

Name KEY Period _____

Simple Genetics Practice Problems

1. For each genotype, put a E in the blank if it is heterozygous or put an O in the blank if it is homozygous.

AA O
Bb E
Cc E
Dd E

Ee E
ff O
GG O
HH O

Ii E
Jj E
kk O
Ll E

Mm E
nn O
Oo O
Pp E

2. For each of the genotypes below, determine the phenotype.

Purple flowers are dominant to white

PP PURPLE
Pp PURPLE
pp WHITE

Brown eyes are dominant to blue

BB BROWN
Bb BROWN
bb BLUE

Round seeds are dominant to wrinkled

RR ROUND
Rr ROUND
rr WRINKLE

Bobtails are recessive to long tails

TT BOBTAILS
Tt BOBTAIL
tt LONG TAIL

3. For each phenotype, list the possible genotypes.

Straight hair is dominant to curly. Pointed heads are dominant to round heads.

TT Tt straight
tt curly

RR Rr pointed
rr round

4. Set up the square for each of the crosses listed below. The trait being studied is round seeds (dominant) and wrinkled seeds (recessive)

Rr x rr

	R	r
R	Rr	Rr
r	Rr	rr

What percentage of the offspring will be wrinkled? 50%

Rr x Rr

	R	r
R	RR	Rr
r	Rr	rr

What percentage of the offspring will be round? 75%

RR x Rr

	R	r
R	RR	Rr

What percentage of the offspring will be round? 100%

Practice with Crosses. Show all work!

5. A TT (tall) plant is crossed with a tt (short plant). Do the cross below and give the genotypic and phenotypic ratios.

	T
t	Tt

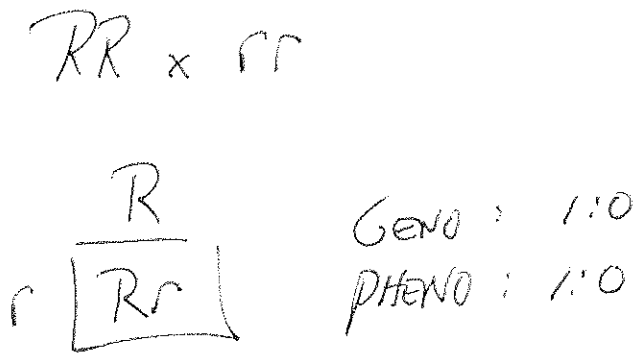
GENO 1:0
PHENO 1:0

6. A Tt plant is crossed with a Tt plant. Do the cross below and give the genotypic and phenotypic ratios.

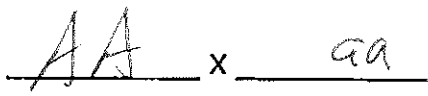
	T	t
T	TT	Tt
t	Tt	tt

GENO : 1:2:1
PHENO : 3:1

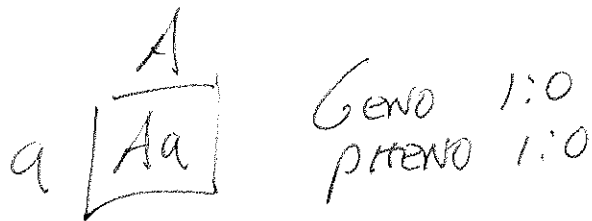
7. A heterozygous round seeded plant is crossed with a homozygous round seeded plant. Do the cross below and give the genotypic and phenotypic ratios.



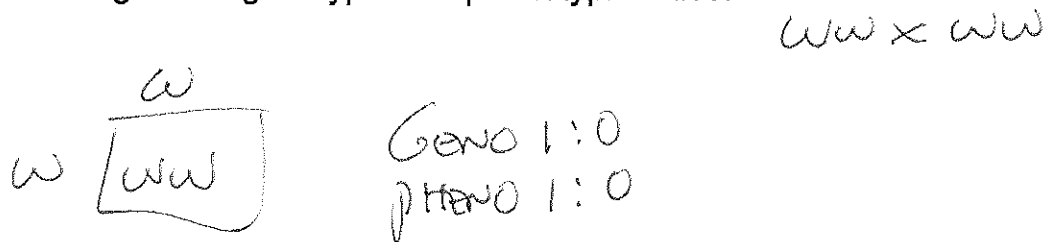
8. Plants homozygous for opposing traits are crossed. What are the genotypes of the parents?



