Lesson 1. Assessment 1.1 (Preassessment)

Name: _____ Per: _____ Date: _____

This is a <u>PREASSESSMENT</u>. We will use it to find out what you know about the topic we are going to study next. **It's OK If you don't know the answer to a question. Do your best to make an educated guess. Credit is based on effort.**

<u>Multiple choice: Circle the ONE best answer among the options (1 point each):</u>

1. Sexual reproduction leads to more variation in traits because:
    a. Alleles are randomly inherited from each parent
    b. The offspring contain double as many genes as the parents
    c. Genes are inherited from only the mom or the dad
    d. Genes are dominant to traits and alleles

2. A dominant trait is:
    a. The most common trait in a population of organisms
    b. The normal trait compared to the recessive trait
    c. Always observed in the presence of a dominant gene
    d. Present in all offspring

3. An example of a scientific model is:
    a. A math equation for bacterial growth
    b. A shoebox with candy representing organelles of an animal cell
    c. A diagram showing how blood moves through the heart
    d. All of the above

<u>Fill the answer in on the line (1 point each, unless shown otherwise):</u>

1. What is a hypothesis? _____
2. How do scientists know if a hypothesis is right or wrong? _____

    _____
3. WHY do scientists use models? _____

    _____
4. What could be a problem with using a model? _____

    _____
5. What is a scientific argument? _____

    _____

    _____

6. What does “random” mean? _____
   _____
7. What is an “allele”? _____
   _____
8. What does “dominant trait” mean? _____
   _____
9. Why do sisters with the same parents not look identical (2 points)? _____
   _____
   _____
   _____
10. Suki says: “A puppy inherits its genes from its mom and dad (not from its grandparents), so it will look more like its parents than like its grandparents.” Is she right? _____ Explain your reasoning (3 points): _____
    _____
    _____
    _____
11. Can traits skip generations? _____Can genes skip generations? _____
    Explain your answer (3 points): _____
    _____
    _____
    _____

Our NEXT objective will be:
I can explain how genes cause the pattern of inheritance of traits.

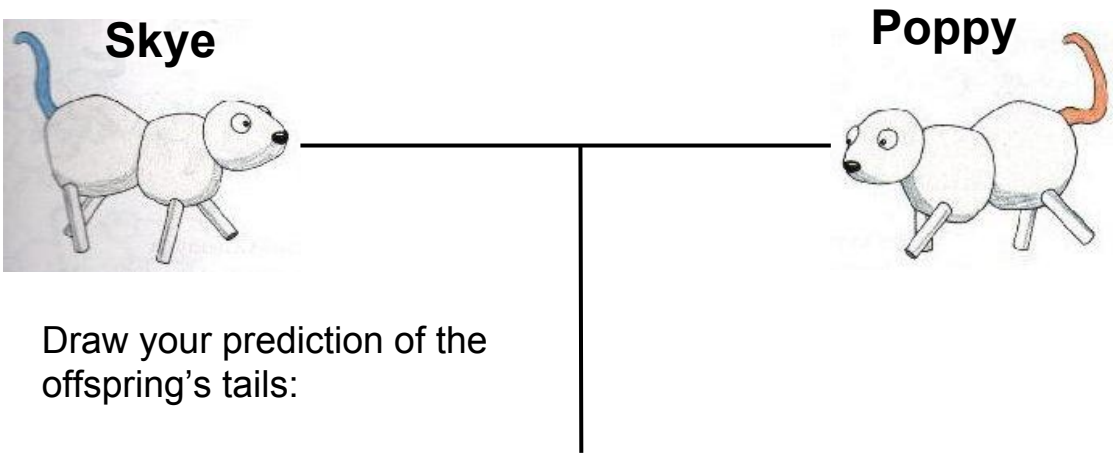
Please circle a number from 1 to 5 to show your progress towards meeting this objective:

I cannot explain it - 1 2 3 4 5 - I can explain it very well

Explain WHY you gave yourself this rating: _____
_____
_____
_____
_____

Name: _____ Per: ___ Group: ____

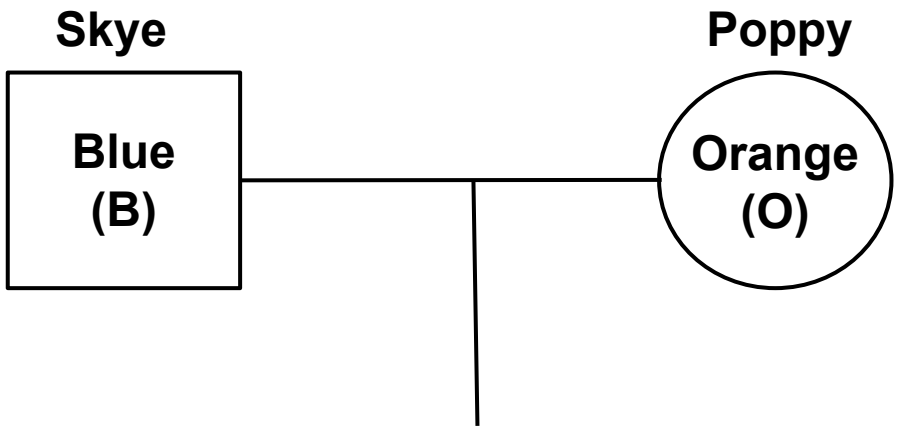
Breeding: First generation cross



Draw your prediction of the offspring's tails:

