Name:

Date:

Period:

# Genetics Problems Set 2

BACKGROUND:

A) All of the genes for one trait that exist in a population are called alleles. You have learned that two alleles exist for pea plant height, the gene for tall (T) and the gene for short (t). Since we used a capital “T” for tall, we know that the tall allele is dominant to the short allele.

B) If an organism has two identical alleles (TT or tt), regardless of whether the allele is recessive or dominant, we call that organism **homozygous** (“homo-” = “same”). If the two alleles are different (Tt), the organism would be **heterozygous** (“hetero-” = “different”).

C) In the problems below, the phrases “Show your work,” and “Diagram the cross,” mean: USE THE SIX STEP METHOD outlined on the front side of Genetics Problem Set 1. Show the phenotypes and genotypes of the parents. Show the possible gametes that each parent may produce. Diagram the cross using a Punnett Square, and then show both the phenotypic and genotypic ratios of the offspring.

PROBLEMS: Answer on a separate sheet of paper.

1. A hybrid cross is made (A CROSS OF TWO HYBRIDS). Two alleles for flower color exist, “R” for red, and “r” for white. In parts (a) and (b) below, remember that you are showing the cross of two **hybrids**.

a) Diagram the cross, assuming that red is completely dominant. (Rr × Rr)

b) Diagram the cross, assuming that the two alleles are **co-dominant**. Co-dominance (a.k.a. incomplete dominance) means that neither gene dominates the other and therefore the heterozygous/hybrid trait is a blending of the pure traits. In this case the “blended” trait is pink flower color. We note codominance with two sets of capital letters; for this cross, R would stand for the red allele, and R′ (R-prime) would stand for the white.

c) Were the two **genotypic** ratios of offspring in the above 2 problems the same or different?

d) Were the two **phenotypic** ratios the same or different?

e) You have learned that it is usually impossible to know for certain an individual’s genotype unless they happen to have the recessive phenotype. Is this still true if the trait is codominant?

2. John crossed a green-seeded plant with a yellow-seeded plant. He knew that the yellow-colored seed is the recessive trait.

a) If the green-seeded plant were hybrid (heterozygous), what phenotypic ratio would he expect in the offspring? DIAGRAM THE CROSS.

b) If the green-seeded plant were pure (homozygous), what phenotypic ratio would he expect in the offspring? DIAGRAM THE CROSS.

3. What kind of cross produces a 1 : 1 PHENOTYPIC RATIO? **Be specific.**

4. What kind of cross produces a 1 : 2 : 1 GENOTYPIC RATIO? **Be specific.**

5. Mary was studying the genetics of dung beetles so that she could perhaps improve their benefits to agriculture. Dung beetles, having made a burrow in the soil, seek out stock (cow) patties (also called meadow muffins). Finding a muffin of the appropriate consistency (requirements vary with different species of dung beetles) they cut out a wad, roll it up into a ball (it’s about the same diameter as the length of the beetle), and then roll it backwards, pushing the ball with their rear legs. The dung ball is pushed into the burrow, where the female lays one or more eggs in the mass of dung. The larvae, when hatched, feed on the microorganisms that live in the undigested organic matter. They eventually pupate into adult dung beetles. Naturally a variety of dung beetle that made bigger dung balls would have a greater fertilizing effect on the soil, hence Mary's interest in dung beetles.

Mary noticed three phenotypes of the species *Copris copriphagis* ; she called these three types pretty, gritty, and dirty. Inevitably, when she crossed two grittys, about one-fourth of the F1s would be pretty, about one-fourth were dirty, and about half were gritty.

a) Diagram the cross. You must first figure out whether the dominance is complete or incomplete; then you may assign appropriate letters to represent the alleles.

b) What kind of relationship exists between the genes for this trait (a dominant-recessive relationship, or codominance)?