

Name: _____ Period: _____ Date: _____

Open **peebedu.com** and navigate to **Gene Mapping Interactive**. Begin on the **Introduction** tab, which covers crossing over during meiosis, how gene distance controls recombination frequency, and how linked genes deviate from Mendel's Law of Independent Assortment. Use the crossing over animation and distance slider to explore these concepts before moving to the **Tutorial** and **Problems** tabs.

Free Response Questions

Question 1 — Conceptual Analysis

Simulation Task: *On the Introduction tab, use the crossing over animation to step through all four phases. Then adjust the gene distance slider from 5 map units to 48 map units and observe how the recombination frequency and linkage status change. Note the testcross ratio table showing how linkage changes offspring ratios compared to independent assortment.*

(A) (1 pt) **Describe** the process by which crossing over during meiosis I produces recombinant chromosomes.

(B) (1 pt) **Explain** why genes located close together on the same chromosome do not follow Mendel's Law of Independent Assortment.

(C) (1 pt) **Predict** how the proportion of recombinant offspring in a testcross would change if the distance between two linked genes increased from 5 map units to 40 map units.

(D) (1 pt) **Justify** your prediction.

Question 2 — Analyze Model / Visual Representation

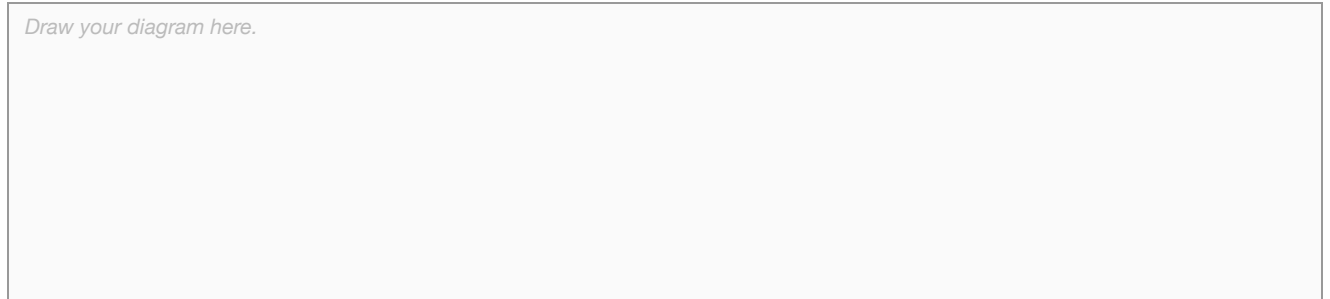
Simulation Task: Navigate to the Problems tab and select Problem 1. Read the testcross data and work through each step: identify parental and recombinant phenotype classes, calculate the recombination frequency, and convert it to map units. After completing Problem 1, select Problem 2 and compare the recombination frequencies between the two gene pairs.

(A) (1 pt) **Describe** how a testcross reveals the allele combinations present in the gametes produced by a heterozygous parent.

(B) (1 pt) **Explain** why the phenotype ratio among testcross offspring reflects the frequencies of the gametes produced by the heterozygous parent.

(C) (1 pt) **Represent** two linked genes on a pair of homologous chromosomes during prophase I of meiosis by drawing a labeled diagram that shows a crossover between the two genes and the parental and recombinant chromatids it produces.

Draw your diagram here.



(D) (1 pt) **Explain** how crossing over during meiosis increases genetic variation in sexually reproducing populations.

5.3.A.1, 5.2.A.3