Describe your prediction in words:

Pattern of inheritance of the tail-color traits in the first generation:



Hypothesis 1: _____

_____

_____

Hypothesis 2: _____

_____

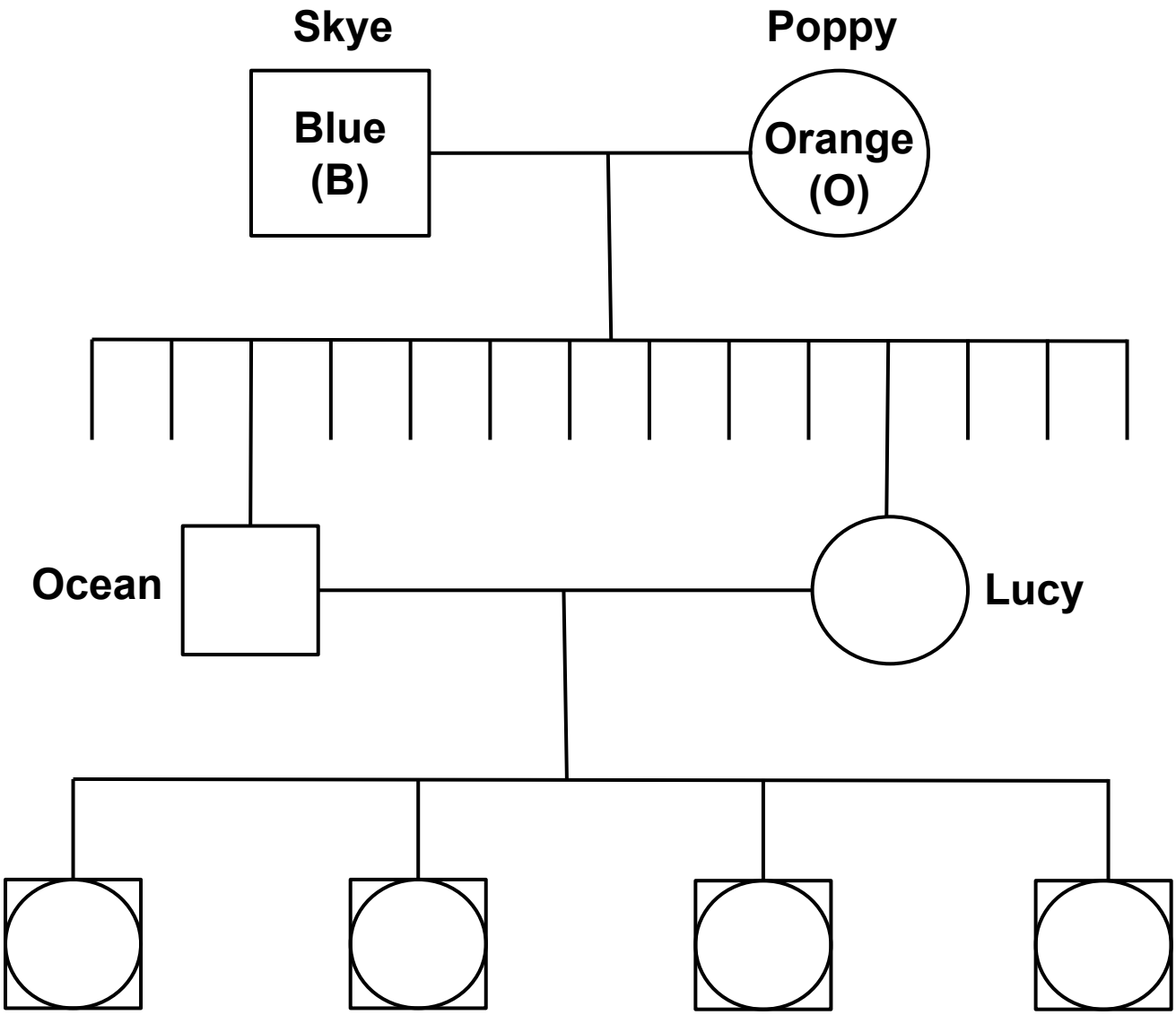
_____

Hypothesis 3: _____

_____

_____

Pattern of inheritance of tail-color traits



Does this evidence (data) affect which hypotheses may be right? Explain:

Exit ticket:

Rate your progress on today's learning target:

CAN you develop three HYPOTHESES for how genes are passed from parents to offspring, based on the pattern of inheritance of traits?

