

Name Answer Key Period: \_\_\_\_\_

**HUMAN GENETICS PRACTICE WORKSHEET**

1. Explain the difference between incomplete and codominance.

heterozygous phenotype = a blend

heterozygous phenotype = see both traits

**Co-Dominance Problems**

2. In some chickens, the gene for feather color is controlled by codominance. The allele for black is B and the allele for white is W. The heterozygous phenotype is known as erminette (black and white spotted).

- a. What is the genotype for black chickens? BB
- b. What is the genotype for white chickens? WW
- c. What is the genotype for erminette chickens? BW

	B	W
B	BB	BW
W	BW	WW

3. If two erminette chickens were crossed, what is the probability that:

- a. They would have a black chick? 25%
- b. They would have a white chick? 25%

Parents: BW x BW

4. A black chicken and a white chicken are crossed. What is the probability that they will have erminette chicks? 100%

Parents: BB x WW

	B	B
W	BW	BW
W	BW	BW

5. What offspring are expected from mating a roan bull and a roan cow?

(roan = red and white)  
25% red, 50% roan, 25% white

	R	W
R	RR	RW
W	RW	WW

6. What phenotypes would you expect from a cross between a red bull and a white cow?

100% red and white (ROAN)

	R	R
W	RW	RW
W	RW	RW

7. Two short-tailed (Manx) cats are bred together. They produce three kittens with long tails, five short tails, and two without any tails. From these results, how do you think tail length in these cats are inherited? Show the genotypes for both the parents and the offspring to support your answer.

3 long: 5 short: 2 manx

blend = inc. dom.

↳ inherited through this genetic pattern

short -  $T^S T^S$   
long -  $T^L T^L$   
manx -  $T^L T^S$

parent genotypes:  $T^L T^S$  x  $T^L T^S$

	$T^L$	$T^S$
$T^L$	$T^L T^L$	$T^L T^S$
$T^S$	$T^L T^S$	$T^S T^S$

**Incomplete Dominance Problems**

8. In snapdragons, flower color is controlled by incomplete dominance. The two alleles are red (R) and white (R'). The heterozygous genotype is expressed as pink.

- a. What is the phenotype of a plant with the genotype RR? red
- b. What is the phenotype of a plant with the genotype R'R'? white
- c. What is the phenotype of a plant with the genotype RR'? pink

9. A pink-flowered plant is crossed with a white-flowered plant. What is the probability of producing a pink-flowered plant? 50%

Parents: RR' X R'R'

	R	R'
R'	RR'	R'R'
R'	RR'	R'R'

*pink*

10. What cross will produce the most pink-flowered plants? Show a punnett square to support your answer.

Parents: RR X R'R'

	R	R
R'	RR'	RR'
R'	RR'	RR'

11. In Andalusian fowls, black individuals (BB) and white individuals (B'B') are homozygous.

A homozygous black bird is crossed with a homozygous white bird. The offspring are all bluish-gray. Show the cross as well as the genotypes and phenotypes of the parents and offspring.

	B	B
B'	BB'	BB'
B'	BB'	BB'

parents: BB x B'B'  
(black) (white)

gen/phenotype (of offspring): 100% BB' (gray)

"blend" of black & white  
↓

12. What results if a black individual is crossed with a bluish-gray individual? (SHOW YOUR WORK)

	B	B
B	BB	BB
B'	BB'	BB'

50% of offspring BB (black)  
50% is BB' (blue-gray)

13. If two bluish-gray individuals were crossed, what would be the ratios for both phenotype and genotype of the offspring?

	B	B'
B	BB	BB'
B'	BB'	B'B'

1 BB : 2 BB' : 1 B'B'  
1 black : 2 blue-gray : 1 white

## Codominance (Blood types)

Human blood types are determined by genes that follow the CODOMINANCE pattern of inheritance. There are two dominant alleles ( $I^A$  and  $I^B$ ) and one recessive allele ( $i$ ).

