Name _____ **Period** _____

AP Biology **Date** _____

GENETICS PRACTICE 2: BEYOND THE BASICS

Solve these genetics problems. Be sure to complete the Punnett square to show how you derived your solution.

INCOMPLETE DOMINANCE

1. In radishes, the gene that controls color exhibits incomplete dominance. Pure-breeding red radishes crossed with pure-breeding white radishes make purple radishes. What are the genotypic and phenotypic ratios when you cross a purple radish with a white radish?

	R	W
W	RW	WW
W	RW	WW

50% purple (RW)

50% white (WW)

2. Certain breeds of cattle show incomplete dominance in coat color. When pure breeding red cows are bred with pure breeding white cows, the offspring are roan (a pinkish coat color). Summarize the genotypes & phenotypes of the possible offspring when a roan cow is mated with a roan bull

	R	W
R	RR	RW
W	RW	WW

25% red (RR)

50% roan (RW)

25% white (WW)

CO-DOMINANCE

3. A man with type AB blood marries a woman with type B blood. Her mother has type O blood. List the expected phenotype & genotype frequencies of their children.

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

25% type AB blood (I^AI^B)

50% type B blood (I^BI^B& I^Bi)

25% type A blood (I^Ai)

4. The father of a child has type AB blood. The mother has type A. Which blood types can their children NOT have?

$I^A\_$ x I^AI^B = no O

5. A woman with type A blood and a man with type B blood could potentially have offspring with what blood types?

$I^A\_$ x $I^B\_$ = AB, A, B, O

6. The mother has type A blood. Her husband has type B blood. Their child has type O blood. The father claims the child can't be his. Is he right?

No*!* $I^A\_$ x $I^B\_$ = AB, A, B, O

7. The mother has type B blood. Her husband has type AB blood. Their child has type O blood. The father claims the child can't be his. Is he right?

Yes*!* $I^B\_$ x I^AI^B = AB, A, B

8. The mother has type AB blood. The father has type B blood. His mother has type O blood. What are all the possibilities of blood type for their children?

$I^A\ I^B$ x I^Bi = AB, A, B

LETHAL DOMINANT

9. Achondroplasia (dwarfism) is caused by a dominant gene. A woman and a man both with dwarfism marry. If homozygous achondroplasia results in death of embryos, list the genotypes and phenotypes of all potential live-birth offspring

	A	a
A	AA	Aa
a	Aa	aa

50% dwarfism (Aa)

25% normal (aa)

What is the expected ratio of dwarfism to normal offspring?

67% dwarfism : 33% normal

SEX-LINKED

10. The genes for hemophilia are located on the X chromosome. It is a recessive disorder. List the possible genotypes and phenotypes of the children from a man normal for blood clotting and a woman who is a carrier. (HINT: You have to keep track of what sex the children are!)

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

50% females normal

50% females carrier

50% males normal

50% males hemophilia

EXTRA CREDIT: Remember those roan cows from question 2? They also have a second gene for horn vs. hornless cattle. The allele for horns dominates the allele for hornless. If a bull and cow are heterozygous for both genes, what are the probabilities for each possible phenotype?

Solving it the short (probability) way:

	R	r
R	RR	Rr
r	Rr	rr

	H	h
H	HH	Hh
h	Hh	hh

Red, horn → RR x H_ = ¼ x ¾ = 3/16
Roan, horn → Rr x H_ = 2/4 x ¾ = 6/16
} **Usually your 9/16 if red showed simple dominance to white**

Red, no horn → RR x hh = ¼ x ¼ = 1/16
Roan, no horn → Rr x hh = 2/4 x ¼ = 2/16
} **Usually your 3/16 if red showed simple dominance to white**

White, horn → rr x H_ = ¼ x ¾ = 3/16
White, no horn → rr x hh = ¼ x ¼ = 1/16

Solving it the long way:

	RH	Rh	rH	rh
RH	RRHH red, horn	RRHh red, horn	RrHh roan, horn	RrHh roan, horn
Rh	RRHh red, horn	RRhh red, no horn	RrHh roan, horn	Rrhh roan, no horn
rH	RrHH roan, horn	RrHh roan, horn	rrHH white, horn	rrHh white, horn
rh	RrHh roan, horn	Rrhh roan, no horn	rrHh white, horn	rrhh white, no horn

RRH_
red, horn: 3/16

RRhh
red, no horn: 1/16

rrH_
white, horn: 3/16

RrH_
roan, horn: 6/16

Rrhh
roan, no horn: 2/16

rrhh
white, no horn: 1/16