Name: _____

Mendel and Inheritance: The Study Guide

1. Define the following terms:

Genotype – is the genetic makeup of a trait, usually consisting of only 2 genes (Example LL, Ll, or ll).

Phenotype – is the physical characteristic of the trait (Example brown hair, blue eyes).

Dominant – is the allele that determines the phenotype in a heterozygous individual

Recessive – is not expressed in a heterozygous individual and is only expressed when an individual possesses 2 recessive allele or gene

Homozygous – pair of identical alleles (PP, pp)

Heterozygous – two different alleles (Pp)

Polygenic trait – 1 trait is determined by more than 2 genes (Example skin color is a result of gene A, gene B, and gene C).

Codominance – both alleles for a trait is dominant. This will result in the 2 phenotypes being expressed separately, but together on the individual (Example: horse coats, C^RC^R = red horses, C^WC^W = white horses, C^RC^W = roan horse (has white hair and red hair all over).

Incomplete Dominance – neither allele for a trait is dominant. This will result in the 2 phenotypes blending together in a heterozygous genotype (Example: snapdragons RR = red flowers, rr = white flowers, Rr = pink flowers (the blend of white and red).

Law of Segregation – **DO NOT NEED TO KNOW**

Linked Genes – **DO NOT NEED TO KNOW**

Pleitropy – 1 gene determines many different traits (Example: sickle cell anemia).

Hermaphrodite – **DO NOT NEED TO KNOW**

Monoecious – **DO NOT NEED TO KNOW**

Test cross – **DO NOT NEED TO KNOW**

Epistasis – 1 gene will change the expression of a different gene's phenotype (Example Labrador retriever's coat).

2. What would be the phenotypic and genotypic ratios for the following crosses?
a) Tt x Tt b) Tt x tt c) TT x tt d) Tt x TT

(A)

	T	t
T	TT	Tt
t	Tt	tt

GR = 1:2:1
PR = 3:1

(B)

	T	t
t	Tt	tt
t	Tt	tt

GR = 0:2:2
PR = 2:2

(C)

	T	T
t	Tt	Tt
t	Tt	Tt

GR = 0:4:0
PR = 4:0

(D)

	T	t
T	TT	Tt
T	TT	Tt

GR = 2:2:0
PR = 4:0

3. Blonde hair is dominant over brown hair. Give the phenotypic and genotypic ratios produced if the father, who is heterozygous for blonde hair, marries a woman who has brown hair, and they have children.

	B	b
b	Bb	bb
b	Bb	bb

GR = 0:2:2
PR = 2:2

4. Normal pigmentation is dominant over albinism.
A) A normally pigmented man marries an albino woman. Their first child is an albino. What are the genotypes of these three people?

Aa x aa

	A	a
a	Aa	aa
a	Aa	aa

B) If this couple has more children, what would they probably be like?

50% chance of normal pigment
50% chance albino

C) An albino man marries a normally pigmented woman. They have 9 children, all normally pigmented. What are the genotypes of the parents and the children?

aa x AA

	a	a
A	Aa	Aa
A	Aa	Aa

5. Having unattached earlobes is dominant over having attached earlobes. The mother and father both have unattached earlobes, but their daughter has attached. What must be the parents' genotype?

Aa x Aa

	A	a
A	AA	Aa
a	Aa	aa

6. In rabbits, white is dominant over brown hair. The Easter bunny is homozygous for white hair and is crossed with a heterozygous white rabbit. What is the probability (percent) that their offspring would have white hair?

	B	B
B	BB	BB
b	Bb	Bb

100% chance of white.

7. Same trait as in #6. If I want to get only white rabbits, what are three possible combinations of parental genotypes could I use to get those results?

① BB x BB

② BB x bb

③ BB x Bb

8. A recessive gene causes albinism in humans. If normal parents have an albino child, what is the probability that their next child will be normal?

75% next child will be normal

	A	a
A	AA	Aa
a	Aa	aa

9. In dragons, having a horn is dominant over one that doesn't. What would be the parental genotypes if after the cross I had 78 dragons with horns and 22 without horns?

Hh x Hh

~75% ~25%

	H	h
H	HH	Hh
h	Hh	hh

10. A brown mouse is repeatedly mated with a white mouse and all their offspring are brown. How could I determine the genotype of a brown mouse? How would this show me whether the mouse is homozygous or heterozygous?

all brown ← homozygous

50% white 50% brown ← heterozygous

If Brown is dominant & white is recessive than crossing the brown mouse with a heterozygous white mouse will show results

	B	B
b	Bb	Bb
b	Bb	Bb

or

	B	b
b	Bb	bb
b	Bb	bb

11. Having freckles is dominant over not having freckles. Tim and Jan both have freckles, but their son Michael does not. If Tim and Jan have **2** more children, what is the probability that **both** would have freckles?

Probability of freckles = $\frac{3}{4}$

	F	f
F	FF	Ff
f	Ff	ff

So... $\frac{3}{4} \times \frac{3}{4} = \frac{9}{16}$ probability of BOTH.

