Bio 1 Revised Nov 2008 Name: KEY

Genetics Practice Problems Worksheet

1. For each genotype below, indicate whether it is heterozygous (**He**) or homozygous (**Ho**)

AA Ho	Ee He	Ii He	Mm He
Bb He	ff Ho	Jj He	nn Ho
Cc He	Gg He	kk Ho	oo Ho
DD Ho	HH Ho	LL Ho	Pp He

2. For each of the **genotypes** below determine what **phenotypes** would be possible.

   a. Purple flowers are dominant to white flowers.
   - PP purp
   - Pp purp
   - pp w

   b. Round seeds are dominant to wrinkled seeds.
   - RR round
   - Rr round
   - rr wrinkled

   c. Brown eyes are dominant to blue eyes
   - BB Brown
   - Bb Brown
   - bb blue

   d. Bobtails in cats are recessive.
   - TT Tail
   - Tt Tail
   - tt bob

3. For each phenotype below, list the **genotypes**

   a. Straight hair is dominant to curly.
   - SS straight
   - Ss straight
   - ss curly

   b. Pointed heads are dominant to round heads.
   - PP pointed
   - Pp pointed
   - pp round

Set up the Punnet squares for each of the crosses listed below.

Round seeds are dominant to wrinkled seeds.

4. Rr x rr
   a. What are the different kinds of gametes these parents can produce? R, r, r, r
   b. Make a punnett square

	r	r
R	Rr	Rr
r	rr	rr

   c. What percentage of the offspring will be round? 50%

5. RR x rr
   a. What are the different kinds of gametes these parents can produce? R, R, r, r
   b. Make a punnett square

	r	r
R	Rr	Rr
R	Rr	Rr

   c. What percentage of the offspring will be round? 100%

6. RR x Rr
   a. What are the different kinds of gametes these parents can produce? R, R, R, r
   b. Make a punnett square

	R	r
R	RR	Rr
R	RR	Rr

   c. What percentage of the offspring will be round? 100%

7. Rr x Rr
   a. What are the different kinds of gametes these parents can produce? R, r, R, r
   b. Make a punnett square

	R	r
R	RR	Rr
r	rR	rr

   c. What percentage of the offspring will be round? 75%

8. A TT (tall) plant is crossed with a tt (short plant).
   a. What are the different kinds of gametes these parents can produce? T, T, t, t
   b. Make a punnett square

	t	t
T	Tt	Tt
T	Tt	Tt

   c. What percentage of the offspring will be tall? 100%

9. A Tt plant is crossed with a Tt plant.
   a. What are the different kinds of gametes these parents can produce? T, t, T, t
   b. Make a punnett square

	T	t
T	TT	Tt
t	tT	tt

   c. What percentage of the offspring will be short? 25%

10. A heterozygous round seed plant (Rr) is crossed w/ a homozygous round seed plant (RR).

a. What are the different kinds of <u>gametes</u> these parents can produce? R, r, R, R
b. Make a punnett square

	R	R
R	RR	RR
r	rR	rR

c. What percentage of the offspring will be homozygous (RR)? 50%

11. A homozygous round seeded plant is crossed with a homozygous wrinkled seeded plant.

a. What are the genotypes of the parents? RR x rr
b. What are the different kinds of <u>gametes</u> these parents can produce? R, R, r, r
c. Make a punnett square

	r	r
R	Rr	Rr
R	Rr	Rr

d. What percentage of the offspring will also be homozygous? 100%

12. **In guinea pigs, the allele for short hair is dominant.**

a. What genotype would a heterozygous short haired guinea pig have? Ss
b. What genotype would a purebred short haired guinea pig have? SS
c. What genotype would a long haired guinea pig have? ss

13. Show the cross for a pure breeding short haired guinea pig and a long haired guinea pig.

ss X SS

	S	S
s	sS	sS
s	sS	sS

a. What percentage of the offspring will have short hair? 100%

14. Show the cross for two heterozygous guinea pigs.

a. What percentage of the offspring will have short hair? 75%

b. What percentage of the offspring will have long hair? 25%

	S	s
S	SS	Ss
s	sS	ss

15. Two short haired guinea pigs are mated several times. Out of 100 offspring, 25 of them have long hair. What are the probable genotypes of the parents? Show work!

Ss x Ss

	S	s
S	SS	Ss
s	Ss	ss

x 25

3/4 short

1/4 long

100 x .25 = 25/100

More <u>DIFFICULT</u> Punnett Squares (start these once we finish Chapter 12):

16. In horses, black color (B) dominates chestnut color (b). The trotting gait (T) dominates the pacing gait (t). A cross is made between a horse homozygous for black color and the pacing gait, and a horse homozygous for chestnut color and the trotting gait. What is the probability that an offspring will be a black trotter? **SHOW WORK FOR CREDIT!**

First Horse's Phenotype: Black/Pace Second Horse's Phenotype: chest/trot

First Horse's Genotype: BBtt Second Horse's Genotype: bbTT

Gametes: Bt, Bt, Bt, Bt Gametes: bT, bT, bT, bT

Punnett Square:

	bT
Bt	BbTt

17. In humans, the condition for normal blood clotting dominates the condition for non-clotting (hemophilia). These genes are **sex-linked**. If a male hemophiliac marries a woman who is a carrier for this trait, what are the chances that a <u>male child</u> will be normal for blood clotting? **SHOW WORK FOR CREDIT!**