Blood Type (Phenotype)	Genotype	Can donate blood to:	Can receive blood from:
O	$ii$	A, B, AB and O (universal donor)	O
AB	$I^A I^B$	AB	A, B, AB and O (universal receiver)
A	$I^A I^A$ or $I^A i$	AB, A	O, A
B	$I^B I^B$ or $I^B i$	AB, B	O, B

1. Write the genotype for each person based on the description:

- Homozygous for the "B" allele
- Heterozygous for the "A" allele
- Type O
- Type "A" and had a type "O" parent
- Type "AB"
- Blood can be donated to anybody
- Can only get blood from a type "O" donor

Handwritten genotypes for the descriptions above:

- $I^B I^B$
- $I^A i$
- $ii$
- $I^A i$
- $I^A I^B$
- $ii$
- $ii$

2. Pretend that Brad Pitt is homozygous for the type B allele, and Angelina Jolie is type "O." What are all the possible blood types of their baby? (show your work)

Handwritten Punnett square for Brad Pitt ( $I^B I^B$ ) and Angelina Jolie ( $ii$ ):

	$I^B$	$I^B$
$i$	$I^B i$	$I^B i$
$i$	$I^B i$	$I^B i$

Result: Type B blood

3. Draw a Punnett square showing all the possible blood types for the offspring produced by a type "O" mother and an a Type "AB" father

Handwritten Punnett square for Type "O" mother ( $ii$ ) and Type "AB" father ( $I^A I^B$ ):

	$I^A$	$I^B$
$i$	$I^A i$	$I^B i$
$i$	$I^A i$	$I^B i$

Result: Type A or Type B blood

4. Mrs. Clink is type "A" and Mr. Clink is type "O." They have three children named Matthew, Mark, and Luke. Mark is type "O," Matthew is type "A," and Luke is type "AB." Based on this information:

- Mr. Clink must have the genotype  $ii$  because mark has blood type  $ii$  (O)
- Mrs. Clink must have the genotype  $I^A i$  because mark has blood type  $ii$  (O)
- Luke cannot be the child of these parents because neither parent has the allele B.

Handwritten pedigree chart for Mrs. Clink and Mr. Clink:

Mrs. Clink ( $I^A i$ ) is crossed with Mr. Clink ( $ii$ ).

Offspring:

- Matthew ( $I^A i$ )
- Mark ( $ii$ )
- Luke ( $I^A I^B$ )

5. Two parents think their baby was switched at the hospital. Its 1968, so DNA fingerprinting technology does not exist yet. The mother has blood type "O," the father has blood type "AB," and the baby has blood type "B."

- Mother's genotype:  $ii$
- Father's genotype:  $I^A I^B$
- Baby's genotype:  $I^B i$  or  $I^A I^A$
- Punnett square showing all possible genotypes for children produced by this couple
- Was the baby switched? **NO - blood type B ( $I^B i$ )**

	$i$	$i$
$I^A$	$I^A i$	$I^A i$
$I^B$	$I^B i$	$I^B i$

6. Two other parents think their baby was switched at the hospital. The mother has blood type "A," the father has blood type "B," and the baby has blood type "AB."

- Mother's genotype:  $I^A i$  or  $I^A I^A$
- Father's genotype:  $I^B i$  or  $I^B I^B$
- Baby's genotype:  $I^A I^B$
- Punnett square that shows the baby's genotype as a possibility:
- Was the baby switched? **NO -**

	$I^A$	$i$
$I^B$	$I^A I^B$	$I^B i$
$i$	$I^A i$	$ii$

7. Based on the information in this table, which man **could not** be the father of the baby? Justify your answer with a Punnett square.

Name	Blood Type
Mother	Type A
Baby	Type B
Sammy the player	Type O
George the sleeze	Type AB
The waiter	Type A
The cable guy	Type B

could be father

	$I^A$	$i$
$I^A$	$I^A I^A$	$I^A i$
$i$	$I^A i$	$ii$

mom + **Sammy**

	$I^A$	$i$
$I^B$	$I^A I^B$	$I^B i$
$i$	$I^A i$	$ii$

mom + **waiter**

can NOT be dad - needs to contribute  $I^B$  allele

8. Based on the information in this table, which man **could not** be the father of the baby? Justify your answer with a Punnett square.

Name	Blood Type
Mother	Type <del>A</del> AB
Baby	Type AB
Bartender	Type O
Guy at the club	Type AB
Cabdriver	Type A
Flight attendant	Type B

could be father

	$I^A$	$I^B$
$i$	$I^A i$	$I^B i$
$i$	$I^A i$	$I^B i$

mom + **bartender**

can NOT be dad - needs to give  $I^A$  or  $I^B$  allele

9. Explain why blood type data cannot prove who the father of a baby is, and can only prove who the father is not.

tons of people have each blood type -  
 can't prove who the father is not because  
 of results of punnett squares -- homo/heter / + or -  
 For RH factor

X-linked Traits

In fruit flies, eye color is a sex linked trait. Red ( $X^R$ ) is dominant to white ( $X^r$ ).

