

incomplete dominance and codominance worksheet

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Understanding Incomplete Dominance and Codominance: A Complete Worksheet Guide

Genetics is a fascinating field that reveals how traits are passed from one generation to the next. While many students learn the basics of dominant and recessive alleles, two less intuitive patterns—**incomplete dominance** and **codominance**—often pose a challenge. This article presents a comprehensive, step by step worksheet designed to help learners master these concepts. By the end, you'll be able to predict phenotypes, create Punnett squares, and understand the real world examples that bring these genetic patterns to life.

Why Incomplete Dominance and Codominance Matter

Traditional Mendelian genetics teaches that one allele completely masks the effect of another. However, nature frequently exhibits more nuanced interactions:

- Incomplete dominance occurs when neither allele fully dominates, resulting in a blended phenotype.
- Codominance happens when both alleles are expressed simultaneously, producing a phenotype that shows both traits distinctly.

These patterns explain many observable variations in plants, animals, and even humans—such as the pink flowers of snapdragons or the blood types in humans. Grasping them is essential for anyone studying biology, agriculture, medicine, or genetics research.

Worksheet Overview

The worksheet below is organized into five sections:

1. Key Definitions & Concepts
2. Creating Punnett Squares
3. Calculating Genotype and Phenotype Ratios
4. Real World Examples
5. Practice Problems & Answers

Each section builds on the previous one, ensuring a logical progression from theory to application.

Section 1: Key Definitions & Concepts

1.1 Incomplete Dominance

In incomplete dominance, the heterozygote shows a phenotype that is an intermediate between the two homozygous forms. The classic example is the cross between red and white snapdragon flowers, producing pink offspring.

1.2 Codominance

Codominance occurs when both alleles in a heterozygote are fully expressed, leading to a phenotype that displays both traits side by side. A well known example is the AB blood type in humans, where both A and B antigens are

present.

1.3 Genotype vs. Phenotype

Remember: the genotype is the genetic makeup (e.g., Rr, Aa), while the phenotype is the observable trait (e.g., pink, AB blood type).

1.4 Punnett Square

A Punnett square is a diagram used to predict the genotypes of offspring from a cross between two parents. It's a foundational tool for all genetic predictions.

Section 2: Creating Punnett Squares

2.1 Step by Step Instructions

1. Identify the alleles: Write the alleles from each parent on the top and side of the grid.
2. Fill the boxes: Combine the alleles from the top and side to fill each square.
3. Read the results: Each box shows a possible genotype of the offspring.

2.2 Incomplete Dominance Punnett Square Example

Cross: Red flower (RR) × White flower (rr)

	R	R
r	Rr	Rr
r	Rr	Rr

All offspring are heterozygous (Rr) and display the intermediate pink phenotype.

2.3 Codominance Punnett Square Example

Cross: A blood type (AA) × B blood type (BB)

	A	A
B	AB	AB
B	AB	AB

All offspring are AB, showing both A and B antigens.

Section 3: Calculating Ratios

3.1 Genotype Ratio

Count the number of each genotype in the Punnett square and divide by the total number of boxes.

3.2 Phenotype Ratio

Group genotypes by their observable traits and calculate the ratio.

3.3 Example: Incomplete Dominance Ratios

Cross: Red (RR) × White (rr)

- Genotype ratio: 1 Rr : 0 Rr (100% Rr)
- Phenotype ratio: 100% Pink

3.4 Example: Codominance Ratios

Cross: A (AA) × B (BB)

- Genotype ratio: 1 AB : 0 AB (100% AB)
- Phenotype ratio: 100% AB blood type

Section 4: Real World Examples

4.1 Incomplete Dominance in Plants

- Snapdragons (*Antirrhinum majus*): Red × white = pink.
- Carrots: Yellow × orange = light orange.

4.2 Codominance in Animals

- Human blood types: A × B = AB.
- Mouse coat color: Yellow (Y) × white (y) = yellow & white stripes.

4.3 Incomplete Dominance in Humans

- Red-green color blindness: The heterozygote often shows partial color vision.

Section 5: Practice Problems & Answers

5.1 Problem 1: Flower Color

Snapdragon flowers come in red (RR) and white (rr). What is the genotype and phenotype of the offspring when a red flower is crossed with a white flower?

Answer: All offspring are heterozygous (Rr) and display pink flowers.

5.2 Problem 2: Human Blood Types

One parent has blood type A (AA) and the other has blood type B (BB). What blood type will their children have?

Answer: All children will have blood type AB.

5.3 Problem 3: Carrot Color

A carrot variety has yellow (YY) and orange (OO) alleles. If a yellow carrot is crossed with an orange carrot, what is the phenotype of the offspring?

Answer: Offspring will have a light orange phenotype (heterozygous YO).

5.4 Problem 4: Mouse Coat Color

A mouse with yellow coat (Yy) is crossed with a white mouse (yy). What are the genotypes and phenotypes of the offspring?

Answer: 50% Yy (yellow & white stripes) and 50% yy (white). Phenotype ratio: 1 yellow & white : 1 white.

5.5 Problem 5: Complex Cross

A plant with incomplete dominance for flower color (Rr = pink) is crossed with a plant homozygous for red (RR). Predict the genotype and phenotype ratios.

Answer: All offspring are heterozygous (Rr) and pink.

Conclusion

Incomplete dominance and codominance illustrate the rich complexity of genetic inheritance beyond simple dominant recessive models. By mastering Punnett squares, genotype and phenotype ratios, and real world examples, students can confidently predict outcomes of genetic crosses. Use this worksheet as a study aid, and soon you'll be able to analyze any genetic scenario with clarity and precision.

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