Do the cross below and give the genotypic and phenotypic ratios.



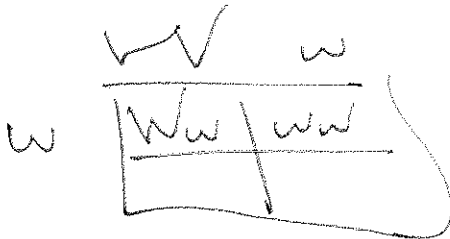
9. In pea plants purple flowers are dominant to white flowers. Cross two white flowered plants below and give the genotypic and phenotypic ratios.



10. A white flowered plant is crossed with heterozygous plant for the trait. What are the genotypes of the parents?

ww x VVw

Do the cross below and give the genotypic and phenotypic ratios.



Geno : 1:1
Pheno : 1:1

11. In guinea pigs, the allele for short hair is dominant to the allele for long hair.

What genotype would a heterozygous short haired guinea pig have? Ll

What genotype would a homozygous short haired guinea pig have? LL

What genotype would a long haired guinea pig have? ll

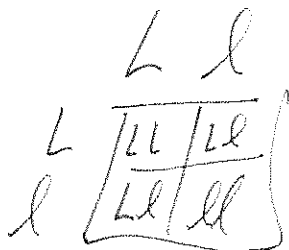
12. Do the cross for a homozygous short haired guinea pig and a long haired guinea pig below and give the genotypic and phenotypic ratios of the offspring.

LL x ll



Geno : 1:0
Pheno : 1:0

14. Do the cross for two heterozygous guinea pigs below and give the genotypic and phenotypic ratios of the offspring.



Geno : 1:2:1
Pheno : 3:1

Incomplete & Codominance Practice

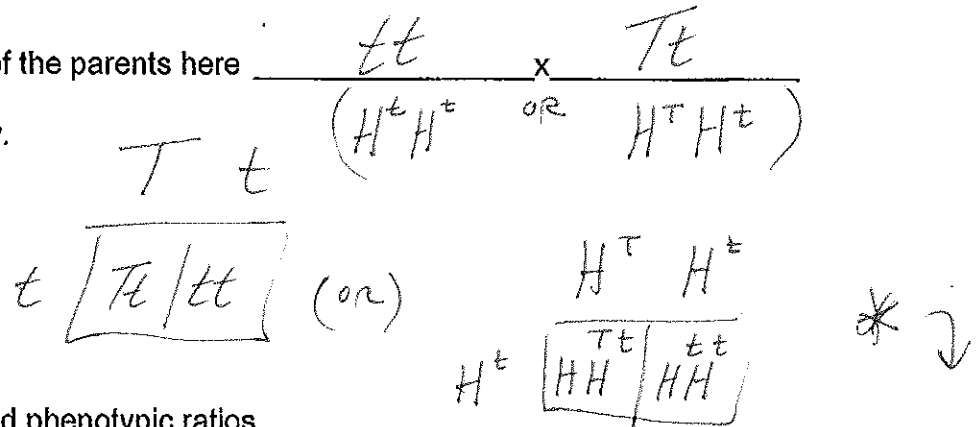
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In certain cats, tail length is determined by a gene that demonstrates incomplete dominance. The allele that causes a long tail (T) is not completely dominant over the allele that causes no tail (t). If a cat is heterozygous for this trait (Tt), then the cat will have a short tail.

1) Cross a cat with no tail with a short tailed cat.

a) Write the genotypes of the parents here $tt \times Tt$
 b) Show the cross below.

