

**Bikini Bottom Genetics**  
**Incomplete Dominance**

Name Key

SpongeBob loves growing flowers for his pal Sandy! Her favorite flowers, Poofkins, are found in red, blue, and purple. Use the information provided and your knowledge of incomplete dominance to complete each section below.

1. Write the correct genotype for each color if R represents a red gene and B represents a blue gene.

Red - RR    Blue - Rr    Purple - Rr

2. What would happen if SpongeBob crossed a Poofkin with red flowers with a Poofkin with blue flowers. Complete the Punnett square to determine the chances of each flower color.

	<u>R</u>	<u>R</u>
<u>r</u>	<u>Rr</u>	<u>Rr</u>
<u>r</u>	<u>Rr</u>	<u>Rr</u>

(a) Give the genotypes and phenotypes for the offspring. 100% Rr purple

(b) How many of the plants would have red flowers? 0%

(c) How many of the plants would have purple flowers? 100%

(d) How many of the plants would have blue flowers? 0%

3. What would happen if SpongeBob crossed two Poofkins with purple flowers? Complete the Punnett square to show the probability for each flower color.

	<u>R</u>	<u>r</u>
<u>R</u>	<u>RR</u>	<u>Rr</u>
<u>r</u>	<u>Rr</u>	<u>rr</u>

(a) Give the genotypes and phenotypes for the offspring. 25% Red RR  
50% Purple Rr  
25% blue rr

(b) How many of the plants would have red flowers? 25%

(c) How many of the plants would have purple flowers? 50%

(d) How many of the plants would have blue flowers? 25%

4. What would happen if SpongeBob crossed a Poofkin with purple flowers with a Poofkin with blue flowers? Complete the Punnett square to show the probability for plants with each flower color.

	<u>R</u>	<u>r</u>
<u>r</u>	<u>Rr</u>	<u>rr</u>
<u>r</u>	<u>Rr</u>	<u>rr</u>

(a) Give the genotypes and phenotypes for the offspring. 50% purple Rr  
50% blue rr

(b) If SpongeBob planted 100 seeds from this cross, how many should he expect to have of each color?

Purple flowers - 50    Blue flowers - 50    Red flowers - 0

Yellow YY blue yy green Yy

SpongeBob and his pal Patrick love to go jellyfishing at Jellyfish Fields! The fields are home to a special type of green jellyfish known as Goobers and only really great jellyfishermen are lucky enough to catch some on every trip. Many of the jellyfish are yellow (YY) or blue (yy), but some end up green as a result of incomplete dominance. Use this information to help you complete each section below.

5. What would happen if SpongeBob and Patrick crossed two "goobers" or green jellyfish? Complete the Punnett square to help you determine the probability for each color of jellyfish.

	Y	y
Y	YY	Yy
y	Yy	yy

(a) Give the possible genotypes and phenotypes for the offspring.  
 25% yellow YY 50% Green Yy 25% blue yy

(b) What percentage of the offspring would be yellow? 25%

(c) What percentage would be blue? 25%

(d) What percentage would be "goobers" (green)? 50%

6. What would happen if they crossed a yellow jellyfish with a goober? Complete the Punnett square to help you determine the probability for each color of jellyfish.

	Y	Y
Y	YY	YY
y	Yy	Yy

(a) Give the possible genotypes and phenotypes for the offspring.  
 50% yellow YY 50% Yy green

(b) What percentage of the offspring would be yellow? 50%

(c) What percentage would be blue? 0%

(d) What percentage would be "goobers" (green)? 50%

7. What would happen if they crossed a blue jellyfish with a yellow jellyfish? Complete the Punnett square to help you answer the questions.

	Y	Y
y	Yy	Yy
y	Yy	Yy

If 100 jellyfish were produced from this cross, how many would you expect for each?

Yellow - 0 Blue - 0 Goobers - 100

8. What would happen if they crossed a blue jellyfish with a goober? Complete the Punnett square to help you answer the questions.

	y	y
Y	Yy	Yy
y	yy	yy

If 100 jellyfish were produced from this cross, how many would you expect for each?