12. A husband and wife have 9 girls. If they want to have one more child, what would the probability be that their child would be a boy?

50%

	X	X
X	XX	XX
Y	XY	XY

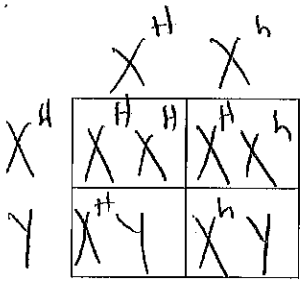
13. A recessive, sex-linked gene causes color blindness. Greg is color blind and Denise carries the gene for color blindness. What is the chance that Tom (a boy) will be colorblind?

X^bY

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

50%

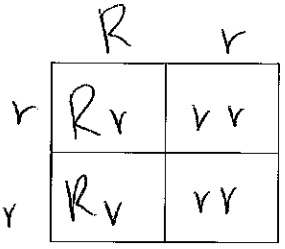
14. A couple are both phenotypically normal, but their son suffers from hemophilia, a sex-linked recessive disorder. (A) What fraction of their children are likely to suffer from hemophilia? (B) What fraction are likely to be carriers?



(A.) 25% or $\frac{1}{4}$

(B) 25% or $\frac{1}{4}$

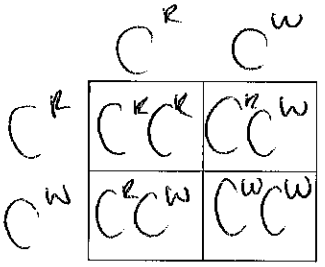
15. In snapdragons, red and white flower color is an example of **incomplete dominance**. How many would I get of each phenotype if I crossed a plant with pink (a blending of red and white) flowers and a plant with white flowers?



50% pink

50% white

16. In horses, red and white hair color are both dominant (**codominant**). What would be my chance of getting a red horse if I crossed two roan horses (red and white hair?

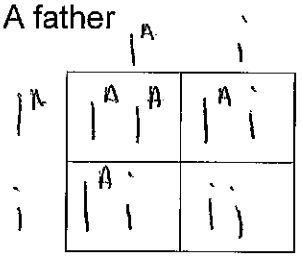


25%

17. What are the possible blood types of children in the following families?

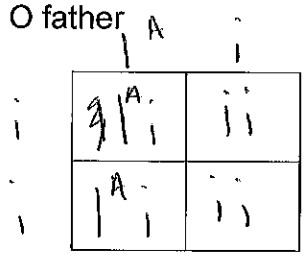
A) Type A mother, Type A father

A or O



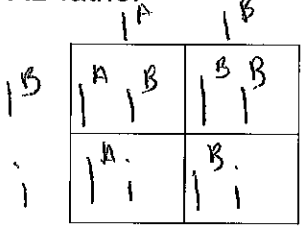
B) Type A mother, Type O father

A or O

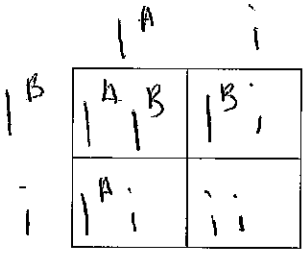


C) Type B mother, Type AB father

AB, B, A



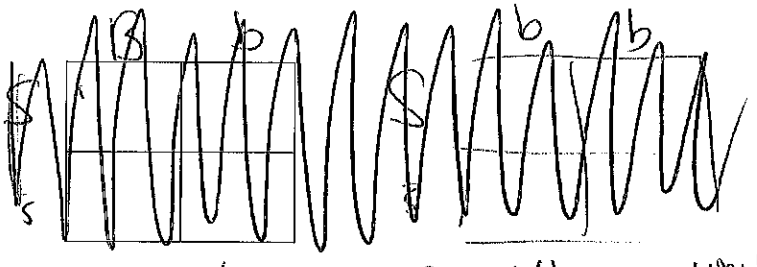
18. If a male is heterozygous for Type A blood and a female is heterozygous for type B blood, what possible blood types would the children have and what is the percent of each?



AB B A O

25% 25% 25% 25%

19. In rabbits, black hair (B) is dominant over white hair and short hair (S) is dominant over long hair. If a heterozygous black short-haired rabbit is crossed with a white short haired rabbit (bbSs), how many of each phenotype would you expect?



	B	b
b	Bb	bb
b	Bb	bb

	S	s
S	SS	Ss
s	Ss	ss

Black/Short $\frac{2}{4} \times \frac{3}{4} = \frac{6}{16}$

Black/long $\frac{2}{4} \times \frac{1}{4} = \frac{2}{16}$

white/short $\frac{2}{4} \times \frac{3}{4} = \frac{6}{16}$

white/long $\frac{2}{4} \times \frac{1}{4} = \frac{2}{16}$

20. Incomplete dominance is seen in the inheritance of hypercholesterolemia. Mack and Toni are both heterozygous for this characteristic and have elevated levels of cholesterol. Their daughter Zoe has a cholesterol level six times normal (she is homozygous *hh*). (A) What fraction of Mack and Toni's children are likely to have elevated but not extreme levels of cholesterol, like their parents? (B) If Mack and Toni have one more child, what is the probability that the child would suffer from the more serious form of hypercholesterolemia see in Zoe?