No idea - 1 2 3 4 5 - Yes I can!

What do you still not understand about today's lesson?

_____

_____

_____

_____

_____

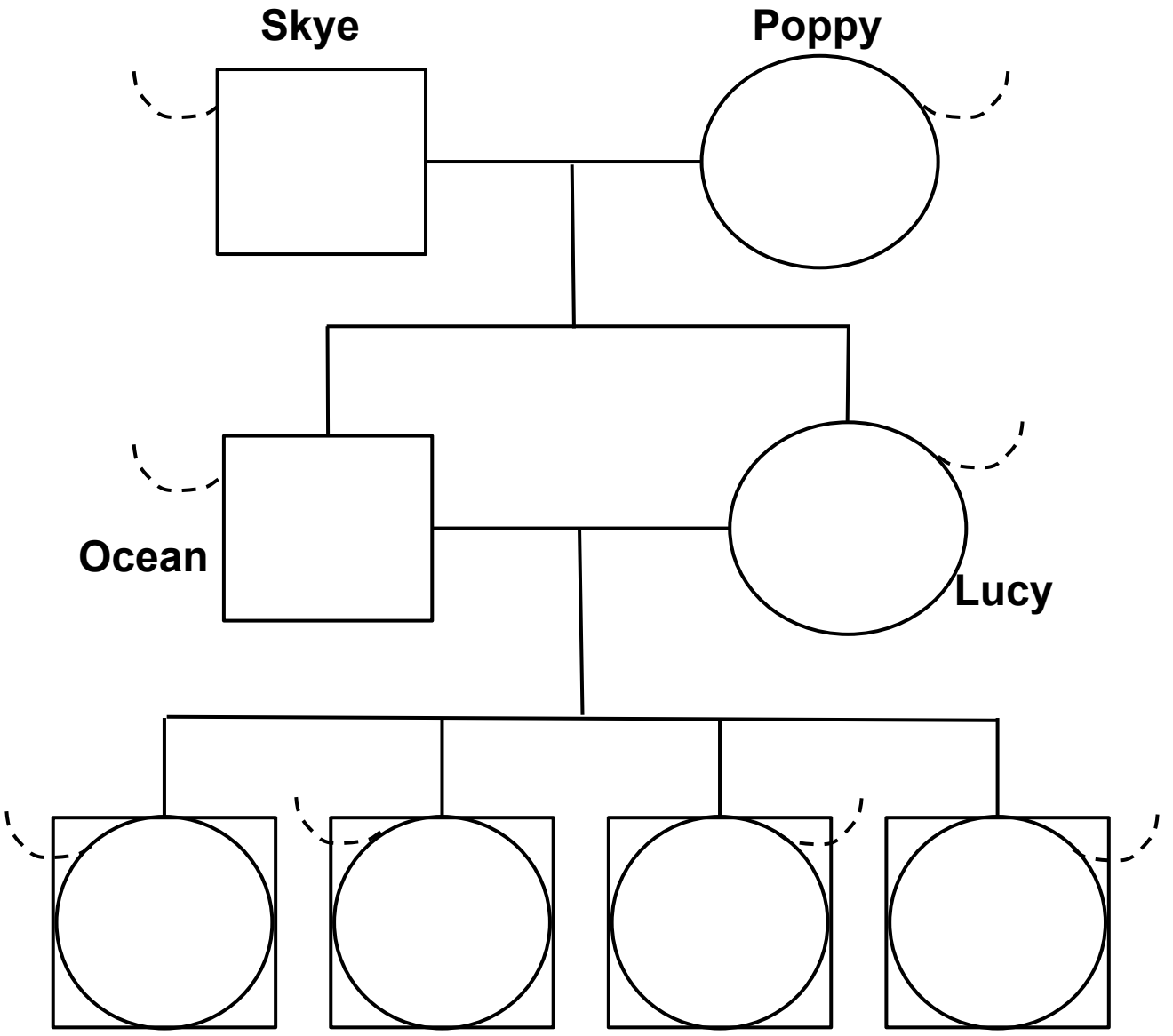
_____

_____

Name: _____ Per:_____

Critter model for **Hypothesis ____**

Use blue and orange colored pencils to draw the disks representing genes:



Use your model to explain how genes cause the pattern of inheritance of traits. (Use the graphic organizer to help you organize your thoughts):

_____

_____

_____

(Explanation, continued:)

Graphic organizer to **EXPLAIN** :

1. Describe the PATTERN of TRAITS

Skye has a _____ tail, and Poppy has a _____ tail. Lucy and Ocean both have _____ tails.

