Name: KEY Date: _____

Genetics Practice 3: Advanced Mendelian Genetics

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?

	C^R	C^W
C^W	C^RC^W	C^WC^W
C^W	C^RC^W	C^WC^W

50% purple, 50% white (1:1) PHENOTYPE

50% C^RC^W, 50% C^WC^W (1:1) GENOTYPE

Codominance

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

	C^R	C^W
C^R	C^RC^R	C^RC^W
C^W	C^RC^W	C^WC^W

25% red, 50% roan, 25% white (1:2:1) PHENOTYPE

25% C^RC^R, 50% C^RC^W, 25% C^WC^W (1:2:1) GENOTYPE

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

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

25% AB, 25% A, 50% B PHENOTYPE

25% I^AI^B 25% I^Ai, 25% I^BI^B, 25% I^Bi GENOTYPE

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

O, AB

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

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: ($I^Ai \times I^Bi$)

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.

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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?

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. What is the expected ratio of dwarfism to normal offspring?

	A	a
A	~~AA~~	Aa
a	Aa	aa

2:1 Dwarfism : Normal Aa : aa

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

2 normal ♀ (1 carrier), 1 normal ♂, 1 hemo. ♂ PHENOTYPE

X^HX^H, X^HX^h, X^HY, X^hY GENOTYPE

Dihybrid

Remember those roan cows from question 2? They also have a second gene for horn versus 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?

	C^R	C^W
C^R	C^RC^R	C^RC^W
C^W	C^RC^W	C^WC^W

$\frac{1}{4}$ RED $\frac{1}{2}$ ROAN $\frac{1}{4}$ WHITE

	H	h
H	HH	Hh
h	Hh	hh

$\frac{3}{4}$ HORNS $\frac{1}{4}$ HORNLESS

HORNED, RED $\frac{3}{4} \times \frac{1}{4} = 18.75\%$ $(\frac{3}{16})$

HORNED, ROAN $\frac{3}{4} \times \frac{1}{2} = 37.5\%$ $(\frac{3}{8})$

HORNED, WHITE $\frac{3}{4} \times \frac{1}{4} = 18.75\%$ $(\frac{3}{16})$

HORNLESS, RED $\frac{1}{4} \times \frac{1}{4} = 6.25\%$ $(\frac{1}{16})$

HORNLESS, ROAN $\frac{1}{4} \times \frac{1}{2} = 12.5\%$ $(\frac{1}{8})$

HORNLESS, WHITE $\frac{1}{4} \times \frac{1}{4} = 6.25\%$ $(\frac{1}{16})$

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