Student Name: _____

7th Grade Science- Week 4

Complete the following assignments for week 4.

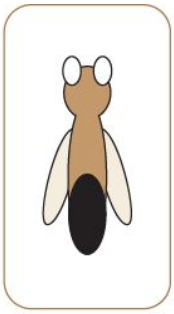
Week	Topic/TEKS	Agenda
4	**Heredity** 7.14(A) Define heredity as the passage of genetic instructions from one generation to the next generation. 7.14 (C) Recognize that inherited traits of individuals are governed in the genetic material found in the genes within chromosomes in the nucleus.	**1. Engage: Fruit Flies** • Observe the offspring fruit fly and determine which set of parents are most likely the offspring's parents. • Answer the questions. **2. Video: Heredity- Why you look the way you do?** • Watch this video for an introduction Heredity. • https://youtu.be/6bWssRDAHW4 • **3. Reading: Heredity** • Read the article. While you read, complete the Linking Literacy: Note Taking Guide **4. Practice: CLOZE-ing in on Science** • Use the word banks to complete the paragraphs. **5. Video: Punnett Squares the Basics** • Watch this video for an introduction to Punnett Squares • https://youtu.be/znWCgqlC-s8 • **6. Introduction to Punnett Squares** • Complete the worksheets.

		7. Math Connection: Heredity • Analyze the data and complete the questions. **8. Reading in Science: Heredity** • Read and annotate the text and answer the questions. **9. Assessment: Heredity** • Complete the assessment.

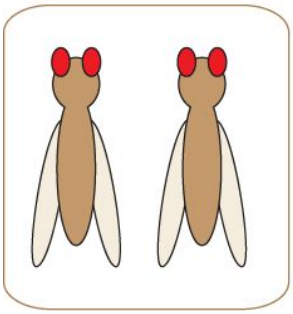
Engage

Name: _____ Date: _____

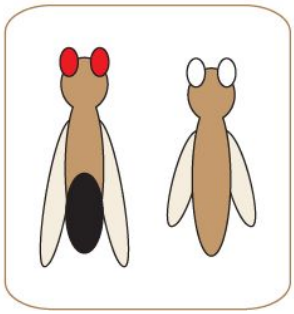
Fruit Flies



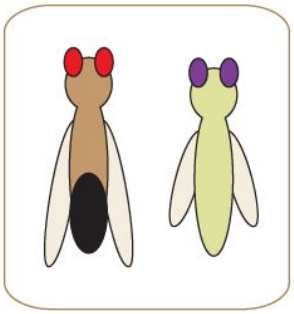
Offspring



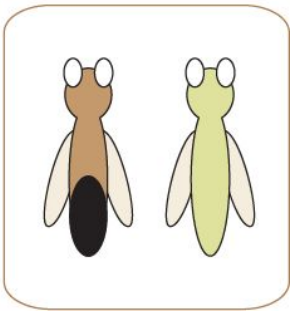
Parents A



Parents B



Parents C



Parents D

As you observe the images above, discuss the following questions with your group. Be prepared to defend your conclusions.

1. Which set of fruit flies is most likely the offspring's parents?

2. What characteristics do you observe that lead you to that conclusion?

3. What do you know about heredity that leads you to that conclusion?

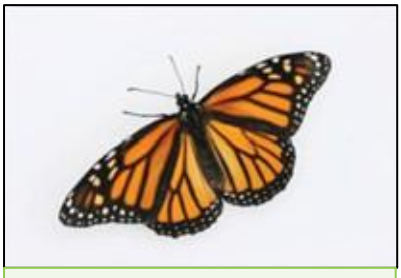
Reflect

Take a look at the three adult bears shown in these photographs:

Which of these adult bears do you think is most likely to be the parent of the bear cubs shown in the photograph on the right? How did you arrive at your conclusion?

Organisms and Inherited Traits

Heredity is the transmission of traits from one generation to the next. These include physical traits such as fur color and body shape that are easy to observe. You probably chose the adult black bear (middle picture) as the parent of the bear cubs above. This is because the bear cubs share more physical features with that adult bear than with the other adult bears.



Monarch butterflies inherit a behavioral trait that prompts them to migrate.