Now describe the tail colors (pattern of traits) for Lucy and Ocean's pups.

_____
_____

2. What RULES did you use to place the disks?

_____ are the instructions for _____. In my model of hypothesis ____, Skye and Poppy each have _____ *(how many?)* **genes for tail color."**

Now describe what genes Lucy and Ocean inherited from Skye and Poppy: _____
_____
_____

Why? Describe the RULES you used to decide what kinds of genes Lucy and Ocean get, so that both their tails would turn out blue.

_____
_____
_____
_____

3. How can the rules from step 2 explain the pups' tail colors?

Lucy and Ocean's pups can have either _____ tails or _____ tails. To get _____ tails, they have to inherit _____ from _____, because

_____
_____
_____

(Hint: Use the rules from step 2 to tell how you can make the different possible tail colors of the pups)

Name: _____

Answer the following questions using complete sentences:

1. How did the model help you towards understanding our overall objective for this week? (I can EXPLAIN how GENES cause the pattern of inheritance of TRAITS).

_____

_____

_____

_____

_____

2. What are the trade-offs of using models to investigate the real world?

_____

_____

_____

_____

Challenge question: Can you think of other examples where scientists use models, and how that might be useful?

_____

_____

_____

Names: _____, _____ Per:____ Group: ___

Table 1: Coin Toss Lab Results

Offspring	Ocean's contribution (T or t?)	Lucy's contribution (T or t?)	Offspring's genes (TT, Tt, tT or tt?)	Offspring's tail color (blue or orange?)
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				

Data organization:

How will you organize the data to prepare a new data table which summarizes the results of your whole table group (4 students)?

a. Discuss this question with your partner. Your data table (Table 2) will need to include the number of times your group of four got each gene combo (TT, Tt, tT, or tt), and the number of times you got each tail color trait (blue or orange).
b. In your science notebook, write a heading (Coin Toss Lab and the date). Then draw this data table (Table 2), and use it to summarize the results of your whole group of four.***

Stop to think:

Answer the following questions in your science notebook:

a. What are you noticing about this data?
b. What was the hardest part of doing this investigation?
c. What do you think you need to do next to analyze the data?

***Template provided to students who struggle with math and data organization:
Students paste this data table directly into their notebooks

Table 2: Summary of Coin Toss lab Results

Gene Combo (Alleles)	Number of times	Tail color	Tail color (Totals)	Whole CLASS Total
TT		blue	_____ blue	_____ blue
Tt		blue		
tT		blue		
tt		orange	_____ orange	_____ orange

Lesson 4. Assessment 4.1

Name: _____ Per: _____

Coin Toss Lab Analysis and Conclusion

Question: Can the coin toss model explain the pattern of inheritance of traits in Ocean and Lucy's offspring?

Analysis:
Our whole class data showed that the coin toss model of random inheritance resulted in _____ blue-tailed and _____ orange-tailed critter pups. Use this WHOLE CLASS data to answer the questions below. Show your work.

1. What is the RATIO of blue-tailed to orange-tailed critter pups?***

_____

_____

2. What are the FRACTIONS of blue-tailed and orange-tailed critter pups?***

_____

_____

3. Explain why we got such a large ratio. Why is the ratio of blue to orange tails not 1:1?

_____

_____

_____

4. If you and your partner toss a coin 100 times, predict how many times the outcome will be tails-tails, heads-heads, heads-tails and tails-heads.

_____

_____

5. How sure are you that you will actually get the exact answers that you gave to question number 4? Why?

_____

_____

_____

6. Why was the ratio of the coin toss results not EXACTLY 3:1?

_____

_____

_____

7. Ocean and Lucy had 19 pups. Five of the pups had orange tails and 14 of them had orange tails. Do the results of the coin toss model match the critter offspring data?

8. About ¼ of Ocean and Lucy's pups have orange tails and about ¾ have blue tails. What is the cause of this pattern of inheritance of tail color? (Use evidence and scientific concepts in your explanation.)***

****Differentiated questions/templates for extra support on questions 1, 2 and 8 (Distribute as needed):*

1. What is the RATIO of blue-tailed to orange-tailed critter pups?

How to get started:

Number of blue-tailed pups = _____
Number of orange-tailed pups = _____
(Blue-tailed pups)/(Orange-tailed pups) = _____
Now figure out: How many blue-tailed pups are there, for every one orange-tailed pup?

_____
_____

2. What are the FRACTIONS of blue-tailed and orange-tailed critter pups?

How to get started:
Number of blue-tailed pups = _____
Number of orange-tailed pups = _____
Total number of pups = _____
Now figure out: (Blue-tailed pups)/(Total pups) = ?
(Orange-tailed pups)/(Total pups) = ?

