一、 選擇題：（每題 4 分）

1. A genetic cross in which the inheritance of two traits is observed is called a
   A) Dihybrid cross.
   B) Monohybrid cross.
   C) Backcross.
   D) Testcross

2. For single crossovers, the frequency of recombinant gametes is half the frequency of crossing over because
   A) A testcross between a homozygous and heterozygote produces 1/2 heterozygous and 1/2 homozygous progeny.
   B) The frequency of recombination is always 50%.
   C) Each crossover takes place between only two of the four chromatids of a homologous pair.
   D) Crossover occur in about 50% of meiosis.

3. In analyzing the results of a three-point testcross, a student determines that the interference is -0.23. What does this negative interference value indicates?
   A) Fewer double crossovers took place than expected on the basis of single-crossover frequencies.
   B) More double crossovers took place than expected on the basis of single-crossover frequencies.
   C) Fewer single crossovers took place than expected.
   D) A crossover in one region interferes with additional crossovers in the same region.

4. A genetic map shows
   A) The location of genes on chromosomes
   B) The relative distance between genes on chromosomes.
   C) The genetic relationships between individuals in a family.
   D) Both A and B

5. Genetic distances shown on a genetic map are obtained by determining the
   A) Number of chromosomes in the genome.
   B) Location of chromosomes in the nucleus.
   C) Number of base pairs between restriction sites.
   D) Frequency of recombination between genes.

6. A male affected with an X-linked dominant trait will have what proportion of offspring affected with the trait?
   A) 1/2 sons and 1/2 daughters.
   B) All sons and no daughters.
   C) All daughters and no sons.
   D) 3/4 daughters and 1/4 son.

7. A trait exhibits 100% concordance in both monozygotic and dizygotic twins. What conclusion can you draw about the role of genetic factors in determining differences in the trait?
   A) Genetic factors are extremely important.
   B) Genetic factors are somewhat important.
   C) Genetic factors are unimportant.
   D) Both genetic and environmental factrs are important.

8. What assumptions underlie the use of adoption studies in genetics?
   A) Adoptees have no contact with their biological parents after birth.
   B) The foster parents and biological parents are not related.
   C) The environments of biological and adopted parents are independent.
   D) All of the above.

9. Which process of DNA transfer in bacteria requires a virus?
   A) Conjugation.
   B) Transduction.
   C) Transformation.
   D) All of the above.

10. In which bacteriophage life cycle does the phage DNA become incorporated into the bacterial chromosome?
    A) Lytic
    B) Lysogenic
    C) Bothe lytic and lysogenic
    D) Neither lytic or lysogenic

11. In gene mapping experiments using generalized transduction, bacterial genes that are co-transducted are
    A) Far apart on the bacterial chromosome.
    B) On different bacterial chromosome.
    C) Close together on the bacterial chromosome.
    D) On a plasmid.

12. How do the sugars of RNA and DNA differ?
    A) RNA has a six-carbon sugar; DNA has a five-carbon sugar.
    B) The sugar of RNA has a hydroxyl group that is not found in the sugar of DNA.
    C) RNA contains uracil; DNA contains thymine.
    D) DNA's sugar has a phosphorus atom; RNA's sugar does not.

13. The antiparallel nature of DNA refers to
    A) Its charged phosphate groups.
    B) The pairing of bases on one strand with bases on the other strand.
    C) The formation of hydrogen bonds between bases from opposite strands.
    D) The opposite direction of the two strands of nucleotides.

14. Griffith's experiment injecting a mixture of dead and live bacteria into mice demonstrated that (choose the correct answer)
    A) DNA is double-stranded
    B) mRNA of eukaryotes differs from mRNA of prokaryotes
    C) A factor was capable of transforming one bacterial cell type into another.
    D) Bacteria can recover from heat treatment if live helper cells are present.

15. For double-stranded DNA, which of the following base ratios always equals 1?
    A) (A+T)/G+C)
    B) (A+G)/(C+T)
    C) C/G
    D) (G+T)/(A+C)

二、 計算題：

1. In D. melanogaster, cherub wing (ch), black body (b), and cinnabar eyes (cn) result from recessive alleles that are all located on chromosome 2. A homozygous wild-type fly was mated with a cherub, black, and cinnabar fly, and the resulting F1 females were testcrossed with cherub, black, and cinnabar males. The following progeny were produced from the test cross:

ch	b^+	cn	105
ch^+	b^+	cn^+	750
ch^+	b	cn	40
ch^+	b^+	cn	4
ch	b	cn	753
ch	b^+	cn^+	41
ch^+	b	cn^+	102
ch	b	cn^+	5
Total			1800

   a. Determine the linear order of the genes on the chromosome (which gene is in the middle). (4 points)

   b. Calculate the recombinant distances between the three loci. (4 points)

   c. Determine the coefficient of coincidence and the interference for these three loci. (4 points)

   d. Please use LOD (logarithm of Odds) methods to demonstrate the most likely gene order. (8 points)

2. In the following testcross, gene a and b are 20 cM apart, and gene b and c are 10 cM apart: a+c/+b+ X abc /abc. If coefficient of coincidence is 0.2 over this interval on the linkage map, how many triply homozygous recessive individuals are expected among 10000 progeny? (10 points) (Note: Morgan's map function was used for genetic distance)

3. Certain varieties of flax show different resistances to specific races of the fungus call flax rust. For example, the flax variety 770B is resistant to rust race 24 but susceptible to rust race 22, whereas flax variety Bombay is resistant to rust race 22 but susceptible to rust race 24. When 770B and Bombay were crossed, the F1 hybrid was resistant to both rust races. When selfed, it produced an F2 containing the phenotypic proportions shown in the table below:

		Rust race 22	
		Resistant	Susceptible
Rust race 24	Resistant	184	63
	Susceptible	58	15

Please propose a hypothesis to account for the genetic basis of resistance in flax to these particular rust races, based on the Chi-square tests. Make a concise stamen of the hypothesis, and define any gene symbols you use. Show your proposed genotypes of the 770B, Bombay, F1, and the four types of F2 flax plants. (10 points)

Critical values of the χ^2 distribution				
df	1	2	3	4
P=0.05	3.841	5.991	7.815	9.488

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