Gene Mapping Worksheet

1. In 1911, Thomas Hunt Morgan collected the following crossover gene frequencies while studying *Drosophila*. Bar-shaped eyes are indicated by the B allele, and carnation eyes are indicated by the allele C. Fused veins on wings (A) and scalloped wings (S) are located on the same chromosomes.

Gene Combinations	Recombination Frequency
A/B	2.5%
A/C	3.0%
B/C	5.5%
B/S	5.5%
A/S	8.0%
C/S	11.0%

2. The following chart shows the crossover frequencies for some genes on an autosome of organism Z. Construct a chromosome map.

Genes	Crossover Frequency
P & Q	5%
P & R	8%
P & S	12%
Q & R	13%
Q & S	17%

3. For a series of experiments, a linkage group composed of genes W, X, Y and Z was found to show the following gene combinations. (All recombinations are expressed per 100 fertilized eggs). Construct a gene map.

Genes	W	X	Y	Z
W	–	5	7	8
X	5	–	2	3
Y	7	2	–	1
Z	8	3	1	–

4. For a series of breeding experiments, a linkage group composed of genes A, B, C, and D was found to show the following gene combinations. (All recombinations are expressed per 100 fertilized eggs). Construct a chromosome map.

Genes	A	B	C	D
A	–	12	15	4
B	12	–	3	8
C	15	3	–	11
D	4	8	11	–

5. In *Drosophila*, the gene for eye color (A), wing shape (B), and body color (C) are all found on the same chromosome. The following crossover frequencies for these genes were determined by experiments.

Genes	Crossover Frequency
A & B	12.5%
A & C	6.0%
B & C	18.5%

What is the correct sequence of the genes A, B and C on the chromosome?

6. Construct a gene map given the following information:

Genes	Crossover Frequency
A & B	24.0%
A & C	8.0%
C & D	2.0%
A & F	16.0%
F & B	8.0%
D & F	6.0%

Challenge Question:

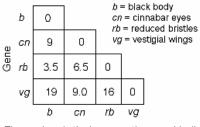**7.** Five traits found in *Drosophila* are yellow body color (y), white eye color (w), vermilion eye color (v), miniature wing (m) and rudimentary wing (r). Given the following crossover frequencies, construct a genetic map.

Genes	Crossover Frequency
y & w	2.2%
v & m	3.0%
v & r	26.6%
v & w	30.0%
v & y	32.2%
w & m	33.0%
y & m	35.2%
w & r	56.6%

8. There are 3 genes on a single chromosome: A, B, and C. They exhibit the following crossing over frequencies:

    a. A-B = 35%
    b. B-C = 10%
    c. C-D = 15%
    d. C-A = 25%
    e. D-B = 25 %

Determine the order of the genes on the chromosome.

9. Genes A, B, and C are linked genes. A testcross shows that the recombination frequencies between A and B is 28%, and between A and C is 12%. Can you determine the linear order of these genes? Explain.

10. Determine the sequence of genes along a chromosome based on the following recombination frequencies:
   f. A-B = 8%
   g. A-C = 28%
   h. A-D = 25%
   i. B-C = 20%
   j. B-D= 33%

11. 4. Determine the sequence of genes along a chromosome based on the following recombination frequencies:
   k. A-B = 30%
   l. A-C = 9%
   m. A-D = 18%
   n. B-C = 21%
   o. B-D = 12%
   p. E-D = 12%
   q. E-A = 6%
   r. E-C = 3%
   s. E-B = 24%

12. Use the table below to map the genes found on this chromosome of a fruit fly.

b = black body
cn = cinnabar eyes
rb = reduced bristles
vg = vestigial wings

Gene	b	cn	rb	vg
b	0			
cn	9	0		
rb	3.5	6.5	0	
vg	19	9.0	16	0

The numbers in the boxes are the recombination frequencies in between the genes (in percent).

13. A space probe discovers a planet inhabited by creatures who reproduce with the same hereditary patterns seen in humans. Three phenotypic characters are height (T = tall, t = short), head appendages (A = antennae, a = no antennae), and nose morphology (S = upturned snout, s = downturned snout). Earth scientists are able to do some controlled breeding experiments on them using various heterozygotes. For a tall heterozygote with antennae cross, the offspring are: tall/antenna - 46, dwarf/antennae - 7, dwarf/no antennae - 42, tall/no antennae - 5. For a heterozygote cross with antennae and an upturned snout the offspring were: antennae/upturned - 47, antennae/downturned snout - 2, no antennae/downturned snout - 48, no antennae/upturned snout -3. Calculate the recombination frequencies for both traits.