_____
_____

8. About ¼ of Ocean and Lucy's pups have orange tails and about ¾ have blue tails. What is the cause of this pattern of inheritance of tail color? (Use evidence and scientific concepts in your explanation.)

Claim:

The pattern of inheritance of tail color is caused by _____ inheritance of different versions of _____.

Evidence and reasoning:

There are _____ different versions of the tail color gene: _____ . Each critter has _____ alleles. Each pup inherits _____ from _____.

The _____ allele for _____ tail color is _____, which means that it will overpower the _____ allele for _____ tail color.

We tested a coin toss model of _____ inheritance of either the _____ or _____ allele. We found (use data!):_____

_____

_____

_____

_____

The ratio of _____ (color) to _____ (color) tails obtained by tossing coins was _____:_____. This is about the same as _____

_____

_____

_____

Therefore, the science concepts of _____and _____ can explain the pattern of inheritance of tail color (about ¼ orange tails and about ¾ blue tails).

Lesson 4. Assessment 4.2

Name: _____ Per: _____

Exit ticket

Rate your progress towards today's learning target:
"Analyze the results of the coin toss lab, and construct an evidence-based explanation for how genes cause the pattern of inheritance of traits."

I have no idea - 1 2 3 4 5 - I know this! I can do it!

What was the hardest part?

_____

_____

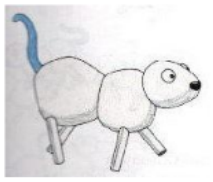
Where can you get more help?

_____

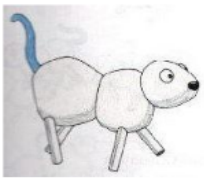
_____

Punnett Square Practice

Name: _____



Tt

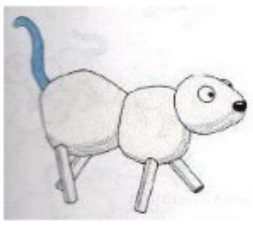


TT

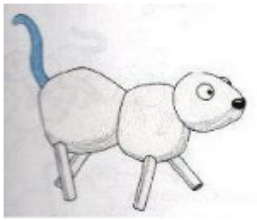
?

Predicted genotypes:

Predicted phenotypes:



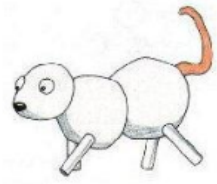
TT



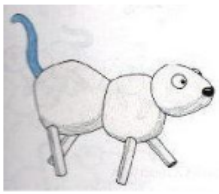
Tt

Punnett Square Practice

Name: _____



tt

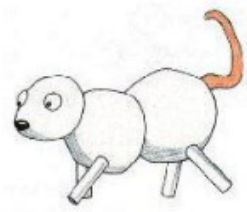


Tt

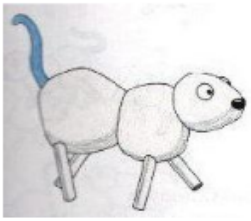
?

Predicted genotypes:

Predicted phenotypes:



tt



Tt

Lesson 5 Assessment 5.2

Name: _____ Per: _____ Date: _____

Quiz: Mendelian inheritance of genes and traits **(32 points)**

(Standards Assessed: NGSS MS-LS3-2, WASS EARL4 6-8 LS3D, EARL2 6-8 INQE)

Multiple choice: Circle the ONE BEST answer (1 point each):

1. Sexual reproduction leads to more variation in traits because:
    a. Parents have homozygous alleles.
    b. The offspring contain double as many genes as the parents
    c. Genes are inherited from only the mom or the dad
    d. Alleles are randomly inherited from each parent

2. A dominant trait is:
    a. The most common trait in a population of organisms
    b. The normal trait compared to the recessive trait
    c. Always observed in the presence of a dominant gene
    d. Present in all offspring of a genetic cross

3. An example of a scientific model is:
    a. A math equation for bacterial growth
    b. A shoebox with candy representing organelles of an animal cell
    c. A diagram showing how blood moves through the heart
    d. All of the above

4. An organism reproduces asexually. It has two alleles (B and b) of a gene. The offspring will:
    a. All have two alleles (B and b)
    b. All have one allele (either a B or a b)
    c. Have BB, Bb or bb alleles
    d. Have no B or b alleles

5. We used a coin toss to:
    a. model that dominant alleles are more likely than recessive alleles
    b. investigate whether the T allele was dominant or recessive
    c. model random inheritance of two different alleles by the offspring
    d. model that all the offspring had blue rather than orange tails

Fill the answers in on the lines (points in parentheses):