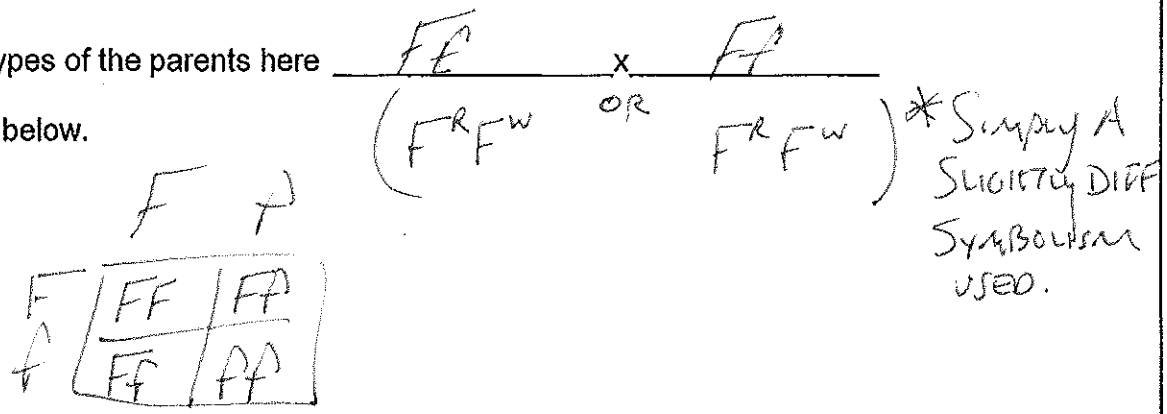


c) Give the genotypic and phenotypic ratios.
 \downarrow \downarrow
 1:1 1:1

Incomplete dominance is seen in snapdragons. The allele that causes red flowers (F) is not completely dominant over the allele that causes white flowers (f). When a plant is heterozygous for the trait of flower color (Ff), pink flowers result.

2) Cross two pink snapdragons.

a) Write the genotypes of the parents here $Ff \times Ff$
 b) Show the cross below.



c) Give the genotypic and phenotypic ratios.
 \downarrow \downarrow
 1:2:1 1:2:1

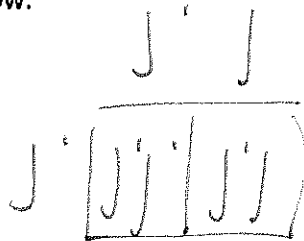
In a certain cactus, the spines can be two pronged (J) or one pronged (J'). If a homozygous one-pronged cactus is crossed with a homozygous two-pronged cactus, the offspring will have a mixture of spines. (That is they will have both one-pronged and two-pronged spines.)

3) What type of inheritance is being displayed? CO-DOMINANCE

4) Cross a cactus with only one pronged spines with a heterozygous cactus.

a) Write the genotypes of the parents here J'J' x J'J

b) Show the cross below.

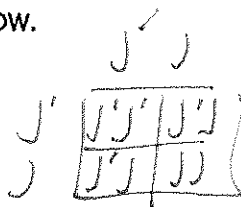


c) Give the genotypic and phenotypic ratios.

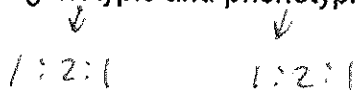


5) Cross two heterozygous cactus.

a) Show the cross below.



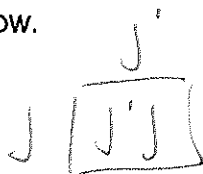
b) Give the genotypic and phenotypic ratios.



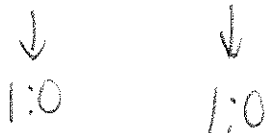
6) Cross two cactus homozygous for opposing traits.

J'J' x JJ

a) Show the cross below.



b) Give the genotypic and phenotypic ratios.

