

# Punnett Squares

Grade Level: 6, 7, 8, 9, 10

Duration: 30-50 mins

Classification: Classroom

Subject(s): Biology, Genetics

Categories (STEM): Science

Keywords: Punnett Squares, Genotype, Phenotype, Probability, Dominant, Recessive

## Introduction

- Summary: Students will learn about Punnett Squares, genotypes, and phenotypes for complete dominance, incomplete dominance, and codominance.
- Description: Students will work together in groups to identify the probability of difference possible genotype and phenotypes of different forms of dominance. Students will pair up with a partner and use their physical characteristics to predict what a potential offspring could attain.

**Online Resource:** [https://www.ck12.org/biology/punnett-squares/lesson/Punnett-Squares-BIO/?referrer=concept\\_details](https://www.ck12.org/biology/punnett-squares/lesson/Punnett-Squares-BIO/?referrer=concept_details)

## Vocabulary

- **Punnett Square** - a model of inheritance that shows depicted phenotypes and genotypes
- **Alleles** - alternative forms of a gene that can be found at a point on a chromosome
- **Dominant feature** - when one allele can “overrule” and define a physical attribute
- **Recessive feature** - when one allele can be “overruled” by another and is not visible as a physical attribute
- **Genotype** - alleles for a given trait or gene
- **Phenotype** - the physical trait or characteristics that is observable because of an individual’s genotype
- **Codominance** - when both alleles present are dominant and affect a physical trait
- **Incomplete Dominance** - when both alleles present are not completely dominant and result in blending of traits















## Materials

Materials	Quantity	Reusable?
Punnett Square Example Handout	1 per 2 students	No
White Copy Paper	1 per student	No
Colored Pencils, Crayons	3-4 packs per classroom	Yes

## Directions

1. Have students pair up with a partner who will act as their potential partner/spouse. Distribute the Example Handout, copy paper, and colored pencils.

2. Give students background knowledge on the topic by using the vocab words above. Go through the example handout as more background for the activity. Make sure to explain what a phenotype and genotype is and how to identify them given a Punnett Square.
3. Have students make Punnett Squares on copy paper for a number (or all) dominant and recessive traits on the chart below, using their own features (to derive genotypes and phenotypes). Instruct students that they may choose if they are homo dominant or heterozygous. **Instruct students that they may choose if they are homo dominant or heterozygous.**

Dominant Gene		Recessive Gene	
Cleft Chin		No Cleft	
Widow's Peak		No Widow's Peak	
Dimples		No Dimples	
Brown/Black Hair		Blonde Hair	
Freckles		No Freckles	
Brown Eyes		Gray/Blue Eyes	
Free Earlobe		Attached Earlobe	

- Once students have completed their Punnett squares, have students draw their potential offspring (child) on the other side of the copy paper with the physical traits that have the highest probability according to their Punnett Squares. **If some of the probabilities are tied, have students pick a random one.**

#### KEY POINTS

- Punnett Squares act as a “multiplication table”. A letter in each row will be distributed all the way across the row. A letter in each column will be distributed all the way down the column.
- Capital letters = dominant alleles**
- Lowercase letters = recessive alleles**

#### Activity Extension

##### PART 2: CODOMINANCE (blood type)

- Have students make (codominant) Punnett Squares and use their own blood type if they know it, otherwise they can pick a random blood type. Draw the example below on the board and explain that *i* is recessive (*ii* = blood type O) and A and B are both dominant.  
Type A =  $I^A i$  or  $I^A I^A$   
Type B =  $I^B i$  or  $I^B I^B$

		Mother	
		<i>i</i>	<i>i</i>
Father	$I^A$	$I^A i$	$I^A i$
	$I^B$	$I^B i$	$I^B i$

Half of the children predicted to be **Type A**, and half **Type B**.

##### PART 3: INCOMPLETE DOMINANCE (plant/flower colors)

- Have students make (incomplete dominant) Punnett Squares and pick the original genotype of flowers they wish to have. Explain that neither allele is dominant.  
Red = *rr*  
White = *ww*  
Pink = *rw*
- For older students, you can have them make a multiple allele Punnett square (4x4) with 4 alleles (two traits) in each square.

#### Discussion Questions

- What is the genotype for homozygous dominant? Homozygous recessive? Heterozygous?  
**HH, hh, Hh**
- Does genotype depend on type of dominance? Does phenotype? **No, Yes**

- How does a Punnett Square help predict probability? How do you calculate it?
- What are some examples of traits that are dominant? What are some that are recessive?
- What are some examples of each of the types of dominance?

### **What is happening?**

- Students will practice filling in Punnett Squares for varied forms of dominance and learn to analyze the genotypes and phenotypes by calculating probabilities of offspring.

### **Applications:**

- Majors
  - Genetics
  - Biology
- Jobs
  - Biologist, Geneticist
  - Physicians
- Real world applications
  - Blood Types
  - Flower Colors
  - Genetic traits in offspring
  - Paternity/Maternity tests



This activity was last updated in fall 2020 by Student Role Models.