6. Name at least one limitation of the coin toss model (1 point): _____

_____

_____

7. What does “random” mean? (1 point) _____

_____

8. What is an “allele”? (1 point) _____

_____

9. What does “recessive trait” mean? (1 point) _____

_____

_____

10. A man has one B allele, and one b allele for an eye color gene. Will all his sperm cells be identical for this gene? _____ Explain your answer (2 points): _____

_____

_____

11. Is it possible for one phenotype to have more than one genotype? _____ Explain your answer (3 points): _____

_____

_____

_____

12. Why do sisters with the same parents not look identical (2 points)? _____

_____

_____

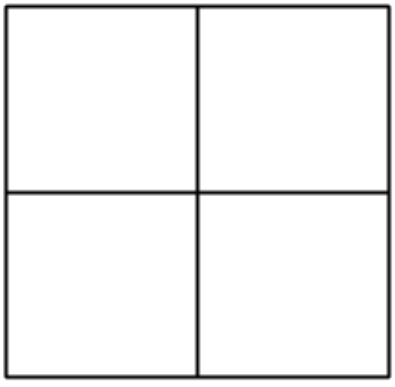
_____

_____

13. Suki says: “A puppy inherits its genes from its mom and dad (not from its grandparents), so it will always look more like its parents than like its grandparents.” Is she right? _____
Explain your reasoning (3 points): _____
_____
_____
_____

14. Can genes skip generations? _____ Explain your answer (2 points): _____
_____
_____

15. In humans, curly hair is dominant (H) to straight hair (h). A man with a genotype of Hh and a woman with a genotype of hh are wondering what their childrens’ hair may look like. Complete the sides and inside of the punnett square below, and fill in the predicted genotypes and phenotypes of the children on the lines in the box (3 points).



Predicted percentages (%) for children:

Genotypes :

Phenotypes :

16. Fish color is caused by a single gene with two different alleles (R and r). You buy a red male fish (called “Jim”) and a yellow female fish (called “Mary”) from the pet store. Jim and Mary produce 50 offspring that are all red. You name one of these red offspring “Bob”, and another one “Sally”. When Bob and Sally produce offspring of their own, there are 31 red fish and 9 yellow fish.

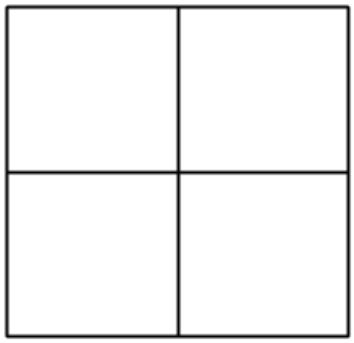
a. List the genotypes of the parents (1 point):

Jim: _____ Mary: _____ Bob: _____ Sally: _____

b. Complete the Punnett square with Bob and Sally as the parents (3 points):

Bob

Sally



Predicted offspring:

Genotype:

_____% _____ (Phenotype: _____)

_____% _____ (Phenotype: _____)

_____% _____ (Phenotype: _____)

c. Write a paragraph using science concepts and evidence (numbers and ratios of the offspring) to explain how genes cause the pattern of inheritance of fish color in Bob and Sally’s offspring (4 points)

_____

_____

_____

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_____

_____

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Lesson 5 Assessment 5.3

Name: _____ Per: _____

Reflection: Your answers will not affect the grade for your Quiz

1. Circle a number from 1 to 5 to show your progress towards meeting our objective: **I can EXPLAIN how GENES cause the pattern of inheritance of TRAITS.**

I cannot explain it - 1 2 3 4 5 - I can explain it very well

Explain WHY you gave yourself this rating _____

_____

2. What was the hardest part of this unit to understand or do? _____

_____

Rate your strengths and needs for what we did this week	**I'm good at this**	**I need a little help**	**I need a LOT of help**
Asking questions and making hypotheses	O	O	O
Using and understanding models	O	O	O
Doing investigations and collecting data	O	O	O
Organizing and Analyzing data	O	O	O
Making conclusions based on evidence	O	O	O
Communicating results	O	O	O

3. What are your next steps to reach a 5 on our objective, and to become an expert on scientific practices?

_____

_____

4. Give examples of books, people or internet sites where you can get more help:

_____

_____

5. Now that we have learned how genes cause the pattern of traits, what do you wonder next? (What should our next question be in learning about genetics?)_____

_____

6. How is what we learned in this unit related to you?_____

_____

_____

Lesson 5 Assessment 5.2

Name: _____ Per: _____ Date: _____

Quiz: Mendelian inheritance of genes and traits **(32 points)**

(Standards Assessed: NGSS MS-LS3-2, WASS EARL4 6-8 LS3D, EARL2 6-8 INQE)

Multiple choice: Circle the ONE BEST answer (1 point each):