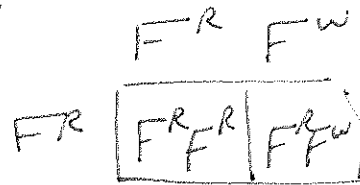


In this same cactus, if you cross a plant that has red flowers to one that has white flowers, you produce a plant that has pink flowers.

7) Cross a pink flowered cactus with a red flowered cactus.

a) Write the genotypes of the parents here $F^R F^W$ x $F^R F^R$

b) Show the cross below.



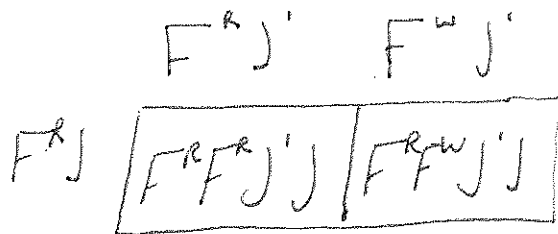
c) Give the genotypic and phenotypic ratios.

\downarrow \downarrow
 1:1 1:1

8) Cross a pink flowered one pronged cactus with a cactus with red flowers and two pronged spines.

a) Write the genotypes of the parents here $F^R F^W J' J'$ x $F^R F^R J J$

b) Show the cross below.



c) Give the phenotypes produced (and the number of each below).

50% RED / MIXED SPINES
 50% PINK / MIXED SPINES

9) Cross two cactus heterozygous for each trait.

a) Write the phenotype of the parents here $F^R F^w J^1 J$ x $F^R F^w J^1 J$

b) Show the cross below.

	$F^R J^1$	$F^R J$	$F^w J^1$	$F^w J$
$F^R J^1$	RRJ^1J^1	RRJ^1J	RWJ^1J^1	RWJ^1J
$F^R J$	RRJ^1J	$RRJJ$	RWJ^1J	$RWJJ$
$F^w J^1$	RWJ^1J^1	RWJ^1J	wwJ^1J^1	wwJ^1J
$F^w J$	RWJ^1J	$RWJJ$	wwJ^1J	$wwJJ$

c) Give the phenotypes produced (and the number of each below).

- RED / SPINE 1
- RED / MIXED SPINE 2
- RED / 2 SPINE 1
- WHITE / SPINE 1
- WHITE / MIXED SPINE 2
- WHITE / 2 SPINE 1
- PINK / SPINE 2
- PINK / MIXED 4
- PINK / 2 SPINE 2

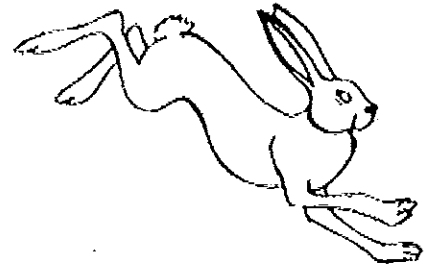
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Genetic Crosses that Involve 2 Traits

In rabbits, grey hair is dominant to white hair. Also in rabbits, black eyes are dominant to red eyes.

GG = gray hair
Gg = gray hair
gg = white hair

BB = black eyes
Bb = black eyes
bb = red eyes



1. What are the phenotypes (physical descriptions) of rabbits that have the following genotypes:

Ggbb GRAY HAIR RED EYES ggBB WHITE HAIR BLACK EYES
ggbb WHITE HAIR RED EYES GgBb GRAY HAIR BLACK EYES

2. A male rabbit with the genotype GGbb is crossed with a female rabbit with the genotype ggBb. The square is set up below. Fill it out and determine the phenotypes and proportions in the offspring.

