

八十五學年度輻射生物研究所系(所) _____ 組碩士班研究生入學考試

科目 生物學 科號 3902 共 四 頁第 1 頁 *請在試卷【答案卷】內作答

Part I.

A. 試填入適當的字(已寫出第一個字母),以完成敘述。(24%)

1. Most spontaneous changes in DNA are quickly erased by a correction process called DNA repair; only rarely do DNA maintenance procedures fail and allow a permanent sequence change, which is called a m _____.
2. DNA t _____ can be viewed as "reversible nuclease" that create either a transient single-strand break (type I) or a transient double-strand break (type II).
3. A central intermediate in general recombination is the cross-strand exchange, which is also called a H _____ junction, after its discovery.
4. The enzyme reverse transcriptase, which transcribes RNA into complementary DNA molecules, accounts for the permanent genetic changes caused by r _____.
5. The three major types of lipids found in cell membranes are called cholesterol, p _____, and glycolipids.
6. The most useful agents for disrupting hydrophobic associations and destroying lipid bilayer are d _____, which are small amphipathic molecules that tends to form micelles in water.
7. Proteins that recognize specific sugar residues are called l _____.
8. Iron is carried in the blood by a specialized transport protein called t _____.
9. Pairs of compounds such as NADH and NAD^+ are called conjugate r _____ pairs, since one compound is converted to the other by the addition of one or more electrons plus one or more protons.
10. Regulated secretion is triggered by an external signal, whereas c _____ secretion occurs continuously in the absence of a stimulatory signal.

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11. In the genes of higher eukaryotes, short segments of coding DNA, called exons, are usually separated by long stretches of noncoding DNA, called i _____.
12. Patients with thalassemia syndromes have an abnormally low level of h _____ which is the oxygen-carrying protein in red blood cells.
13. The binding of a gene r _____ protein to a specific DNA sequence turns a gene off; this type of gene control is called negative regulation.
14. The c _____ is a complex network of protein filaments that enables eukaryotic cells to adopt a variety of shapes and to carry out coordinated and directed movements.
15. Cells reversibly adjust their sensitivity to a stimulus by a process called a _____.
16. When normal cells are cultured in suspension, unattached to any solid surface, they never divide, a phenomenon known as a _____ dependence of cell division.

B. 問答題 (16%)

1. 試寫出三種研究細胞蛋白質的方法、並扼要說明其原理及使用時機。
2. 試寫出三種研究細胞核酸的方法、並扼要說明其原理及使用時機。

Part II.

1. Definition (10%)

- a. polysome
- b. polymorphism
- c. polyadenylation
- d. polyploidy
- e. polysaccharide

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2. Which of the following organelles contain inner and outer membrane? (3%)
a. nucleus b. endoplasmic reticulum c. mitochondria d. chloroplasts
e. Golgi apparatus f. vacuole
3. List the order of length (nm) and strength (kcal/mole) in water of the following chemical bonds (from high to low). (4%)
a. covalent b. ionic c. hydrogen d. van der Waals attraction (per atom)
4. In mechanism, photophosphorylation is most similar to (2%)
a. substrate-level phosphorylation b. the Calvin cycle c. glycolysis
d. oxidative phosphorylation e. gluconeogenesis
5. The stage of photosynthesis that actually produces sugar is (2%)
a. the Calvin cycle b. photosynthesis I c. photosynthesis II
d. the light reaction e. splitting of water
6. Please indicate the ratio of various inorganic ions inside and outside an animal cell (inside/outside >, < or = 1). (3%)
a. Na^+ b. K^+ c. Cl^-
7. DNA molecules are constantly subjected to various potential damaging agents. When DNA is damaged, it can be detected and repaired by a team of enzymes. For a type of repair called excision repair, a segment of DNA will be removed and filled again. Please indicate the enzymes that involve in the repair system directly. (3%)
a. DNA polymerase b. RNA polymerase c. topoisomerase d. nuclease
e. reverse transcriptase f. ligase g. Hind III h. primase
8. List the order of chromatin packing processes. (5%)

DNA → a → b → c → d → e

Choose from the followings to fit a to e: 30 nm chromatin fiber, metaphase chromosome looped domains, nucleosome, condensed chromatin (heterochromatin)
9. A powerful technique developed recently in the molecular studies is the polymerase chain reaction (PCR). Please describe in detail about the principle of the technique. (4%)

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10. Indicate and explain the error in each statement. If there is no error, please indicate "correct". (8%)

RNA polymerase

- transcribes both DNA strands, but always in a 5'→3' direction
- transcribes both exons and introns
- starts transcribing at an AUG triplet on one DNA strand
- can produce several polypeptide chain at one time through the creation of polysomes

11. Two methods that use metal replica have been particularly useful in cell biology. They are freeze-fracture and freeze-etch electron microscopy. Please describe the methods and what can be observed by the techniques. (6%)

12. DNA sequence can be revealed by a dideoxynucleotide chain termination (Sanger) method. Please describe the principle of the technique. (4%)

13. Though different in length, number per cell and beating pattern, cilia and flagella actually share a common ultrastructure. Please describe. Also, how "dynein working" moves cilia and flagella. (6%)