Name: Key

Basic Genetics - Monohybrids & Dihybrids

1. A pea plant is the F1 offspring of a true-breeding plant with purple flowers and a true-breeding plant with white flowers. This plant is crossed with one that has white flowers (recessive). How many of the plants in the next generation will have white flowers?

P = purple
p = white
Pp x pp

	P	p
p	Pp	pp
p	Pp	pp

G:
½ Pp
½ pp

P:
½ purple
½ white

2. In humans, tongue rolling is a dominant trait, those with the recessive condition cannot roll their tongues. Bob can roll his tongue, but his mother could not. He is married to Sally, who cannot roll her tongue. What is the probability that their first born child will not be able to roll his tongue?

T = roller
t = nonroller

Bob Tt
Sally tt

	T	t
t	Tt	tt
t	Tt	tt

G:
½ Tt
½ tt

P:
½ roller
½ nonroller

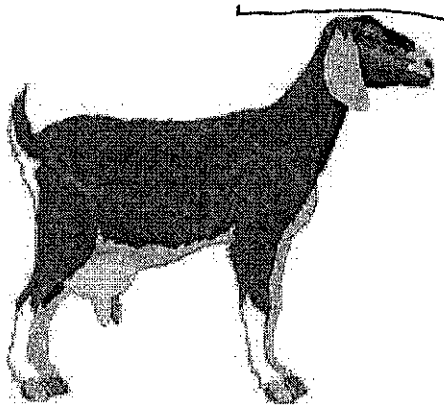
3. In goats, a recessive gene causes the goats to "faint" when they are startled. A farmer breeds two goats (that have never fainted) and their first offspring faints two days after its birth. What must the parent's genotypes have been? Show the cross that resulted in this offspring.

F = normal
f = faints

Ff x Ff

	F	f
F	FF	Ff
f	Ff	ff

← their baby goat



4. In guinnea pigs, short hair is dominant to long hair. Also in guinnea pigs, black eyes are dominant to red eyes. A male guinnea pig that is heterozygous for both traits is crossed with a female that is long haired and red eyed. What are the expected phenotypes of their offspring and in what proportion?

S = short
s = long
B = black
b = red

SsBb x ssbb

G
¼ SsBb
¼ Ssbb
¼ ssBb
¼ ssbb

	SB	Sb	sB	sb
sb	SsBb	Ssbb	ssBb	ssbb
sb				
sb				
sb				

P:
¼ short, black
¼ short, red
¼ long, black
¼ long, red

5. If both parents are heterozygous for both traits, what are the expected phenotypes of their offspring and in what proportion?

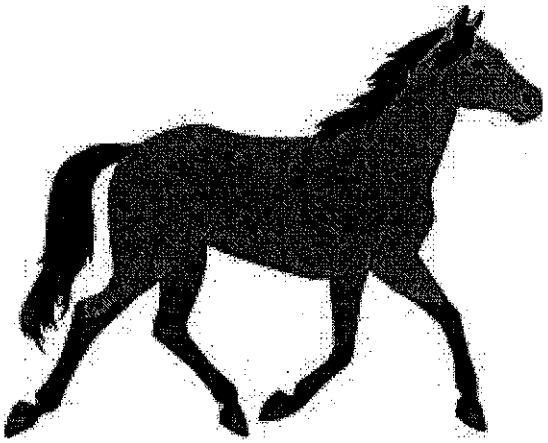
SsBb x SsBb

P: 9:3:3:1
9/16 Short, black
3/16 short, red
3/16 long, black
3/16 long, red

	SB	Sb	sB	sb
SB				
Sb				
sB				
sb				

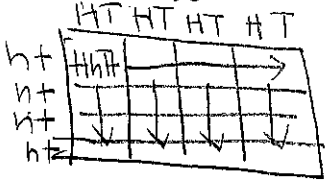
6. In horses, trotter (T) is dominant over pacer (t). Straight manes (H) are dominant over curly manes. (h)