	H	h
H	HH	Hh
h	Hh	hh

(A) 50%

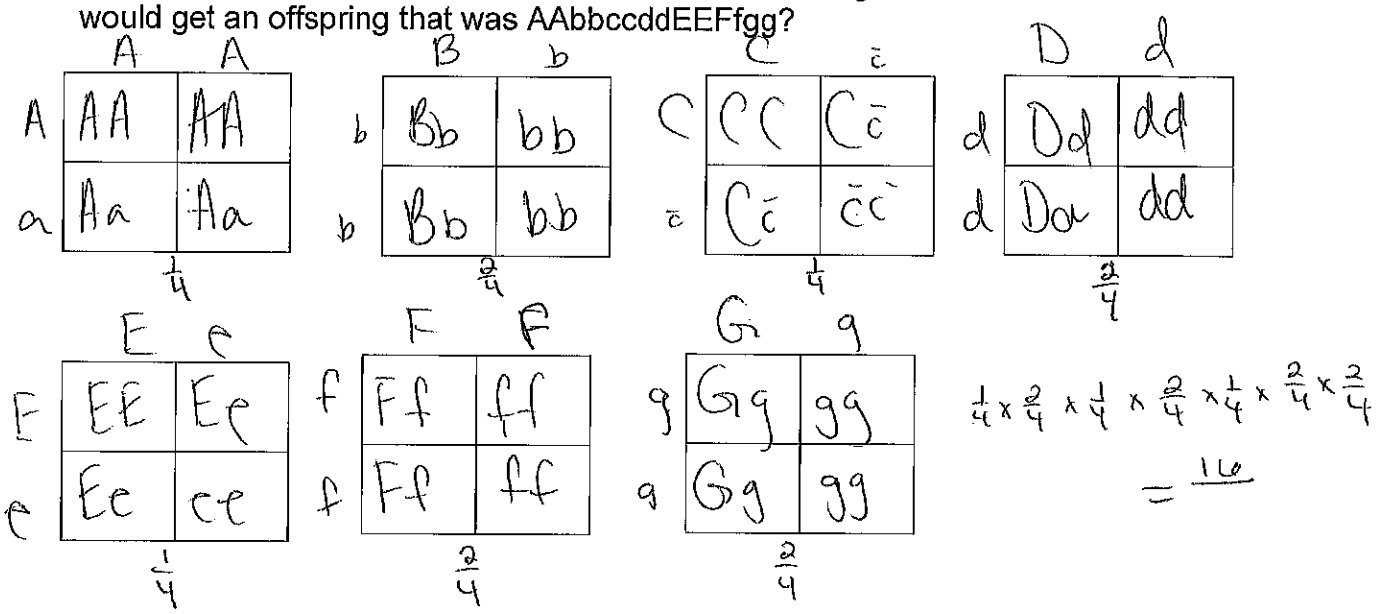
(B) 25%

21. In pea plants, the genes for flower color and the genes for pollen shape are on the same chromosome. In a pea plant that is PpLl, P is linked to l and p is linked to L. Show how this pea plant could produce gametes containing four different combinations of alleles. Label which are the parental-type gametes and which are the recombinant gametes.

$P\bar{p}L\,Lx\,P\bar{p}Ll$

	PL	Pl	$\bar{p}L$	$\bar{p}l$
PL	PPLL	PPLl	$P\bar{p}LL$	$P\bar{p}Ll$
Pl	PPLl	PPll	$P\bar{p}Ll$	$P\bar{p}ll$
$\bar{p}L$	$P\bar{p}LL$	$P\bar{p}Ll$	$\bar{p}\bar{p}LL$	$\bar{p}\bar{p}Ll$
$\bar{p}l$	$P\bar{p}Ll$	$P\bar{p}ll$	$\bar{p}\bar{p}Ll$	$\bar{p}\bar{p}ll$

22. If I cross AABbCcddEeFFGg and AabbCcDdEeffGg, what is the chance that I would get an offspring that was AAbbccddEEFfgg?



23. A fruit fly with a gray body and red eyes (BbPp) is mated with a fly having a black body and purple eyes (bbpp). What offspring, in what proportions would you expect if the body color and eye color are on different chromosomes?

DO NOT NEED TO COMPLETE

24. When this experiment was done, most of the 1,507 offspring looked like the parents but 60 had a gray body and purple eyes and 45 had a black body and red eyes. What is the recombination frequency?

DO NOT NEED TO COMPLETE

25. Use the below recombination frequencies for five different linked genes to construct a gene map.

Genes	Recombination freq (%)	Genes	Recombination freq (%)	Genes	Recombination freq (%)	Genes	Recombination freq (%)
A-B	10	B-C	10	C-D	18	D-E	23
A-C	20	B-D	8	C-E	5	D-F	17
A-D	2	B-E	15	C-F	35		
A-E	25	B-F	25				
A-F	15						

Do Not need to Know