	Gb	Gb	Gb	Gb							
gB	GgBb				NOT NEEDED... ALL THE SAME <table border="1" style="border-collapse: collapse; text-align: center; margin-left: auto;"> <tr><td></td><td>Gb</td></tr> <tr><td>gB</td><td>GgBb</td></tr> <tr><td>gb</td><td>Ggbb</td></tr> </table>		Gb	gB	GgBb	gb	Ggbb
	Gb										
gB	GgBb										
gb	Ggbb										
gB											
gb											
gb	Ggbb										

How many out of 16 have grey fur and black eyes? 50% (8) G_ B_

How many out of 16 have grey fur and red eyes? 50% (8) G_ bb

How many out of 16 have white fur and black eyes? 0 ggB_

How many out of 16 have white fur and red eyes? 0 ggbb

3. A male rabbit with the genotype GgBb is crossed with a female rabbit with the genotype GgBb. The square is set up below. Fill it out and determine the phenotypes and proportions in the offspring.

	GB	Gb	gB	gb
GB	GGBB	GGBb	GgBB	GgBb
Gb	GGBb	Ggbb	GgBb	Ggbb
gB	GgBB	GgBb	ggBB	ggBb
gb	GgBb	Ggbb	ggBb	ggbb

How many out of 16 have grey fur and black eyes? 9

How many out of 16 have grey fur and red eyes? 3

How many out of 16 have white fur and black eyes? 3

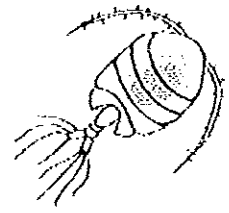
How many out of 16 have white fur and red eyes? 1

4. Show the cross between a ggBb and a GGBb. You'll have to set the square up yourself!

\rightarrow \leftarrow
 C C
 GB Gb

<u>gB</u>	GgBB	GgBb
<u>gb</u>	GgBb	Ggbb

5. An aquatic arthropod called a Cyclops has antennae that are either smooth or barbed. The allele for barbs is dominant. In the same organism, resistance to pesticides is a recessive trait. Make a "key" to show all the possible genotypes (and phenotypes) of this organism. Use the rabbit key to help you if you're lost.



B = BARBS.

b = SMOOTH.

R = NON RESISTANT

r = RESISTANCE

BB - BARB

Bb - BARB

bb - SMOOTH

RR - NOT RES.

Rr - NOT RES.

rr - RESISTANT

6. A Cyclops that is resistant to pesticides and has smooth antennae is crossed with one that is heterozygous for both traits. Show the genotypes of the parents. bbrr
x BbRr

8. Set up a punnet square for the cross and show the phenotypic ratio.

	BR	Br	bR	br
br	BbRr	Bbrr	bbRr	bbrr

1: 1: 1: 1
 BARBED / NOT RES. BARBED / RES.
 SMOOTH / NOT RES. SMOOTH / RES.

Multiple Allele – Blood Type Problems NAME _____
 Period _____

Blood type is controlled by 3 alleles: I^A , I^B , i .

I^A & I^B are co-dominant, while i is recessive to both I^A & I^B .

1. What are the possible genotypes of a person with type A blood? $I^A I^A$ or $I^A i$
2. What are the possible genotypes of a person with type B blood? $I^B I^B$ or $I^B i$
3. What is the genotype of a person with type AB blood? $I^A I^B$
4. What is the genotype of a person with type O blood? ii

5. Two individuals with type AB blood have a child. Show the cross below.

	I^A	I^B
I^A	AA	AB
I^B	AB	BB

- a. What is chance (%) that the child will have type A blood? 25% ($\frac{1}{4}$)
- b. What is chance (%) that the child will have type B blood? 25% ($\frac{1}{4}$)
- c. What is chance (%) that the child will have type AB blood? 50% ($\frac{1}{2}$)
- d. What is chance (%) that the child will have type O blood? 0%

