※ 考生請注意：本試題不可使用計算機。**所有考題均請於答案卷(卡)作答**，於本試題紙上作答者，不予計分。

一.選擇題,共 10 題,每題 2 分,共 20 分

Choose the correct answer (only one answer) from each of the question. (18%)

1. Imagine a species with three loci thought to be on the same chromosome. The recombination rate between locus A and locus B is 35%, and the recombination rate between locus B and locus C is 33%. Predict the recombination rate between A and C.

   A) The recombination rate between locus A and locus C is either 2% or 68%.

   B) The recombination rate between locus A and locus C is probably 2%.

   C) The recombination rate between locus A and locus C is either 2% or 50%.

   D) The recombination rate between locus A and locus C is either 2% or 39%.

   E) The recombination rate between locus A and locus C cannot be predicted.

2. When a disease is said to have a multifactorial basis, it means that

   A) both genetic and environmental factors contribute to the disease.

   B) it is caused by a gene with a large number of alleles.

   C) it affects a large number of people.

   D) it has many different symptoms.

   E) it tends to skip a generation.

3. A cross between homozygous purple-flowered and homozygous white-flowered pea plants results in offspring with purple flowers. This demonstrates

   A) the blending model of genetics.

   B) true breeding.

   C) dominance.

   D) a dihybrid cross.

   E) the mistakes made by Mendel.

4. Mendel's law of independent assortment has its physical basis in the:

   A) separation of alleles into haploid cells.

   B) spindle attachment in anaphase I.

   C) haploid cells forming.

   D) sister chromatids separating in meiosis II.

   E) random arrangement of chromosomes on the metaphase plate in meiosis I.

5. An extensive study was conducted on identical twins who were separated at birth. Among other things, the study showed that the individual from each pair who received better nutrition during childhood tended to score higher on standardized intelligence tests. This can best be described

as an example of how

A) mutation alters genotype.

B) mutation alters phenotype..

C) environment alters genotype

D) environment alters.phenotype.

E) pleiotropic genes affect more than one trait.

6. One of the typical ratios resulting from epistatic interactions in dihybrid cross would be

A) 3:1

B) 1:2:1

C) 12:3:1

D) 1:1:1:1

E) 9:3:3:1

7. Cystic fibrosis (CF) is a Mendelian disorder in the human population that is inherited as a recessive. Two normal parents have two children with CF. The probability of their next child being normal for this characteristic is which of the following?

A) 1/8

B) 1/4

C) 1/2

D) 2/3

E) 3/4

8. One explanation for organelle inheritance is that _____.

A) mitochondria and chloroplasts lack DNA and are therefore dependent on the maternal cytoplasmic contributions

B) mitochondria and chloroplasts have DNA that is subject to mutation

C) organelles such as mitochondria are always wild type

D) chloroplasts, for example, are completely dependent on the nuclear genome for components

E) None of the answers listed is correct.

9. A genomic condition that may be responsible for some forms of fragile-X syndrome, as well as Huntington disease, involves _____.

A) multiple inversions in the X chromosome

B) F plasmids inserted into the FMR-1 gene

C) multiple breakpoints fairly evenly dispersed along the X chromosome

D) various lengths of trinucleotide repeats

E) single translocations in the X chromosome

10. Which of the following terms best characterizes catabolite repression associated with the lactose operon in *E. coli*?

A) inducible system

B) repressible system

C) negative control

D) positive control

E) constitutive

二. 問答題,共 11 題,每題 5 分,共 55 分

1. Triploid species are usually sterile (unable to reproduce), whereas tetraploids are often fertile. Please provide a likely good explanation for these facts?

2. What are complementation tests, and why do geneticists find them so useful?

3. How many clones do you need if you could like to construct a 10X coverage genomic library of an organism which genome size is 5Mb.　Assuming the average DNA fragment cloned is 2kb.

4. What are **orthologous and paralogous genes**?

5. What are the current uses of **Allele-specific oligonucleotide (ASO) probes**?

6. What advantages do cDNA libraries provide over genomic DNA libraries?

7. Why are most recombinant human proteins produced in animal or plant hosts instead of bacterial host cells?

8. What is alternative splicing?

9. List the components of a nucleosome, and describe how these components are associated?

10. What are the differences between prokaryotic and eukaryotic transcription?

11. What is the function of DNA gyrase?

三.填充題,共 7 題 13 個答案,共 25 分

1. The diagram on the right is a tetraneucleotide, **what is the chemical group in the position (1) and (2)** (1% x 2). This tetranucleotide is composed of the bases 5'-GCTA-3', please **fill in the parentheses (3)-(6) with the expected bases**. (2% x 4)

2. The discontinuous aspect of replication of DNA *in vivo* is caused by _____ _____. (3%)

3. _____ rRNA, 5S rRNA, and _____ rRNA are among the major components of prokaryotic ribosomes. (2% X 2)
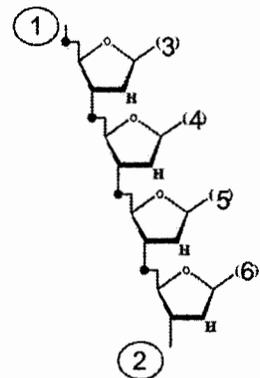
4. A class of mutations that results in multiple contiguous amino acid changes in proteins is likely to be _____. (2%)

5. The process of error correction of mismatched bases carried out by DNA polymerases is called _____. (2%)

6. If 15% of the nitrogenous bases in a sample of DNA from a particular organism is thymine, _____ (what percentage) should be cytosine. (2%)

7. Deoxyribonuclease is an enzyme that adds 3'-hydroxyl groups to RNA. True or False? (2%)