Male Genotype: $X_h Y$ Female Genotype: $X_h X$

Gametes: X_h ; Y Gametes: X_h ; X

Punnett Square:

	X_h	X
X_h	$X_h X_h$	$X_h X$
Y	$X_h Y$	XY

18. In humans, normal color vision dominates red-green colorblindness. This is a sex-linked trait. Two parents produce daughters who are all carriers and sons who are all normal. What are the probable genotypes of the parents? **SHOW WORK FOR CREDIT!**

♂ - X_cY XX - ♀

	X	X
X_c	X_cX	X_cX
Y	XY	XY

19. Assume a male with type O blood mates with a female who has type A blood. The female's mother had type A blood and her father had type B. What is the probability that their first child will have type A blood? What is the probability that their third child will have type O blood? **SHOW WORK FOR CREDIT!** A - , B -

Male Genotype: OO Female Genotype: AO

Gametes: O, O Gametes: A, O

Punnett Square:

	A	O
O	AO	OO
O	AO	OO

50% OO

20. In humans, hair color is controlled by two interacting genes. The same pigment, melanin, is present in both brown-haired and blond-haired people, but brown hair has much more of it. Brown hair (B) is dominant to blond-hair (b). Whether any melanin can be synthesized depends on another gene. The dominant form (M) allows melanin synthesis; the recessive form (m) prevents melanin synthesis. Homozygous recessive (mm) are albino, regardless of whether they have brown or blonde alleles. What will be the expected proportions of phenotypes in the children of the following parents? **SHOW WORK FOR CREDIT, INCLUDING PUNNETT SQUARES!**

a. BBMM x BbMm

BM

	BM	Bm	bM	bm
BM	BBMM	BBMm	BbMM	BbMm
BM	BBMM	BBMm	BbMM	BbMm
BM	BBMM	BBMm	BbMM	BbMm
BM	BBMM	BBMm	BbMM	BbMm

16:0
Brown & pigmented

b. BbMm x BbMm

	BM	Bm	bM	bm
BM	BBMM	BBMm	BbMM	BbMm
Bm	BBMm	BBmm	BbMm	Bbmm
bM	BbMM	BbMm	bbMM	bbMm
bm	BbMm	Bbmm	bbMm	bbmm

9 brown/pig.
3 brown/albi
3 blonde/pig
1 blonde/alb

c. BbMm x bbmm

	bm	bm	bm	bm
BM	BbMm	BbMm	BbMm	BbMm
Bm	Bbmm	Bbmm	Bbmm	Bbmm
bM	bbMm	bbMm	bbMm	bbMm
bm	bbmm	bbmm	bbmm	bbmm

4 brown/pig: 4 brown/al
4 blonde/pig: 4 blon

21. In humans, one of the genes determining color vision is located on the X chromosome. The dominant form (C) produces normal color vision; red-green color blindness (c) is recessive. If a man with normal color vision marries a color-blind woman, what is the probability of their having a color-blind son? A color-blind daughter? **SHOW WORK!!**

$XY \times X_c X_c$

	X_c	X_c
X	XX_c	XX_c
Y	X_cY	X_cY

Prob. CB ♂ = 100.

Prob CB ♀ = 0%

22. In the couple described in the last problem, the woman gives birth to a color-blind but otherwise normal daughter. The husband sues for a divorce on the grounds of adultery. Will his case stand up in court? Explain. **SHOW WORK FOR CREDIT**

$X? \; Y \times X_c X_c$

	X_c	X_c
$X?$	X_cX_c	X_cX_c
Y	X_cY	X_cY

← color blind daughter

$X? = X_c$

ADULTERER!

This next problem contains a sex-linked trait and a non sex-linked trait. Pay attention!

23. In humans, brachydactylism is the result of a dominant allele. Individuals that suffer from this trait have very short fingers. Defective dentine is also the result of a dominant allele but it is carried on the X chromosome. The allele causes the teeth to wear down rapidly and usually only stubs remain by adolescence.
Assume a female who has brachydactylism and defective dentine (she is heterozygous for both traits) mates with a male who has normal fingers and teeth. **SHOW WORK!**

a. What is the genotype of the female? $Bb\ X_DX$

b. What is the genotype of the male? $bb\ XY$

c. What kind of gametes can the female produce? BX_D; BX; bX_D; bX

d. What kind of gametes can the male produce? bX; bY

e. What is the probability that a son from these parents will have both brachydactylism and defective dentine? **SHOW ALL WORK INCLUDING PUNNETT SQUARE!**

	.25 BX_D	.25 BX	.25 bX_D	.25 bX
.25 bX	BbX_DX	$BbXX$	bbX_DX	$bbXX$
.25 bX	BbX_DX	$BbXX$	bbX_DX	$bbXX$
.25 bY	BbX_DY	$BbXY$	bbX_DY	$bbXY$
.25 bY	BbX_DY	$BbXY$	bbX_DY	$bbXY$

$(BbX_DY)2$

$.25 \times .25 = 0.06$

$0.0625 \times 2 =$

0.125 probabi

f. What is the probability that a daughter will have both defects?

(same - because both dominant!)

0.125 probability