6. A woman homozygous for type B blood has a child with a man that has type O blood. Do the cross below.

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

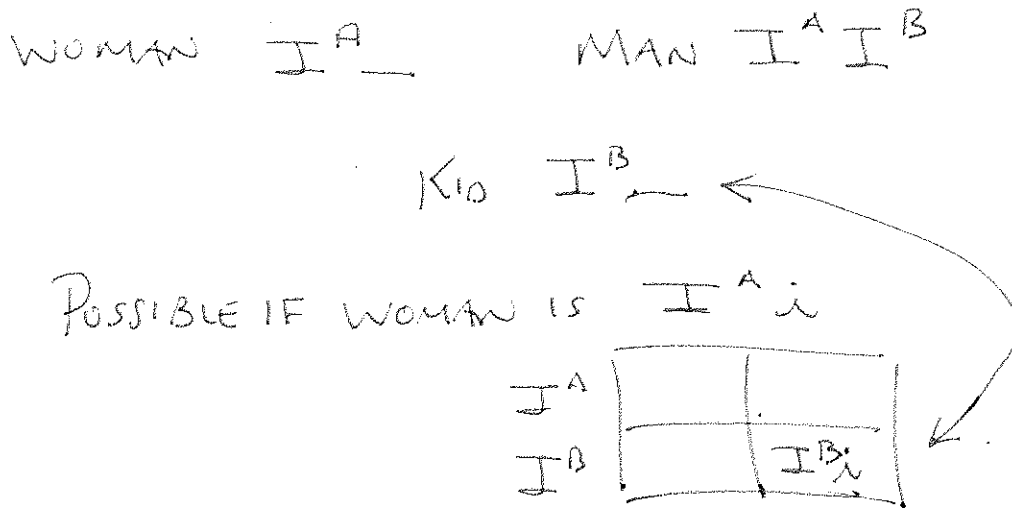
- a. What is the only genotype that can result? $I^B i$
- b. What is the only phenotype that can result? B type

7. Two individuals heterozygous for type A and type B blood have a child. Show the cross below.

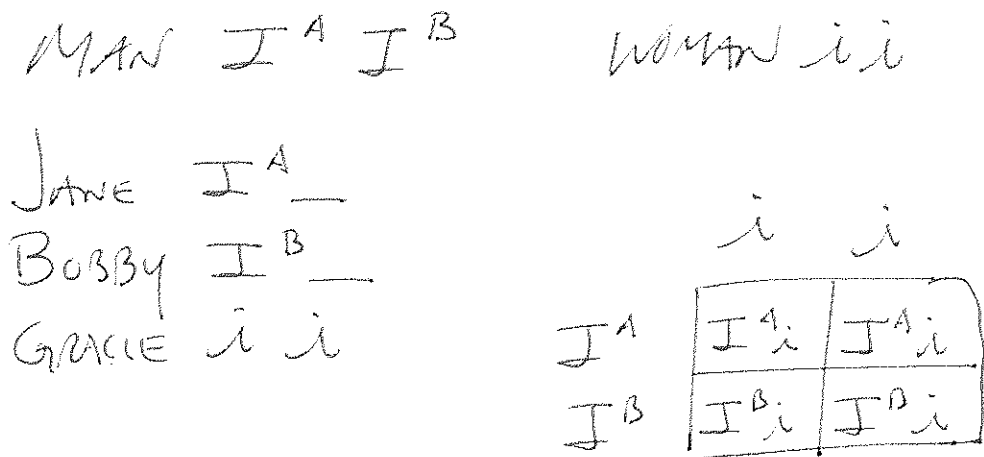
	$I^A i$	
I^B	AB	Bi
i	Ai	ii

- a. What is the genotype ratio of the offspring? 1:1:1:1
- b. What is the phenotype ratio of the offspring? 1:1:1:1

8. A woman with blood type A is claiming that a man with blood type AB is the father of her child that is blood type B. Explain, using Punnett Squares to help, if this man could be the father of the child.



9. A man with blood type AB is married to a woman with blood type O. They have two biological children and adopt a third child. Their children are named Jane (blood type A), Bobby (blood type B) and Gracie (blood type O). Explain, using Punnett Squares to help, which of the three children is adopted.



All Kids will Be Type A or B
 BUT O TYPE IS NOT POSSIBLE

THUS
 "GRACIE" IS ADOPTED.

Sex-linked (X) Genes Practice

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In fruit flies, eye color is a sex linked trait. Red is dominant to white.

