the genetic diversity of the offspring of sexual reproduction?
   a. Introns act as alternate coding regions in genes and therefore constitute additional DNA in which protein-altering mutations can occur
   b. Introns make chromosomes longer and therefore result in a higher rate of crossing over between loci
   c. Introns make it possible to have alternating splicing patterns in mRNA and therefore increase the diversity of proteins that a cell can express
   d. Introns are excised at random from the genome during early embryonic development, thereby increasing the genetic difference between individuals
   e. Introns represent proviral genomes and therefore can enter and leave the genome, creating genetic diversity

7. Long legged cheetahs are well adapted to catching prey. The ancestor of the cheetah is believed to have had relatively short legs. According to Darwinian vies, the evolution of long-legged cheetahs is best explained by
   a. stabilizing selection
   b. the theory of use and disuse
   c. directional selection
   d. the theory of acquired characteristics
   e. both b and d

8. You are interested in doing sequence analysis on DNA of extinct species. Which of the following fossils would have a significant chance of containing DNA?
   a. a brachiopod cast preserved in mudstone
   b. a tooth that rolled along a riverbed until it came to rest on a sandbar and was buried
   c. an ant preserved in amber
   d. a piece of petrified wood
   e. both c and d

9. Evolutionary biologists theorize that land plants have evolved from the green algae. This theory is supported by the observation that unlike other algae, the green algae resemble land plants because
   a. they transport water and nutrients using xylem and phloem
   b. neither produce motile sperm or eggs
   c. both produce carotenoids and chlorophylls a and b
   d. all of these
   e. none of these

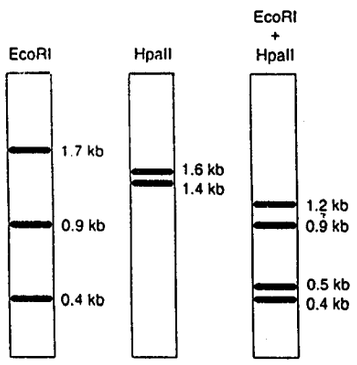
10. A mutant protist is found in which some mitochondria lack an inner mitochondrial membrane. Which of the following pathways would be completely disrupted in these mitochondria?
   a. chemiosmosis
   b. alcoholic fermentation
   c. the Krebs cycle
   d. glycolysis
   e. both c and d

B. Answer the following questions, 4 points each. (20%)

1. RFLP is very commonly used for genetic identity determination. Please spell out the full name for RFLP and describe its principle and its application.

2. Recombinant DNA technique is widely adapted in different fields of biological, biomedical, and biochemical, even in evolutionary, systematic phylogenic and ecological research. If you face a problem that the material you want to start with is very precious and not too much DNA is available. What would you do? How?

3. Your advisor asked you to draw a restriction map of a 3.0 Kb BamHI restriction fragment which contain a "SMART" gene. You digest three samples of the fragment with EcoRI, HpaII, and a mixture of EcoRI and HpaII. After gel electrophoresis and ethidium bromide staining, you found a pattern of bands in the following figure. From t these results, prepare a restriction map that shows the relative positions of the EcoRI, and HpaII recognition sites and the distances in kilobases (Kb) between them.



4. What is the "Molecule of the year" for 1994? What is the significance of the molecule?

5. The Nobel Laureates of Medicine in 1994 are shared by two American scientists. Do you know who are they? What are their contributions?

二、第二部份：(50%)

1. Describe the concepts of species and pattern of speciation (4%)
2. Classification of prokaryotes by morphology and metabolic diversity (4%)
3. Draw picture and describe the life cycle of an angiosperm (4%)
4.. How taxonomists to reconstruct animal phyla phylogeny (5%)
5. Describe the type of plant cell (4%)
6. Describe the rrole of bacteria in nitrogen nutrition of plant (5%).
7. Describe the rrole of heip T cell (4%)
8. Draw picture and describe the reproductive cycle of the human female (5%)
9. Draw picture and describe the action potential (5%)
10. Draw picture and describe the fertilization (5%)
11. Compare the gastrulation between frog and avian (5%)