1. Sexual reproduction leads to more variation in traits because:
    a. Parents have homozygous alleles.
    b. The offspring contain double as many genes as the parents
    c. Genes are inherited from only the mom or the dad
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2. A dominant trait is:
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3. An example of a scientific model is:
    a. A math equation for bacterial growth
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4. An organism reproduces asexually. It has two alleles (B and b) of a gene. The offspring will:
    a. All have two alleles (B and b)
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Fill the answers in on the lines (points in parentheses):

6. Name at least one limitation of the coin toss model (1 point): _____

_____

_____

7. What does “random” mean? (1 point) _____

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8. What is an “allele”? (1 point) _____

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_____

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_____

_____

11. Is it possible for one phenotype to have more than one genotype? _____ Explain your answer (3 points): _____

_____

_____

_____

12. Why do sisters with the same parents not look identical (2 points)? _____

_____

_____

_____

_____

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14. Can genes skip generations? _____ Explain your answer (2 points): _____
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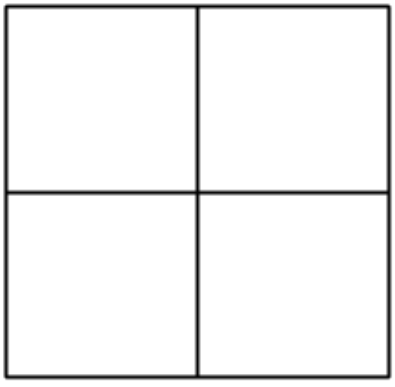


Predicted percentages (%) for children:

Genotypes :

Phenotypes :

16. Fish color is caused by a single gene with two different alleles (R and r). You buy a red male fish (called “Jim”) and a yellow female fish (called “Mary”) from the pet store. Jim and Mary produce 50 offspring that are all red. You name one of these red offspring “Bob”, and another one “Sally”. When Bob and Sally produce offspring of their own, there are 31 red fish and 9 yellow fish.

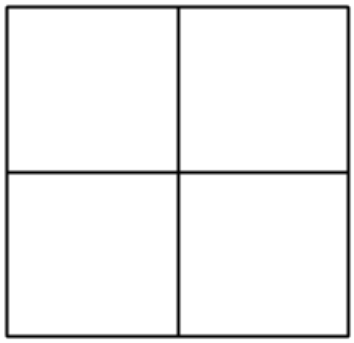
a. List the genotypes of the parents (1 point):

Jim: _____ Mary: _____ Bob: _____ Sally: _____

b. Complete the Punnett square with Bob and Sally as the parents (3 points):

Bob

Sally



Predicted offspring:

Genotype:

_____% _____ (Phenotype: _____)

_____% _____ (Phenotype: _____)

_____% _____ (Phenotype: _____)

c. Write a paragraph using science concepts and evidence (numbers and ratios of the offspring) to explain how genes cause the pattern of inheritance of fish color in Bob and Sally’s offspring (4 points)

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

Part D: EVALUATION CRITERIA for Assessment 5.2

Standards evaluated are :

MS-LS3-2 (abbreviated LS3-2 below)

EARL4 6-8 LS3D (abbreviated LS3D below)

EARL2 6-8 INQE (abbreviated INQE below)

MULTIPLE CHOICE (questions 1-5)

(1 point each, 5 Points Total)

Answer number	Correct answer	Aligned with Learning target	Aligned with standards
1	**d**	LT4	LS3-2; LS3D
2	**c**	LT4	LS3-2; LS3D
3	**d**	LT2	INQE
4	**a**	LT5	LS3-2; LS3D
5	**c**	LT3, LT4	LS3-2; LS3D; INQE

WRITE-IN ANSWERS (questions 6-15)

(Variable as indicated, 19 Points Total)

Answer number (LT) [standard]	Evaluation criteria		
6 (LT5) [INQE]	**1 point** Correctly identifies a limitation of the model related to inheritance of traits and genes. Possible answers include the inability of the model to explain incomplete dominance, inheritance of multigenic traits, or environmental effects. (Acceptable answers include an example instead of naming these concepts)	**½ point** Demonstrates partial understanding of the question, for example answer relates to limitation due to bias introduced by weight of coin or tossing procedure.	**0 points** No answer or does not demonstrate partial understanding of the question
7 (LT4) [LS3-2; LS3D]	**1 point** Shows conceptual understanding of all outcomes being equally likely, such as in the coin toss model (for example, acceptable answers include 50-50 chance, cannot be predicted, or not controlled).	**0 points** No answer or shows no understanding of equal likelihood of outcomes	
8 (LT4) [LS3-2; LS3D]	**1 point** Correct definition, for example "a version of a gene" (Acceptable answers includes "a gene" or "the DNA", but not "a trait")	**½ point** Only provides an example of notation, for example B or b OR Answer includes correct AND wrong statements.	**0 points** No answer or does not demonstrate partial understanding (for example, "a trait" or "Bb")