Yellow - 0 Blue - 50 Goobers - 50

# Worksheet: Multiple Allele Crosses

## UNIT 3: GENETICS

**Directions:** Answer the following genetic cross problems. You can refer to the "Punnett Square Cheat Sheet" attached at the end of this worksheet to help you solve the different types of problems. It is essential that you know all of the vocabulary included in the "cheat sheet" as well. Remember when you are doing a genetic cross to follow the steps below to complete!

**STEP 1:** Determine what kind of problem you are trying to solve.

**STEP 2:** Determine letters you will use to specify traits.

**STEP 3:** Determine parent's genotypes.

**STEP 4:** Make your Punnett square and make gametes

**STEP 5:** Complete cross and determine possible offspring.

**STEP 6:** Determine genotypic and phenotypic ratios.

### Multiple Allele Genetic Crosses

So far we have studied traits or genes that are coded for by just two alleles. Like in rabbits, there was one allele for brown hair color and one allele for white hair. However, some traits are coded for by more than two alleles. One of these is blood type in humans. This is a violation of Mendel's Principle of unit characteristics.

1. In humans, there are four types of blood; type A, type B, type AB, and type O. The alleles A and B are codominant to each other and the O allele is recessive to both A and B alleles. So a person with the genotype AA or AO will have A type of blood.

a. What possible genotypes will produce B type of blood? BB or BO

b. What is the only genotype that will produce O type of blood? OO

c. What is the only genotype that will produce AB type of blood? AB

2. You are blood type O and you marry a person with blood type AB.

a. Complete a Punnett square for this cross.

	O	O
A	AO	AO
B	BO	BO

b. List the possible blood types (phenotypes) of your offspring.

A and/or B

3. In the 1950's, a young woman sued film star/director Charlie Chaplin for parental support of her illegitimate child. Charlie Chaplin's blood type was already on record as type AB. The mother of the child had type A and her son had type O blood.

a. Complete a Punnett square for the possible cross of Charlie and the mother.

	A	B
A	AA	AB
O	AO	BO

b. The judge ruled in favor of the mother and ordered Charlie Chaplin to pay child support costs of the child. Was the judge correct in his decision based on blood typing evidence? Explain why or why not. \*refer to any Punnett squares to support your answer.

No, Charlie cannot produce a child with O blood type.

4. Suppose a newborn baby was accidentally mixed up in the hospital. In an effort to determine the parents of the baby, the blood types of the baby and two sets of parents were determined. Baby 1 had type O Mrs. Brown had type B Mr. Brown had type AB. Mrs. Smith had type B Mr. Smith had type B

Baby O O Mrs. B - B Mr. B - AB Mrs. S - B Mr. S - B

a. Draw Punnett squares for each couple (you may need to do more than 1 square/couple)

Brown

	B	B
A	AB	AB
B	BB	BB

Smith

	B	B
B	BB	BB
O	BO	BO

or

	B	B
B	BB	BB
O	BO	BO

B or O

	B	O
A	AB	AO
B	BB	BO

	B	B
B	BB	BB
B	BB	BB

b. To which parents does baby #1 belong? Why? Hint you may want to refer to your Punnett squares.

Baby belongs to the Smith's because the Brown's cannot produce a child with O blood type.

5. Assume that blood type is inherited as A and B dominant over O, but A and B are codominant over each other. Genotypes ( $I_A I_A$ ) and ( $I_A i$ ) are then phenotypically type A, genotypes ( $I_B I_B$ ) and ( $I_B i$ ) are type B, genotype ( $I_A I_B$ ) is type AB, and genotype ( $i i$ ) is type O blood. A man with blood type  $I_A I_A$  marries a woman with type AB blood. What are the genotypic and phenotypic ratios of the children?

	A	A	
A	AA	AA	50% AA 50% AB
B	AB	AB	

6. A man with type B blood marries a woman with type A blood. They have the first child with blood type O.

a. What are the genotypes of the father and the mother?

B*O* and A*O*

b. What is the genotype and phenotype of the baby?

type O

	B	O
A	AB	AO
O	BO	OO

7. A man with type O blood marries a woman with type AB blood. What is the predicted genotypic and phenotypic ratios of their children?

	O	O	
A	AO	AO	50% AO 50% BO
B	BO	BO	

