

# GENETICS SAMPLE PROBLEMS STUDY SHEET

The FOUR STEPS TO SOLVING GENETIC PROBLEMS are shown below. Use these steps **every** time to solve genetic problems.

## **NOTES:**

- 1) **Complete Dominance Problems:** Dominant traits mask recessive traits. Use the same letters, but capital for dominant & lower case for recessive.
- 2) **Incomplete Dominance Problems:** Neither trait is completely dominant, nor are there recessive traits. Use different letters for different genes, and always use capitals.

**STEP 1:** Choose letters to represent the genes in the cross.

**STEP 2:** Write the genotypes of the parents being crossed.

**STEP 3:** Make a Punnett square.

**STEP 4:** Write the percent probability for each listed genotype and phenotype appearing.

**Directions:** Solve the following genetic sample problems using the FOUR STEPS we practiced in class. To prepare for Friday's QUIZ, I recommend you solve all six problems Wednesday for homework then check each of your STEPS against the answers that follow. Solve at least the first three (or all six) a second time on Thursday evening to increase your chances of doing well on Friday's QUIZ.

## **SAMPLE PROBLEM #1**

This is a Complete Dominance problem. A tall hybrid female plant is crossed with a tall hybrid male plant. Tall is dominant.

- A. What percent of the offspring will be tall purebred? \_\_\_\_\_
- B. What percent of the offspring will be tall hybrid? \_\_\_\_\_
- C. What percent of the offspring will be short purebred? \_\_\_\_\_
- D. What percent of the offspring will be tall? \_\_\_\_\_
- E. What percent of the offspring will be short? \_\_\_\_\_

## **SAMPLE PROBLEM #2**

This is an Incomplete Dominance problem. Neither red nor white are dominant and a hybrid is pink. A pink flowered male snapdragon is crossed with a white flowered female snapdragon.

- A. What percent of the offspring will be red flowered snapdragons? \_\_\_\_\_
- B. What percent of the offspring will be white flowered snapdragons? \_\_\_\_\_
- C. What percent of the offspring will be pink flowered snapdragons? \_\_\_\_\_
- D. What percent of the offspring will be hybrids? \_\_\_\_\_
- E. What percent of the offspring will be purebred pink snapdragons? \_\_\_\_\_

### SAMPLE PROBLEM #3

This is a Sex-Linked & Complete Dominance problem. A normal female, but a carrier of the hemophiliac gene is crossed with a normal male. Normal blood clotting is dominant and the hemophiliac gene is recessive.

- A. What percent of the offspring will be female and purebred? \_\_\_\_\_
- B. What percent of the offspring will be normal female carriers of the hemophiliac gene? \_\_\_\_\_
- C. What percent of the offspring will have normal blood clotting capabilities? \_\_\_\_\_
- D. What percent of the offspring will be males? \_\_\_\_\_
- E. What percent of the offspring will be hemophiliacs? \_\_\_\_\_

### SAMPLE PROBLEM #4

This is a Complete Dominance problem. A brown eyed hybrid female is crossed with a blue eyed male. Brown eyes are dominant.

- A. What percent of the offspring will likely have brown eyes? \_\_\_\_\_
- B. What percent of the offspring will have blue eyes? \_\_\_\_\_
- C. What percent of the offspring will be purebred brown eyes? \_\_\_\_\_
- D. What percent of the offspring will be hybrid brown eyes? \_\_\_\_\_
- E. What percent of the offspring will be purebred blue eyes? \_\_\_\_\_

### SAMPLE PROBLEM #5

This is an Incomplete Dominance problem. Neither black nor white are dominant and a hybrid is gray. A black mouse is crossed with a gray mouse.

- A. What percent of the offspring will be black? \_\_\_\_\_
- B. What percent of the offspring will be white? \_\_\_\_\_
- C. What percent of the offspring will be gray mice? \_\_\_\_\_
- D. What percent of the offspring will be hybrids? \_\_\_\_\_
- E. What percent of the offspring will be purebred? \_\_\_\_\_

### SAMPLE PROBLEM #6

This is a Sex-Linked & Complete Dominance problem. A normal female, but a carrier of the colorblind gene is crossed with a colorblind male. Normal vision is dominant and colorblind vision is recessive.

- A. What percent of the offspring will be female and purebred? \_\_\_\_\_
- B. What percent of the offspring will be normal female carriers of the colorblind gene? \_\_\_\_\_
- C. What percent of the offspring will have normal vision? \_\_\_\_\_
- D. What percent of only the males will be colorblind? \_\_\_\_\_
- E. What percent of only the females will be colorblind? \_\_\_\_\_

# ANSWERS

## SAMPLE PROBLEM #1

This is a *Complete Dominance* problem. A tall hybrid female plant is crossed with a tall hybrid male plant. Tall is dominant.