1. What are the sexes and eye colors of flies with the following genotypes:

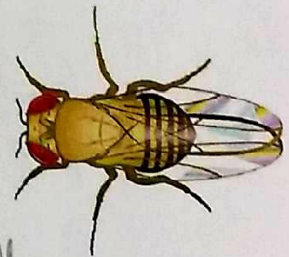
- a.  $X^R X^r$  female-red
- b.  $X^R Y$  male-red
- c.  $X^R X^R$  female-red
- d.  $X^r Y$  male-white

2. What are the genotypes of these flies:

- a. white eyed, male  $X^r Y$
- b. red eyed female (heterozygous)  $X^R X^r$
- c. white eyed, female  $X^r X^r$
- d. red eyed, male  $X^R Y$

3. Show the cross of a white eyed female  $X^r X^r$  with a red-eyed male  $X^R Y$ .

	$X^r$	$X^r$
$X^R$	$X^R X^r$	$X^R X^r$
$Y$	$X^r Y$	$X^r Y$



4. Show a cross between a pure red eyed female and a white eyed male.

- a. What are the genotypes of the parents  $X^R X^R$  &  $X^r Y$
- b. How many are white eyed, male 0%
- c. How many are white eyed, female 0%
- d. How many are red eyed, male 50%
- e. How many are red eyed, female 50%

	$X^R$	$X^R$
$X^r$	$X^R X^r$	$X^R X^r$
$Y$	$X^R Y$	$X^R Y$

5. Show the cross of a red eyed female (heterozygous) and a red eyed male.

- a. What are the genotypes of the parents?  $X^R X^r$  &  $X^R Y$

- b. How many are white eyed, male 25%
- c. How many are white eyed, female 0%
- d. How many are red eyed, male 25%
- e. How many are red eyed, female 50%

	$X^R$	$X^r$
$X^R$	$X^R X^R$	$X^R X^r$
$Y$	$X^R Y$	$X^r Y$

6. In humans, hemophilia is a sex linked trait. Females can be normal, carriers, or have the disease. Males will either have the disease or not (but they won't ever be carriers)

$X^H X^H$  = female, normal

$X^H Y$  = male, normal

$X^H X^h$  = female, carrier

$X^h Y$  = male, hemophiliac

$X^h X^h$  = female, hemophiliac

a. Show the cross of a man who has hemophilia with a woman who is a carrier.

	$X^h$	$Y$
$X^H$	$X^H X^h$	$X^H Y$
$X^h$	$X^h X^h$	$X^h Y$

b. What is the probability that their children will have the disease?

SOL

7. A woman who is a carrier marries a normal man. Show the cross.

	$X^H$	$X^h$
$X^H$	$X^H X^H$	$X^H X^h$
$X^h$	$X^H X^h$	$X^h X^h$
$Y$	$X^H Y$	$X^h Y$

a. What is the probability that their children will have hemophilia?

25%

b. What sex will a child in the family with hemophilia be?

male

8. A woman who has hemophilia marries a normal man.

a. How many of their children will have hemophilia, and what is their sex?

	$X^h$	$X^h$
$X^H$	$X^H X^h$	$X^H X^h$
$Y$	$X^h Y$	$X^h Y$

50% - males (only)

In cats, the gene for calico (multicolored) cats is codominant. Females that receive a B and an R gene have black and orange splotches on white coats. Males can only be black or orange, but never calico.

Here's what a calico female's genotype would look like.  $X^B X^R$

9. Show the cross of a female calico cat with a black male.

	$X^B$	$X^R$
$X^B$	$X^B X^B$	$X^B X^R$
$X^R$	$X^B X^R$	$X^R X^R$
$Y$	$X^B Y$	$X^R Y$

a. What percentage of the kittens will be black and male?

25%

b. What percentage of the kittens will be calico and male?

0%

can't ever get

c. What percentage of the kittens will be calico and female?

25%

10. Show the cross of a female black cat, with a male orange cat.

	$X^B$	$X^B$
$X^R$	$X^R X^B$	$X^R X^B$
$Y$	$X^R Y$	$X^B Y$

a. What percentage of the kittens will be calico and female?

50%

b. What color will all the male cats be?

black (phenotype)