Give the genotypes and phenotypes of all of the horses. Skip



7. A curly maned pacer horse is mated to one who is homozygous dominant for both traits. What would you expect their offspring to look like?

hhtt x HHTT



100% HhTt

100% trotter, straight

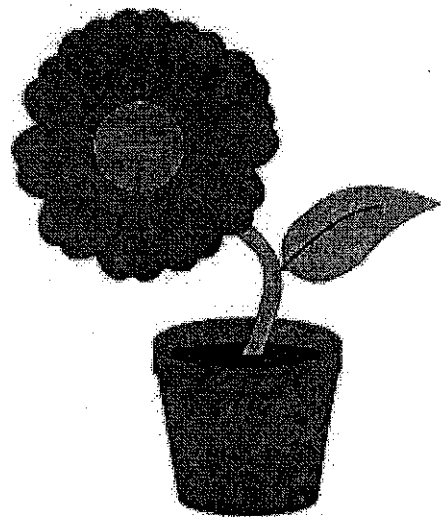
8. If you have two horses that are both heterozygous for both traits – trotting and mane. What ratio of the offspring would you expect to be curly maned and a pacer?

HhTt x HhTt (see #5 for how to set up a dihybrid cross punnett square).

P: 9:3:3:1

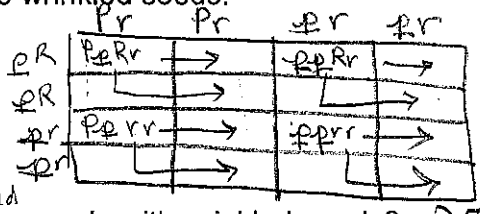
9/16 straight, trotter, 3/16 straight, pacer
3/16 curly trotter, 1/16 curly, pacer

9. In pea plants, purple flowers are dominant to white flowers.
Round seeds are dominant to wrinkled seeds.



P=purple
p=white
R=round
r=wrinkled

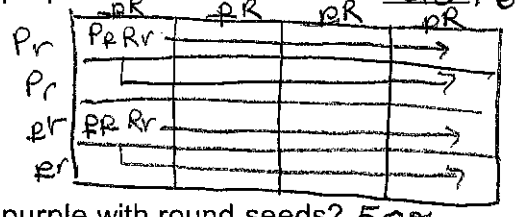
Pprr x ppRr



1/4 purple, round
1/4 purple, wrinkled
1/4 white, round
1/4 white, wrinkled

How many offspring are purple with wrinkled seeds? 25%

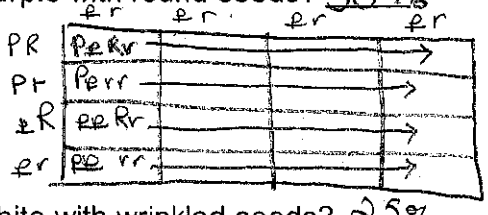
ppRR x Pprr



1/2 purple, round
1/2 white, round

How many offspring are purple with round seeds? 50%

pprr x PpRr



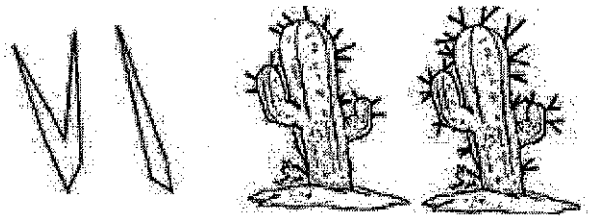
1/4 purple, round
1/4 purple, wrinkled
1/4 white, round
1/4 white, wrinkled

How many offspring are white with wrinkled seeds? 25%

Name: Key Date: _____

Beyond Mendel – Codominance, Multiple Alleles, and Polygenic Traits

1) In a certain cactus, prickly spines can be two pronged or one pronged. If a true breeding one-pronged cactus is crossed with a true breeding two-pronged cactus, the F1 generation has a mixture of spines, some are two-pronged, some are one-pronged.



a. Is this an example of codominance or incomplete dominance?

b. Show the F2 generation (a cross between the two F1's). What are the phenotypes of the offspring and in what proportion?