9 (LT4) [LS3-2; LS3D]	**1 point** Answer shows conceptual understanding of a trait that is hidden or masked by a dominant trait, or a trait that is only observed in the absence of the dominant allele.		**½ point** Shows partial understanding, or shows understanding but includes an erroneous statement (for example rare or uncommon trait)	**0 points** No answer or does not demonstrate partial understanding
10 (LT5) [LS3-2; LS3D]	**2 points** Answers the question with "no" AND shows understanding of the concept that each sperm contains just one gene/allele (B or b).		**1 point** Answers the question with "no" but provides an explanation which is insufficient, OR shows partial understanding	**0 points** No answer provided OR provides wrong explanation.
11 (LT4) [LS3-2; LS3D]	**3 points** Answers the question with "yes". Shows understanding of the concept that a genotype is a combination of two alleles, so one phenotype can result from two dominant alleles, or one dominant and one recessive allele. May use example to explain, such as TT and Tt both make blue tails.	**2 points** Answers the question with "yes" AND shows partial understanding of the concept, but lacks sufficient detail to infer complete understanding	**1 point** Answers the question with "yes" but explanation does not provide evidence or understanding, or provides only minimal connection	**0 points** No answer OR answer provides wrong explanation.
12 (LT4) [LS3-2; LS3D]	**2 points** Shows understanding that random inheritance of alleles or genes results in differences between siblings. (Acceptable answers include genetic material inherited from both parents, but different sperm and egg cells combine.)		**1 point** Answer demonstrates partial understanding	**0 points** No answer or does not demonstrate partial understanding
13 (LT4) [LS3-2; LS3D]	**3 points** Answers the question with "no" and answer includes concept that a TRAIT may skip a generation (or may be "hidden" in the parents).	**2 points** Answers the question with "no" But does not articulate concept of hidden or recessive traits, or contains a factual error	**1 point** Explanation includes factually correct concepts of inheritance of genes/ traits from parents, but does not show evidence of understanding that traits can skip a generation.	**0 points** No answer OR no evidence of understanding of inheritance provided

14 (LT4) [LS3-2; LS3D]	**2 points** Answers the question with "no", and shows understanding that genes are physically inherited from generation to generation (whereas traits may skip generations)		**1 point** Answer is "yes", but explanation shows understanding of inheritance of genes and traits OR answer is no, but explanation does not provide sufficient evidence of conceptual understanding	**0 points** No answer or answer does not demonstrate partial understanding
15 (LT5) [LS3-2; LS3D; INQE]	**3 points** 1) Punnett square is accurately filled out, showing alleles of parents (H and h), and genotypes (Hh, Hh, hh, hh, matched to allele locations in the squares). 2)Genotypes are 50% Hh and 50% hh 3)Phenotypes are 50% curly and 50% straight	**2 points** One of the three elements is missing or incorrect	**1 point** Two of the three elements is missing or incorrect	**0 points** No answer, or all three elements incorrect

WRITE-IN ANSWER: Performance task of CF (question 16)

(8 Points Total)

16a (LT3, LT4) [LS3-2; LS3D]	**1 point** Genotypes of parents are RR, rr, Rr and Rr (in order).		**½ point** Contains at least two correct genotypes.	**0 point** Genotypes not provided, or 3 or more errors.
16b (LT5) [LS3-2; LS3D; INQE]	**3 points** 1) Punnett square is accurately filled out, showing alleles of parents (R and r), and genotypes (RR, Rr, Rr, rr, matched to allele locations in the squares). 2)Genotypes are 25% RR, 50% Rr and 25% rr 3)RR and Rr red; rr yellow	**2 points** One of the three elements is missing or incorrect	**1 point** Two of the three elements is missing or incorrect	**0 points** No answer, or all three elements incorrect

16c (LT4) [LS3-2; LS3D; INQE]	**4 points** Explanation demonstrates understanding of how genes cause the pattern of inheritance of traits (CF), by including: 1) the concepts of <u>dominance</u> (1 point) AND <u>random</u> inheritance (1 point), AND 2) a comparison of the numbers of actual offspring (data) with the expected ratio from random inheritance (2 points)	**3 points** Explanation demonstrates conceptual understanding of how genes cause the pattern of inheritance of traits (CF), but lacks one of the four elements described (one of the concepts, numbers (data), OR expected ratio of 3:1)	**2 points** Explanation demonstrates some understanding of how genes cause the pattern of inheritance of traits (CF), but lacks two of the four elements described	**1 point** Some evidence of understanding provided, and explanation contains one of the 4 elements described	**0 points** No explanation, or explanation does not demonstrate partial understanding of central focus. None of the 4 elements are present.