Other types of traits are also passed from parents to offspring. These include behavioral traits and biochemical traits. An example of an inherited behavioral trait occurs in migrating butterflies. An example of an inherited biochemical trait is the blood type passed from human parents to their children. Biochemical traits can only be observed by studying the chemical composition of biological samples.

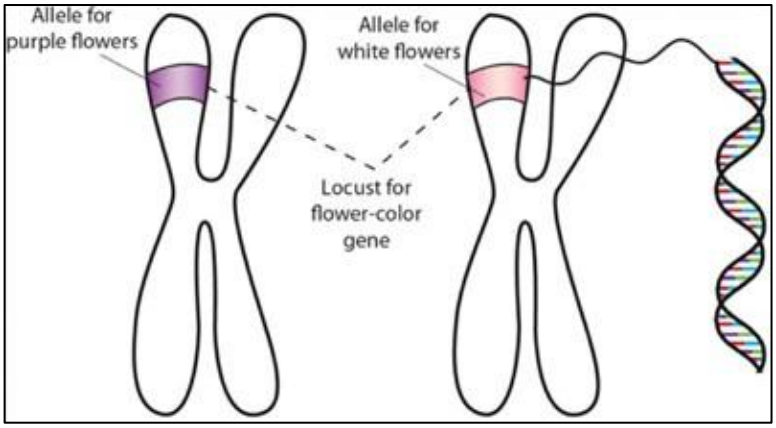
Genes: The Units of Inheritance

Inherited traits are determined by information stored in an organism's genes. Genes are sequences of DNA that are part of the structure of the organism's chromosomes. Chromosomes are located in the nucleus of every cell in that organism. An organism has two copies of each chromosome. During sexual reproduction, one copy comes from the organism's female parent. The other copy comes from the organism's male parent.

Reflect

Alleles and Genotypes

Because each chromosome is present in two copies, each gene is present in two copies. However, the DNA sequences of the two copies may not be the same. These variations of a gene are called *alleles*. As an example, suppose that a scientist inspected the chromosomes present in a flowering plant. The scientist might observe something similar to the situation diagramed below. Alleles for the same gene have been identified on two chromosomes. One allele codes for purple flower color. The other allele codes for white flower color. One allele came from the plant's female parent. The other allele came from the plant's male parent.



The pair of alleles an organism inherits for each gene determines the *genotype* of that individual. In the example shown above, suppose the purple color allele is given the abbreviation, *P*, and the white color allele is given the abbreviation, *p*. This plant's genotype for flower color is *Pp*.

What Do You Think?

Suppose a plant has two alleles for purple flowers. What is the plant's genotype for flower color? What is the genotype for flower color if a plant has two alleles for white flowers?

Phenotypes

An individual's *phenotype* is determined by the traits that are expressed and observed. Suppose that the plant with a genotype of *Pp* has purple flowers. We say the plant's phenotype for flower color is purple. The chart below summarizes the possible genotypes and phenotypes resulting from the allele combinations for flower color (purple or white). Remember, in sexual reproduction, an offspring inherits one allele from each parent.

Allele Combinations for Purple and White Flowers

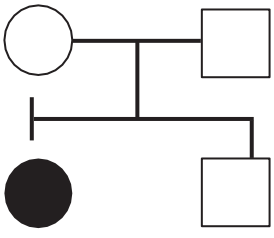
genotype	phenotype
PP	purple
Pp	purple
pp	white

What Do You Think?

Dominant and Recessive Alleles
You may have noticed an interesting phenomenon in the chart above. Three different genotypes (*PP, Pp*, and *pp*) only produced two phenotypes (purple color or white color). This is because the allele for purple color is *dominant* and the allele for white color is *recessive*. Dominant alleles are expressed if they are present. Recessive alleles are only expressed when the dominant allele is absent. Therefore, *PP* and *Pp* genotypes have the same purple phenotype. Only the *pp* genotype has the white phenotype.

If an organism has two different alleles for a trait, such as *Pp*, it is *heterozygous* for that trait. If an organism has the same alleles for a trait (*PP* or *pp*), it is *homozygous* for the trait. *PP* is classified as homozygous dominant and *pp* is classified as homozygous recessive.

Study the diagram at the right. It represents four people: two parents and their two children. Parents are indicated by the symbols in the top row. Children are indicated by the symbols in the bottom row. Circles represent females and squares represent males.