O = 1 prong
T = two prong
OT = some 1, some 2

OT x OT

	O	T
O	OO	OT
T	OT	TT

P
1/4 1-prong
1/2 some 1, some 2
1/4 2-prong

2. In this same cactus, if you cross a plant that has red flowers to one that has yellow flowers, you produce a plant that has orange flowers. Is this codominance or incomplete dominance? Show the cross of an orange flowered plant to a red flowered plant.

R = red
r = yellow
Rr = orange

	R	r
R	RR	Rr
R	RR	Rr

P
1/2 red
1/2 orange

3. A red flowered, two-pronged cactus is crossed with a yellow flowered one-pronged cactus. What are the resulting offspring and in what proportion?

RRTT x rrOO

	RT	RT	RT
rO	RrOT		
rO			
rO			
rO			

F1:
100% RrOT

P:
100% orange, some 1, some 2 prong.

4. Show the cross of a cactus that is heterozygous for both traits crossed with one that has red flowers and one-pronged spikes.

RrOT x RROO

	RO	RT	rO	rT
RO	RROO	RROT	RrOO	RrOT
RO				
RO				
RO				

1/4 red, 1-prong
1/4 red, some 1, some 2
1/4 orange, 1-prong
1/4 orange, some 1, some 2.

5. A man with type A blood is married to a woman with type O blood. What are ALL of the possible blood types of their children.

A = A blood
o = O blood
B = B blood

	o	o
A	Ao	Ao
o	Oo	oo

P:
1/2 A
1/2 O

6. A man with type AB blood is married to a woman with type O blood. What are all the possible blood types of their children?

AB x oo

	A	B
o	Ao	Bo
o	Ao	Bo

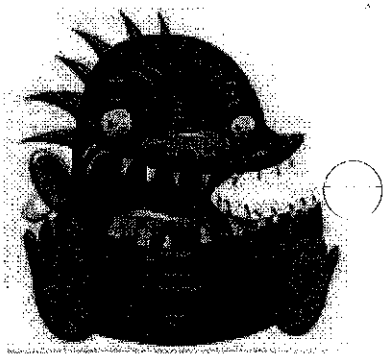
P:
1/2 A
1/2 B

7) A man with type A blood whose mother was type O is married to a woman with type AB blood. What are the blood types of their children and in what proportion?

Ao x AB

	A	B
A	AA	AB
o	Ao	Bo

1/2 A
1/4 AB
1/4 B



8. In Snarlymonsters, the number of teeth is polygenic. The recessive condition (aabbcc) results in a toothless Snarlymonster, and the dominant condition (AABBCC) results in a Snarlymonster with 6 teeth. There are 5 other possible variations.

How many teeth would a AaBbCc Snarlymonster have? 3
How many would a AABBcc Snarlymonster have? 4
How many would a aaBbcc Snarlymonster have? 1

9. List the phenotypic ratios (how many teeth) of all the potential offspring for the cross AABBCc x AAbbcc .

Skip

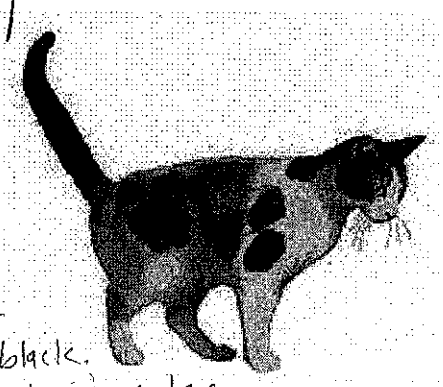
10. List the phenotypic ratios (how many teeth) of all the potential offspring for the cross aaBbCc x AAbbcc .

