Name: _____ Date: _____ Block: _____

Genetics Packet ~ Punnett Square Practice KEY

Basics

1. The following pairs of letters represent alleles of different genotypes. Indicate which pairs are **Heterozygous** and which are **Homozygous**. Also indicate whether the homozygous pairs are **Dominant** or **Recessive** (*note **heterozygous** pairs don't need either dominant nor recessive labels.)

A. BB = __Homozygous dominant__

B. Bb = __Heterozygous__

C. Gg = __Heterozygous__

D. gg = _Homozygous recessive__

E. aa = _Homozygous recessive__

F. Ee = _Heterozygous_

2. In humans, brown eye color (B), is dominant over blue eye color (b). What are the **phenotypes** of the following genotypes?

A. Bb = __Brown eyes__

B. BB = __Brown eyes__

C. bb __blue eyes__

Monohybrid Crosses with Complete Dominance

3. A heterozygous smooth pea pod plant is crossed with a wrinkled pea pod plant. *There are two alleles for pea pod, smooth and wrinkled. Use R for seed texture.* **Predict the offspring from this cross.**

a. What is the genotype of the parents? _Rr x rr____

b. Set up a Punnett square with possible gametes.

	R	r
r	Rr	rr
r	Rr	rr

c. Fill in the Punnett square for the resultant offspring.

d. What is the predicted genotypic ratio for the offspring? ___1 Rr : 1 rr__

e. What is the predicted phenotypic ratio for the offspring? ___1 smooth : 1 wrinkled___

f. If this cross produced 50 seeds how many would you predict to have a wrinkled pod? __25__

4. In humans, achondroplasia "dwarfism" (D) is dominant over normal (d).
A homozygous dominant (DD) person dies before the age of one.
A heterozygous (Dd) person is dwarfed. A homozygous recessive individual is normal.
A heterozygous dwarf man marries a heterozygous dwarf woman…

	D	d
D	DD	Dd
d	Dd	dd

a.What is the probability of having a normal child? __1/3… 33.3%__
b.What is the probability that the next child will **also** be normal? __1/3… 33.3%__
each child is a new shot at the same punnett square!
c.What is the probability of having a child that is a dwarf? __2/3… 66.6%_____
d.What is the probability of having a child that dies at one from this disorder? __25%__

5. In humans, free earlobes (F) is dominant over attached earlobes (f). If one parent is homozygous dominant for free earlobes, while the other has attached earlobes, can they produce any children with attached earlobes?

No, the homozygous parent will give a dominant allele to each child keeping it from expressing the attached earlobe trait.

	F	F
r	Ff	Ff
r	Ff	Ff

6. In humans widow's peak (W) is dominant over straight hairline (w). A heterozygous man for this trait marries a woman who is also heterozygous.

	W	w
W	WW	Ww
w	Ww	ww

a. List possible genotypes of their offspring.
WW, Ww, and ww

b. List the phenotypic ratio for their children.
Widow's peak and straight hairline

Dihybrid Crosses

10. In pea plants, the round seed allele is dominant over the wrinkled seed allele, and the yellow seed allele is dominant over the green seed allele. The genes for seed texture and those for seed color are on different chromosomes. A plant heterozygous for seed texture and seed color is crossed with a plant that is wrinkled and heterozygous for seed color. **R = round, r = wrinkled, Y= yellow, y = green*

a. Construct a Punnett square (16 boxes) for this cross.

**** REMEMBER YOU MUST F.O.I.L. to find the possible gametes!!! ****

	RY	Ry	rY	ry
rY	RrYY	RrYy	rrYY	rrYy
ry	RrYy	Rryy	rrYy	rryy
rY	RrYY	RrYy	rrYY	rrYy
ry	RrYy	Rryy	rrYy	rryy

b. What are the possible phenotypes of the seedlings?
Round & Yellow
Wrinkled & Yellow
Round & Green
Wrinkled & Green

c. What is the **phenotypic** ratio of offspring would you expect?
6 Round & Yellow : 6 Wrinkled & Yellow : 2 Round & Green : 2 Wrinkled & Green

11. In humans there is a disease called Phenylketonuria (PKU), caused by a recessive allele that doesn't code for the enzyme that breaks down the amino acid phenylalanine. This disease can result in mental retardation or death. Let "**E**" represent the normal enzyme. Also in humans in a condition called galactose intolerance or galactosemia, which is also caused by a recessive allele. Let "**G**" represent the normal allele for galactose digestion. In both diseases, normal dominates over recessive.

a. Complete the Punnett Square for a cross between two adults were heterozygous for both traits (EeGg):

**** REMEMBER YOU MUST F.O.I.L. to find the possible gametes!!! ****

	EG	Eg	eG	eg
EG	EEGG	EEGg	EeGG	EeGg
Eg	EEGg	EEgg	EeGg	Eegg
eG	EeGG	EeGg	eeGG	eeGg
eg	EeGg	Eegg	eeGg	eegg

What are the chances of having a child that is completely normal? __9/16__

Has just PKU? __3/16__

Has just galactosemia? __3/16__

Has both diseases? __1/16__

Incomplete Dominance

12. Cross two pink Four o'clock flowers (incomplete dominance).

Use R = red, W = white.

a. Complete a Punnett square for this cross.

	R	W
R	RR	RW
W	RW	WW

b. What is the predicted genotypic ratio for the offspring?

1RR : 2RW : 1 WW

c. What is the predicted phenotypic ratio for the offspring?