In this family, only the daughter expresses a particular trait. The other members of the family (unshaded symbols) do not express this trait. Could this trait be dominant, or is it recessive? How do you know?

Key
Circle = female Square = male Unshaded = trait not expressed
Shaded = trait expressed

Look Out!

It is important to remember the differences between traits, genes, alleles, and phenotypes. These terms are often confused. A trait is one particular characteristic such as eye color. The gene is the segment of DNA that codes for that trait. Alleles are the different possibilities for the trait (brown, blue, green.) Phenotype is which one of those possibilities is actually observed in a particular individual.

Genetic Variation
Recall that each parent contributes a set of chromosomes to a child. This is why children look similar, but not identical, to their parents. However, the set of chromosomes that a child inherits from each parent is random. This is why siblings, other than identical twins, look similar to one another, but not identical. In the case of identical twins, they actually do both inherit the same sets of chromosomes. Humans have 46 chromosomes. This leads to many different possible combinations of chromosomes that each child can inherit.

Look Out!

Career Corner: What does a geneticist do?
A *geneticist* is a scientist who studies the genetic makeup of organisms. *Research geneticists* study a variety of organisms from single-celled bacteria to worms and fruit flies in order to learn about genes. For example, they might ask questions such as: How many genes are needed to sustain life? Which genes are essential, and which genes can be eliminated without harm to the organism? What does each gene do for the organism? To answer these questions, research geneticists use laboratory techniques to isolate and identify genes at the level of DNA.

Geneticists use DNA maps to analyze genes isolated from living cells.

Clinical geneticists focus specifically on human genetics. They, too, work in the laboratory and use techniques for observing gene structure and function. But, clinical geneticists are often concerned about how genes play specific roles in human health and disease. They want to know which genes are involved in certain diseases and why. Knowing these things can help identify methods for treating these diseases and possibly preventing the diseases from developing in others.

Try Now

What do you know?
Match words from the list below to the appropriate descriptions in the chart. Write your answers in the right column of the chart, directly across from the matching description.

Word List: genotype, phenotype, heredity, allele, chromosomes, trait

Description	Word
The physical appearance of an individual's genetic makeup	
A particular characteristic of an individual	
The passage of genetic instructions from one generation to the next generation	
One variation of a particular gene	
The specific genetic makeup of an individual	
Contain the genes of an individual	

Now use what you have learned about heredity to complete the chart below. The allele pairs in the left column represent eye color in fruit flies. *R* is the dominant color (red) and *r* is the recessive color (white). Study the chart and fill in the missing phenotypes.

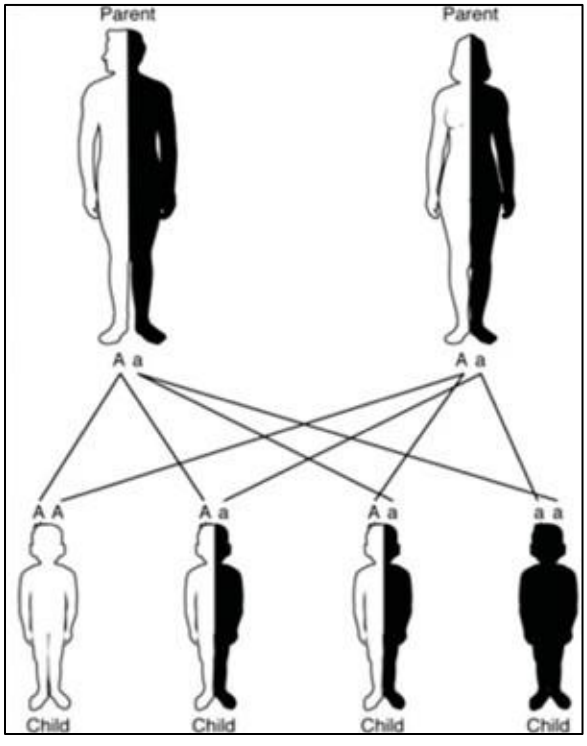
Allele Pairs for Eye Color in Fruit Flies

Genotype	Phenotype
RR	
Rr	
rr	

Connecting With Your Child

Genetics: Simulation and Research

Run a simulation with your child to explore the possible genotypes and phenotypes of offspring produced from the parental cross shown at the right. Your child should follow this procedure:



1. Gather these materials:
   - 2 brown paper lunch bags
   - 10 red beads
   - 10 blue beads
   - A marker
2. Red beads represent the dominant allele, *A*. Blue beads represent the recessive allele, *a*.
3. Make up one of the paper bags to represent the female parent. Label the bag, "female." Place five red and five blue alleles in her bag. What is her genotype? What is her phenotype?
4. Make up the other paper bag to represent the male parent. Place five red and five blue alleles in his bag. Notice that he has the same genotype and phenotype as the female.
5. Without looking, pull one allele from the female bag and one allele from the male bag. This represents their first offspring. Begin a chart to record the genotype and phenotype of this offspring. Place the beads back in their original bags.
6. Shake the bags to mix the alleles and repeat the mating process from Step 5. Record the results as before. Repeat until you have produced 20 offspring. It is unlikely that a single set of parents will produce 20 offspring. However, repeating the process 20 times gives an idea of the likelihood for a particular genotype. For example, if you pull out red, blue (*Aa*) 10 times, you can say that the likelihood of a child inheriting this genotype is 10 out of 20, or 50%.
7. Ask your child these questions:
   a. How many of each genotype are present in the offspring?
   b. How many of each phenotype are present?

Linking Literacy

Name: _____ Date: _____

Note-Taking Guide

Use the table below to record important facts from the text. Be sure to record the page number where you found the information.

Fact	Page	Fact	Page

CLOZE-ing in on Science

Name: _____ Date: _____

INSTRUCTIONS: Use the words in the box below to fill in the blanks based on what you have learned about heredity. Words may be used more than once or not used at all.

Word Bank

genes external Heredity chromosomes generation learned internal inherited traits environment

CLOZE 1

_____ is the passage of genetic instructions from parent to offspring. The genetic instructions are found in _____ within the DNA, which is contained in _____ inside the nucleus of the cells. The genetic information is passed to the next _____ by sexual reproduction. This information controls the _____ traits that are passed down. These include _____ characteristics like eye color and _____ characteristics like blood type. These traits are directly passed down and are not affected by the _____ surrounding the organism.

CLOZE-ing in on Science

INSTRUCTIONS: Use the words in the box below to fill in the blanks based on what you have learned about heredity. Words may be used more than once or not used at all.

Word Bank

phenotype	parent	hereditary	DNA
Alleles	pairs	three	genotype

CLOZE 2

Genes are the parts of DNA that contain the _____ information passed down from generation to generation. _____ are the possible variations of the gene that controls a specific trait and always come in _____. Offspring receive one allele from each _____. The _____ of the offspring is the combination of inherited alleles that control a certain trait. The physical appearance of a trait is the offspring's _____.

CLOZE-ing in on Science

INSTRUCTIONS: Use the words in the box below to fill in the blanks based on what you have learned about heredity. Words may be used more than once or not used at all.

Word Bank

alleles	parent	dominant	recessive
	expressed	hidden	

CLOZE 3

The two _____ received from the parents to control a specific trait are not always expressed. Some alleles are _____, meaning they are always expressed in the phenotype. Other alleles are _____, meaning they are only expressed when there is no dominant allele. These alleles may remain _____ for generations and appear in offspring much later.

date _____ period _____ name _____

Introducing Punnett Squares

Circle the correct choice:

egg OR sperm	1. human sex chromosome always contains an X
genotype OR phenotype	2. represented by alleles Tt
dominant OR recessive	3. RR
egg OR sperm	4. sex chromosome determines sex of offspring
truebred OR hybrid	5. short plants (tt) and tall plants (TT)
genotype OR phenotype	6. trait of tallness expressed in a plant
heterozygous OR homozygous	7. Tt
truebred OR hybrid	8. plants used as parents by Mendel; also called "purebred"
heterozygous OR homozygous	9. TT and tt
dominant OR recessive	10. when alleles tt are present, the plant is short