1) What are the sexes and eye colors of flies with the following genotypes?

- a) $X^R X^r$ Red FEMALE c) $X^R Y$ Red MALE e) $X^r X^r$ White FEMALE
 b) $X^R X^R$ Red FEMALE d) $X^r Y$ White MALE

2) What are the genotypes of these flies:

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

3) Cross a white eyed female with a red-eyed male.

a) Write the genotypes of the parents here $X^r X^r$ x $X^R Y$

b) Show the cross below.

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

c) Give the genotypic and phenotypic ratios.

$1:1$ $1:1$
 GENO PHENO

4) Cross a homozygous red eyed female and a white eyed male.

a) Write the genotypes of the parents here $X^R X^R \times X^r Y$

b) Show the cross below.

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

c) Give the genotypic and phenotypic ratios.

GENO PHENO
 1:1 1:1

5) Show the cross of a heterozygote and a red eyed fly.

a) Write the genotypes of the parents here $X^R X^r \times X^R Y$

b) Show the cross below.

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

c) Give the genotypic and phenotypic ratios.

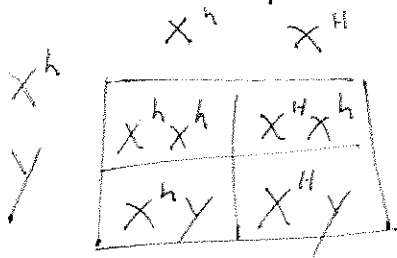
GENO PHENO
 1:1:1:1 2:1:1

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.

$X^H X^H$ = normal female
 $X^H X^h$ = carrier female
 $X^h X^h$ = hemophiliac female

$X^H Y$ = normal male
 $X^h Y$ = hemophiliac male

1) Cross a man who has hemophilia with a woman who is a carrier.

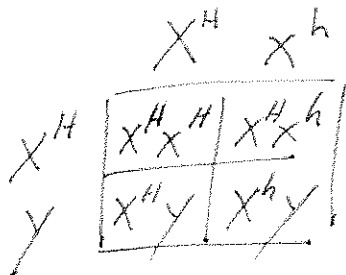


a) What is the probability that their children will have the disease?

50%

2) A woman who is a carrier marries a normal man.

a) Show the cross.



b) What is the probability that their children will have hemophilia?

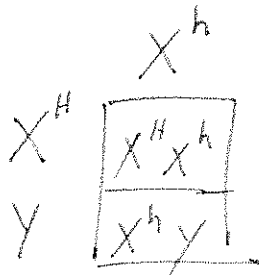
25%

c) What gender will a child with hemophilia be?

MALE

3) A woman who has hemophilia marries a normal man.

a) Show the cross.



b) Give the genotypic and phenotypic ratios.

↓
1:1

↓
1:1

In cats, the gene for calico (tortoiseshell) cats is codominant. Females that receive a **B** and an **O** gene have black and orange splotches on white coats. Males can only be black or orange.

1) Make a key like the one given for hemophilia for color in these cats.

$X^B X^B$ - BLACK FEMALE

$X^B X^O$ - TORTOISESHELL FEMALE

$X^O X^O$ - ORANGE FEMALE

$X^B Y$ - BLACK MALE

$X^O Y$ - ORANGE MALE

2) Cross a calico cat with a black cat.

a) Show the cross.

	X^B	X^O
X^B	$X^B X^B$	$X^B X^O$
X^O	$X^B X^O$	$X^O X^O$
Y	$X^B Y$	$X^O Y$

b) What percentage of the kittens will be black and male? 25%

c) What percentage of the kittens will be calico and male? 0%

d) What percentage of the kittens will be calico and female? 25%

3) Cross a female black cat with an orange cat.

a) Show the cross.

	X^B	X^B
X^O	$X^B X^O$	$X^B X^O$
Y	$X^B Y$	$X^O Y$

b) What percentage of the kittens will be calico and female? 50%

c) What color will all the male cats be? BLACK