1 Red : 2 Pink : 1 White

13. In humans straight hair (SS) and curly hair (CC) are incompletely dominant, that result in hybrids who have wavy hair (SC). Cross a curly hair female with a wavyh aired male.
a. Complete a Punnett square for this cross.

	C	C
C	CC	CC
S	CS	CS

b. What are the chances of having a curly haired child? _50%__
c. What genotype(s) would you need to produce a curly haired child? __CC with CS or CC with CC__

Codominance

14. A black chicken (BB) is crossed with a speckled chicken (BW). a. Show the Punnett square for the cross.

	B	B
B	BB	BB
W	BW	BW

b. What is the predicted genotypic ratio for offspring? ___1 BB : 1 BW____

c. What are the chances of having a white chick? __0%__

Codominance & Multiple Alleles

15. Human blood types:
a. What possible genotypes will produce B type blood? I^Bi (heterozygous) OR I^BI^B (homozygous dominant)
b. What possible genotypes will produce A type blood? I^Ai (heterozygous) OR I^AI^A (homozygous dominant)
c. What is the only genotype that will produce O type of blood? ii
d. What is the only genotype that will produce AB type of blood? I^AI^B

16. You are blood type O and you marry a person with blood type AB.
a. Complete a Punnett square for this cross.

b. List the possible blood types (phenotypes) of your offspring.
Type A or Type B

	i	i
I^A	I^Ai	I^Ai
I^B	I^Bi	I^Bi

17. 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 (AO) and her son had type O blood (OO).
a. Complete a Punnett square for the possible cross of Charlie and the mother.

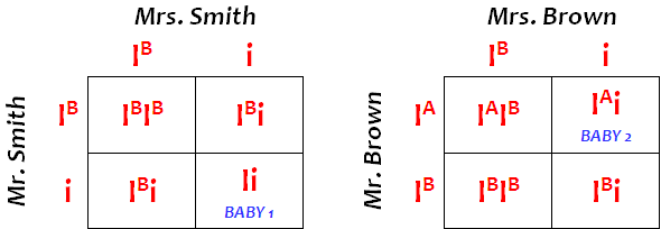
	I^A	I^B
I^A	I^AI^A	I^AI^B
i	I^Ai	I^Bi

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.*
The judge was wrong!!
There is NO way Charlie Chaplin fathered the child in question because he doesn't have a recessive (i) allele to contribute to the child to make the child have type O blood.

18. Suppose two newborn babies were accidentally mixed up in the hospital. In an effort to determine the parents of each baby, the blood types of the babies and the parents were determined.

Baby 1 had type O, Mrs. Brown had type B, Mrs. Smith had type B, Baby 2 had type A, Mr. Brown had type AB, and Mr. Smith had type B.

a. Draw Punnett squares for each couple (you may need to do more than 1 square/ couple)
Baby 2 MUST belong to the Browns because Mr. Brown is the only parent with an A allele to contribute… then the rest works out as follows:



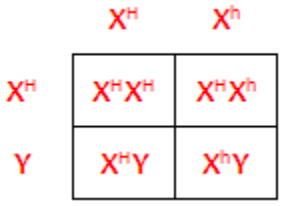
b. To which parents does baby #1 belong? Why? *Hint you may want to refer to your Punnett squares.*
Baby 1 must belong to the Smiths, because they are the only ones with the possibility of EACH having a recessive allele to pass down to the baby, Mr. Brown has type AB blood and therefore only has the dominant A and dominant B alleles – no recessive allele possible.

Sex-Linked Traits

19. Hemophilia is a sex-linked trait. A person with hemophilia is lacking certain proteins that are necessary for normal blood clotting. Hemophilia is caused by a recessive allele so use "N" for normal and "n" for hemophilia. Since hemophilia is sex- linked, remember a woman will have two alleles (NN or Nn or nn) but a man will have only one allele (N or n). A woman who is heterozygous (a carrier) for hemophilia marries a normal man:

a. What are the genotypes of the parents? X^HX^h x X^HY_____

b. Make a Punnett square for the above cross.



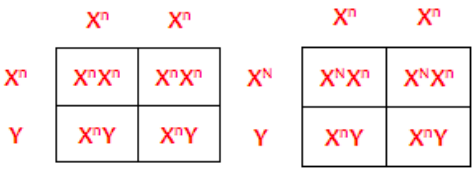
c. What is the probability that a male offspring will have hemophilia? 50%

d. What is the probability of having a hemophiliac female offspring? 0%

20. Can a color blind female have a son that has normal vision?

Color blindness is caused by a sex-linked recessive allele.

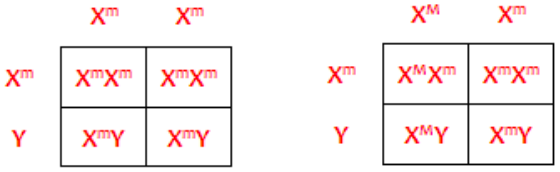
Do the Punnett square. ***use N = normal vision and n = color blind***



NO, if the mother has an affected X for colorblindness, she will pass that X chromosome on to her son, the son will receive a Y from his father so the only place he gets an X is from mom and that X will be affected if she is colorblind.

21. Muscular dystrophy is a sex-linked trait.

What **parental genotypes** could produce a female with muscular dystrophy? Do the Punnett square. ***use M = normal muscles, and m = muscles missing dystrophin protein***



Mom has to have at least one recessive allele and dad must HAVE muscular dystrophy (and therefore one recessive allele)