T = tall
t = short

P x P	T	T
t		
t		

F1 x F1	T	t
T		
t		

number of TT =
number of Tt =
number of tt =
genotypic ratio =

number of TT =
number of Tt =
number of tt =
genotypic ratio =

# of tall plants =
# of short plants =
phenotypic ratio =

# of tall plants =
# of short plants =
phenotypic ratio =

R = round seeds
r = wrinkled seeds

P x P	R	R
r		
r		

F1 x F1	R	r
R		
r		

number of RR =
number of Rr =
number of rr =
genotypic ratio =

number of RR =
number of Rr =
number of rr =
genotypic ratio =

# of plants with round seeds =
# of plants with wrinkled seeds =
phenotypic ratio =

# of plants with round seeds =
# of plants with wrinkled seeds =
phenotypic ratio =

Y = yellow seeds
y = green seeds

P x P	Y	Y
y		
y		

F_1 x F_1	Y	y
Y		
y		

number of YY =
number of Yy =
number of yy =
genotypic ratio =

number of YY =
number of Yy =
number of yy =
genotypic ratio =

# of plants with yellow seeds =
# of plants with green seeds =
phenotypic ratio =

# of plants with yellow seeds =
# of plants with green seeds =
phenotypic ratio =

Name: _____ Date: _____

Heredity

Studying genetics has a multitude of benefits. It helps scientists identify genetic markers for certain diseases in humans and animals, assists farmers in establishing hardier crops, and predicts patterns of inheritance and indicators in family lines. Inherited traits include expressed external characteristics such as eye color and hair color, and internal characteristics such as blood type.

Use the following information to answer questions 1–5:

A Punnett square can assist us in predicting the appearance of certain traits in plants and animals that reproduce sexually.

1. In 1960, a scientist named Gregor Mendel used pea plants to determine the dominance of certain traits. In one of his experiments, he looked at the inheritance of pod color. Construct a Punnett square for a pea plant with YY phenotype for a yellow pod cross-pollinated with a pea plant with GG phenotype for a green pod.

X	G	G
Y		
Y		

2. If the Y (yellow pod) allele is dominant over the G (green pod) allele, what percent of offspring will have a yellow pod? What would their genotype be?

X		

3. Suppose two of these offspring were cross-pollinated. Create a Punnett square to show the potential combinations of genotypes for pod color.

X		

4. Calculate the percentages of each genotype. What percentage will have a yellow pod phenotype?

5. Suppose the cross-pollination produced 20 offspring. How many of those offspring could be predicted to have green seed pods?

Math Connections

Use the following information to answer questions 6–11:

Punnett squares can help us predict the probability of certain traits being passed down family lines. Suppose your maternal grandparents had a phenotype of brown hair with genotypes of Bb and BB. Your paternal grandfather has brown hair (Bb,) and your paternal grandmother has blonde hair (bb.)

6. Construct the Punnett squares that represent the possibilities of genotypes for your parents' hair color.

Mom

X	B	b
B		
B		

Dad

X	B	b
b		
b		

7. What are the possible genotypes for your mother's hair color? Your father's hair color?

8. Knowing that each parent has only two possible combinations, construct the Punnett squares that represent the possibilities of their offspring's hair color.

X		

X		

X		

X		

9. Blonde hair is produced by inheriting double recessive alleles (bb) from one's parents. What is the probability of their offspring having blonde hair?

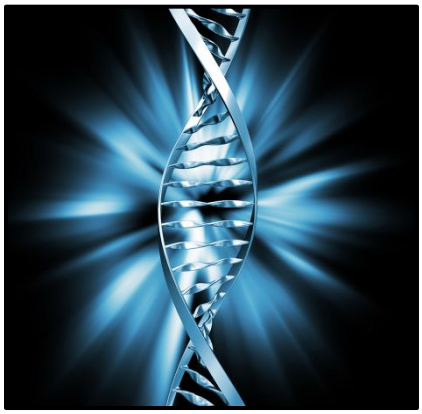
10. What percentage of their offspring will have a BB genotype for brown hair?

11. How likely is it that the offspring will have brown hair? (Likely, Unlikely, Certain, or Impossible) Support your answer with mathematical reasoning.

Reading Science

Name: _____ Date: _____

The Father of Modern Genetics



1 Between 1856 and 1863, Gregor Mendel made over 29,000 experiments in a monastery garden. This curious and observant priest was an avid gardener. He spent many hours gardening. He noticed that the same type of plants would grow in highly predictable ways. What he found out is that heredity happens in a foreseeable manner. Heredity is the passing of traits from parent to offspring. No one noticed his work until 40 years after his death. Scientists found it again while trying to figure out how traits are passed from one generation to another. Our understanding of heredity is built on his work.