Skip

♀ = female
♂ = male

Name: Key

Practice Problems – Sex Linkage



1) Coat color in cats is a codominant trait and is also located on the X chromosome. Cats can be black, orange or calico. A calico cat has black and orange splotches. In order to be calico. the cat must have an allele for the black color and an allele for the orange color. Use a punnett square to show why there are no male calico cats.

X^B = black
X^O = orange
X^BX^O = calico

	X^B	Y
X^B	X^BX^B	X^BY
X^O	X^BX^O	X^OY

The cat needs 2 alleles: one for orange & one for black. They can't get that as males.

2. A female calico cat is crossed with a male black cat. What are the phenotypes of the offspring and in what proportion?

(See above)

P

¼ ♀ black
¼ ♀ calico
¼ ♂ black
¼ ♂ orange

3. Also located on the X chromosome of a cat is a gene that codes for deafness. This gene is recessive. A black female cat that is heterozygous for deafness (Dd) is crossed with a orange male cat that is not deaf. Show the cross. What are the phenotypes of the offspring and in what proportion? Hint: place two letters on the X chromosome in your cross. (You will need to use two superscript letters on your X chromosome)

X^D = normal
X^d = deaf

$X^{BD}X^{Bd} \times X^{OD}Y$

	X^{OD}	Y
X^{BD}	$X^{BD}X^{OD}$	$X^{BD}Y$
X^{Bd}	↓	$X^{Bd}Y$

½ ♀ calico, normal
¼ ♂ black, normal
¼ ♂ black, deaf

4. Eye color in fruit flies is sex linked, with the recessive allele causing white eyes. Show the cross for a white eyed female and a red-eyed male. How many offspring will have white eyes and what is their sex?

X^R = red
X^r = white

$X^rX^r \times X^RY$

	X^R	Y
X^r	X^RX^r	X^rY
X^r	X^RX^r	X^rY

½ ♀ red
½ ♂ white

5. In humans, colorblindness is sex linked and recessive. If a woman is a carrier for the trait, what is the chance that her sons will be colorblind? Her daughters? (Assume the father has normal vision.)

X^B = normal
X^b = colorblind

X^BX^b
X^BY

	X^B	Y
X^B	X^BX^B	X^BY
X^b	X^BX^b	X^bY

½ ♀ normal
¼ ♂ normal
¼ ♂ colorblind

0 ♀ colorblind

6. In humans, hemophilia is sex linked. If a woman is a carrier for the trait, what is the chance that her daughters will also be carriers. (assume father is normal)

X^H = normal
X^h = hemophilia

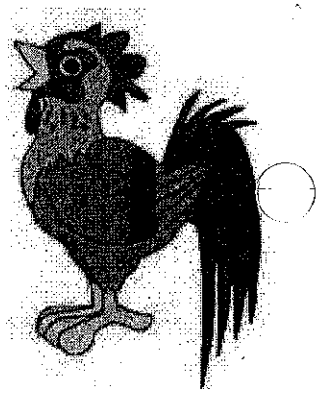
X^HX^h
X^HY

	X^H	Y
X^H	X^HX^H	X^HY
X^h	X^HX^h	X^hY

¼ ♀ Carrier (X^HX^h)

7. It is difficult to determine the sex of very young chickens, but it is easy to tell, by visual observation, whether the feathers are "barred." The barred pattern is inherited as a sex-linked dominant trait. This trait is used regularly by chicken breeders who receive orders for only male or female chicks, and must be able to deliver the appropriate sex of very young birds. Determine whether the male and female parents should

be taken from normal or barred true-breeding lines in order for the sex of all chicks to be determined at the time of hatching. Show the Punnett square for the mating you select, to confirm that the desired phenotypes result.



(Note: In birds, sex is determined as follows: XX = male, XO = female; only the X chromosome carries sex-linked genes.)

X^B = barred

X^b = not barred

male \ female	X^B	O
X^b	X^BX^b	X^bO
X^b	X^BX^b	X^bO

if male bird is not barred & female bird is barred, then all ♂ chickens will be barred and all ♀ will be not barred.