**STEP 1:**

**T = Tall**  
**t = Short**

**STEP 2:**

**Tt x Tt**

**STEP 3:**

	T	t
T	TT	Tt
t	Tt	tt

**STEP 4:**

- |  |            |
|--|------------|
| A. What percent of the offspring will be tall purebred?  | <u>25%</u> |
| B. What percent of the offspring will be tall hybrid?    | <u>50%</u> |
| C. What percent of the offspring will be short purebred? | <u>25%</u> |
| D. What percent of the offspring will be tall?           | <u>75%</u> |
| E. What percent of the offspring will be short?          | <u>25%</u> |

## SAMPLE PROBLEM #2

This is an *Incomplete Dominance* problem. Neither red nor white are dominant and a hybrid is pink. A pink flowered male snapdragon is crossed with a white flowered female snapdragon.

**STEP 1:**

**R = Red**  
**W = White**

**STEP 2:**

**RW x WW**

**STEP 3:**

	R	W
W	RW	WW
W	RW	WW

**STEP 4:**

- |  |            |
|--|------------|
| A. What percent of the offspring will be red flowered snapdragons?   | <u>0%</u>  |
| B. What percent of the offspring will be white flowered snapdragons? | <u>50%</u> |
| C. What percent of the offspring will be pink flowered snapdragons?  | <u>50%</u> |
| D. What percent of the offspring will be hybrids?                    | <u>50%</u> |
| E. What percent of the offspring will be purebred pink snapdragons?  | <u>0%</u>  |

### SAMPLE PROBLEM #3

This is a *Sex-Linked & Complete Dominance* problem. A normal female, but a carrier of the hemophiliac gene is crossed with a normal male. Normal blood clotting is dominant and the hemophiliac gene is recessive.

**STEP 1:**

**N = Normal blood clotting**  
**n = Hemophiliac gene**

**STEP 2:**

$X^N X^n \times X^N Y$

**STEP 3:**

	$X^N$	$X^n$
$X^N$	$X^N X^N$	$X^N X^n$
Y	$X^N Y$	$X^n Y$

**STEP 4:**

- |   |            |
|---|------------|
| A. What percent of the offspring will be female and purebred?                     | <u>25%</u> |
| B. What percent of the offspring will be female carriers of the hemophiliac gene? | <u>25%</u> |
| C. What percent of the offspring will have normal blood clotting capabilities?    | <u>75%</u> |
| D. What percent of the offspring will be males?                                   | <u>50%</u> |
| E. What percent of the offspring will be hemophiliacs?                            | <u>25%</u> |

### SAMPLE PROBLEM #4

This is a *Complete Dominance* problem. A brown eyed hybrid female is crossed with a blue eyed male. Brown eyes are dominant.

**STEP 1:**

**B = Brown eyes**  
**b = Blue eyes**

**STEP 2:**

$Bb \times bb$

**STEP 3:**

	B	b
b	Bb	bb
b	Bb	bb

**STEP 4:**

- |   |            |
|---|------------|
| A. What percent of the offspring will likely have brown eyes? | <u>50%</u> |
| B. What percent of the offspring will have blue eyes?         | <u>50%</u> |
| C. What percent of the offspring will be purebred brown eyes? | <u>0%</u>  |
| D. What percent of the offspring will be hybrid brown eyes?   | <u>50%</u> |
| E. What percent of the offspring will be purebred blue eyes?  | <u>50%</u> |

### SAMPLE PROBLEM #5

This is an *Incomplete Dominance* problem. Neither black nor white are dominant and a hybrid is gray. A black mouse is crossed with a gray mouse.

**STEP 1:**

**B = Black**  
**W = White**

**STEP 2:**

**BB x BW**

**STEP 3:**

	B	B
B	BB	BB
W	BW	BW

**STEP 4:**

- |   |            |
|---|------------|
| A. What percent of the offspring will be black?     | <u>50%</u> |
| B. What percent of the offspring will be white?     | <u>0%</u>  |
| C. What percent of the offspring will be gray mice? | <u>50%</u> |
| D. What percent of the offspring will be hybrids?   | <u>50%</u> |
| E. What percent of the offspring will be purebred?  | <u>50%</u> |

### SAMPLE PROBLEM #6

This is a *Sex-Linked & Complete Dominance* problem. A normal female, but a carrier of the colorblind gene is crossed with a colorblind male. Normal vision is dominant and colorblind vision is recessive.

**STEP 1:**

**N = Normal vision gene**  
**n = Colorblind vision gene**

**STEP 2:**

**X<sup>N</sup>X<sup>n</sup> x X<sup>n</sup>Y**

**STEP 3:**

	X <sup>N</sup>	X <sup>n</sup>
X <sup>n</sup>	X <sup>N</sup> X <sup>n</sup>	X <sup>n</sup> X <sup>n</sup>
Y	X <sup>N</sup> Y	X <sup>n</sup> Y

**STEP 4:**

- |   |            |
|---|------------|
| A. What percent of the offspring will be female and purebred?                           | <u>25%</u> |
| B. What percent of the offspring will be normal female carriers of the colorblind gene? | <u>25%</u> |
| C. What percent of the offspring will have normal vision?                               | <u>50%</u> |
| D. What percent of only the males will be colorblind?                                   | <u>50%</u> |
| E. What percent of only the females will be colorblind?                                 | <u>50%</u> |