2 Mendel grew vegetables in the monastery garden. He spent many hours growing peas. Some peas were tall plants. He noticed, however, that others were short plants. At the time, most people believed in blended inheritance. If one parent is tall and one is short, blended inheritance predicts a child of medium height.

3 However, Gregor Mendel was very observant. Mendel mixed purebred tall and purebred short peas. He saw that they only produced tall peas. Blended inheritance theory predicts peas somewhere in-between in height. That never happened. In fact, a mix of short and tall peas always produced tall peas. The tall trait always won over the short trait. This made no sense. How could short peas keep showing up if it were so easy to erase the short trait? This mystery was solved when the first generation of offspring (F_1) were mixed. That usually produced three tall plants and one short plant. The second generation (F_2) showed that hidden traits carry on to future generations.

4 Traits are controlled by genes. Different forms of genes are called alleles. Hair color is determined by genes. Red hair is a particular allele of the hair color gene. Each organism inherits two possibilities for each trait. This is called its genotype. Some of these possibilities are expressed, or observable. If they are visible, they are called phenotypes. Some of these possibilities are not expressed. They are recessive, or hidden by the dominant allele. Even if an allele is not visible because it is recessive, it is still present. Like the short trait in impure pea plants, it is hiding in the genotypes. The recessive allele is waiting to be matched with another recessive allele and become visible again.

Reading Science

5 The discovery of recessive alleles changed how we thought about heredity. Now a red-headed child born to brown-haired parents could be explained. Each brown-haired parent could carry both the brown-hair and red-hair allele. The brown-hair allele is dominant. Thus, the parents would each have brown hair. They would still be able to pass on their recessive red-hair allele. Both could pass on the red-hair allele to the same offspring. That child would have red hair.

6 Generations may pass before recessive alleles are matched with another to become phenotypes. Recessive alleles explain many inherited disorders like sickle cell anemia and Huntington's disease. Inherited traits had seemed like surprises from nature. We can now calculate the chance that an offspring will have a certain trait. We can do that using a chart called Punnett Square. We must start with the genotype of the parents. A Punnett Square shows all the combinations of alleles possible for offspring of those parents. Before Mendel's discovery, no one could have imagined this was possible. Mendel is now called the Father of Genetics. It is unfortunate that he never learned how important his work would be for science.

Reading Science

1 Which words in the story help the reader understand the meaning of the word **avid** in paragraph 1?

A "What he found out"

B "Many hours gardening"

C "This curious and observant"

D "He noticed"

2 Eye color is also determined by genes. Brown eyes are dominant, and blue eyes are recessive. What must be true for two brown-eyed parents to produce a blue-eyed child?

A One person passes on the blue-eye allele.

B They each pass on the blue-eye allele.

C One person's parents are blue-eyed.

D One person's grandparents are blue-eyed.

3 What can the reader reasonably conclude based on the information in this passage?

A Gregor Mendel was well paid for his research.

B Gregor Mendel noticed other things about peas.

C Gregor Mendel won a Nobel Prize for his work.

D Gregor Mendel hated gardening.

4 What can a Punnett Square be used to determine?

A the possible combinations of alleles in offspring

B what an offspring will look like

C the height of offspring

D genetic heritage

5 Which words in the story help the reader understand the meaning of the word **foreseeable** in paragraph 1?

A "Same type of plants"

B "No one noticed"

C "The passing of traits"

D "Highly predictable ways"

6 What will the result be if a purebred tall pea plant is mixed with a purebred short pea plant?

A a short pea plant. due to chance

B a short pea plant, because short is the dominant allele

C a tall pea plant, because tall is the dominant allele

D a tall pea plant. due to chance

Assessment: Heredity

1 Heredity is the passage of what from parent to offspring?

A Genetic material

B Oxygenated blood

C Digestive enzymes

D Connective tissue

---

2 A gene is best described as –

A the release of energy.

B a unit of heredity.

C the waste produced by cells.

D a collection of adaptations.

---

3 The inherited traits of an organism are governed by –

A leukocytes.

B genes.

C cytoplasm.

D enzymes.

---

4 The hereditary information in animal and plant cells is located on the chromosomes, which the cells store in the –

A vacuoles.

B nucleus.

C cytoplasm.

D ribosomes.

5 What structure in a cell contains the genetic information?

A Lysosome

B Ribosome

C Nucleus

D Mitochondria

---

6 Recessive genes are expressed under which of the following conditions?

A Every time they are found in an organism.

B In green plants that reproduce through seeds.

C When asexual organisms produce a pair of offspring.

D Only in the absence of dominant genes for the same trait.

---

7 Heredity defines the passage of genetic material from –

A parent to child.

B sibling to sibling.

C mate to mate.

D predator to prey.

---

8 Recessive traits are expressed –

A in one quarter of all offspring produced.

B always, in all members of the population.

C only when the dominant gene is not present.

D if the trait is carried by the male parent.

---

9 A gene can be best described as a unit of –

A metabolism.

B circulation.

C heredity.

D digestion.

10 Genetic material is primarily responsible for –

A removing cell waste.

B governing inherited traits.

C creating new enzymes.

D participating in digestion.

---

11 Heredity is best described as the –

A passage of genetic information from one generation to the next.

B movement of nutrients through the digestive system.

C creation of new blood cells to replace old blood cells.

D removal of waste products from processes within each cell.

---

12 On what structures are genes located?

A Chromosomes

B Lysosomes

C Ribosomes

D Golgi bodies

---

13 Which of the following statements accurately denotes the frequency of expression of dominant and recessive traits?

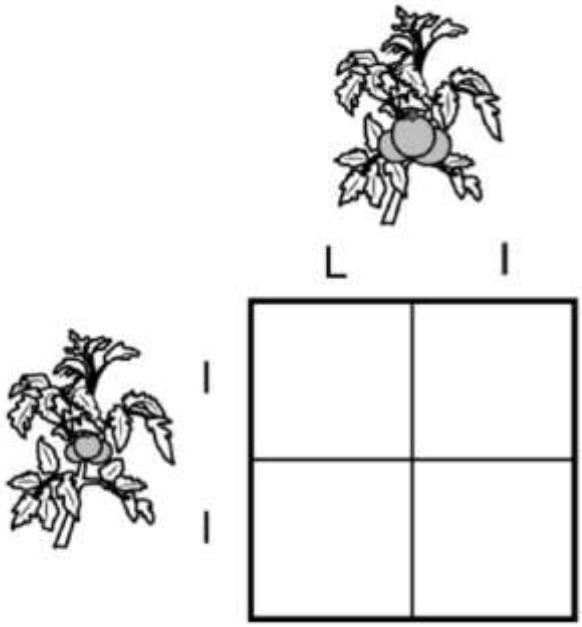
A Dominant traits = always / Recessive = never

B Dominant traits = never / Recessive = sometimes

C Dominant traits = always / Recessive = sometimes

D Dominant traits = sometimes / Recessive = sometimes

14 Isaiah has started growing tomatoes in his backyard. He will conduct a series of experiments to determine which genetic crosses will have the greatest change of producing large tomatoes.



The gene for a large-size fruits (*L*) in a tomato plant is dominant over the gene for small-size fruits (*l*). In a cross between a heterozygous parent plant with a homozygous recessive parent plant, we can predict that what percentage of the offspring will produce large fruits?

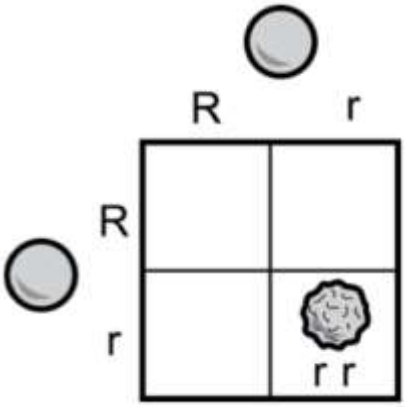
A 100%

B 50%

C 75%

D 25%

15 A Punnett square showing the cross between two pea plants is shown. In pea plants, the smooth coat allele (R) is dominant over the wrinkled coat allele (r).



One part of the Punnett square is filled in, but the remainder is blank. Which of the following best describes the correct method for filling in the remainder of the squares?

A RR =  Rr =  Rr = 

B RR =  Rr =  Rr = 

C RR =  Rr =  Rr = 

D RR =  Rr =  Rr =