Chapter 6

Gregor Mendel and Genetics Worksheets

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- **Lesson 6.1: Mendel's Investigations**
- **Lesson 6.2: Mendelian Inheritance**

6.1 Mendel's Investigations

Lesson 6.1: True or False

Name_____ **Class**_____ **Date**_____

Write true if the statement is true or false if the statement is false.

_____ 1. A homozygous individual could have a *Bb* genotype.

_____ 2. In Mendel's experiments, purple flowers are dominant over white flowers.

_____ 3. Heredity is the science of genetics.

_____ 4. In Mendel's initial experiments, white flowers disappeared after the first parental crosses.

_____ 5. It was his knowledge of genes that allowed Mendel to interpret his data correctly.

_____ 6. Having naturally light or dark skin is part of your phenotype.

_____ 7. Different alleles account for much of the variation in the characteristics of organisms.

_____ 8. Mendel showed that factors controlling different characteristics are inherited independently.

_____ 9. Mendel came up with the idea that two factors control a characteristic, such as pod color.

_____ 10. Mendel developed three laws of inheritance.

_____ 11. The expression of an organism's phenotype produces its genotype.

_____ 12. After he published his work, Mendel achieved great fame among scientists.

_____ 13. Through his experiments, Mendel was able to prove some aspects of the blending theory of inheritance.

_____ 14. A *Dd* genotype has two different alleles.

_____ 15. Flowers are the reproductive organs of plants.

Lesson 6.1: Critical Reading

Name_____ Class_____ Date_____

Read these passages from the text and answer the questions that follow.

Mendel's First Set of Experiments

At first, Mendel experimented with just one characteristic at a time. He began with flower color. As shown in the figure below, Mendel cross-pollinated purple- and white-flowered parent plants. The parent plants in the experiments are referred to as the P (for parent) generation.
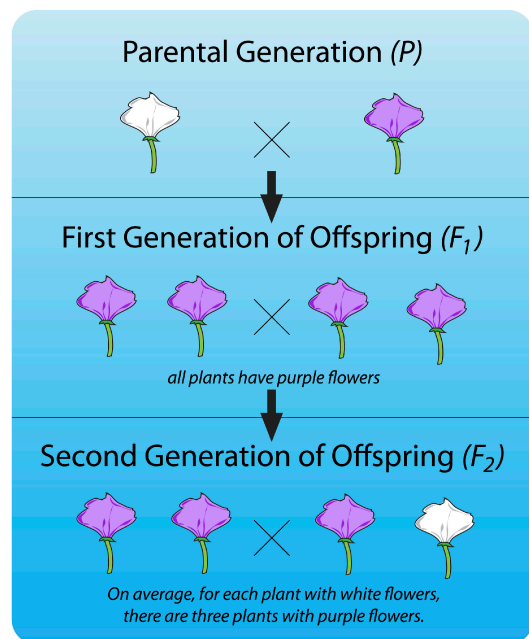
This diagram shows Mendel's first experiment with pea plants. The F1 generation results from cross-pollination of two parent (P) plants. The F2 generation results from self-pollination of F1 plants. *(Image courtesy of CK-12 Foundation and under the Creative Commons license CC-BY-NC-SA 3.0.)*

F1 and F2 Generations

The offspring of the P generation are called the F1 (for filial, or "offspring") generation. As you can see from the figure above, all of the plants in the F1 generation had purple flowers. None of them had white flowers. Mendel wondered what had happened to the white-flower characteristic. He assumed some type of inherited factor produces white flowers and some other inherited factor produces purple flowers. Did the white-flower factor just disappear in the F1 generation? If so, then the offspring of the F1 generation — called the F2 generation — should all have purple flowers like their parents. To test this prediction, Mendel allowed the F1 generation plants to self-pollinate. He was surprised by the results. Some of the F2 generation plants had white flowers. He studied hundreds of F2 generation plants, and for every three purple-flowered plants, there was an average of one white-flowered plant.

Law of Segregation

Mendel did the same experiment for all seven characteristics. In each case, one value of the characteristic disappeared in the F1 plants and then showed up again in the F2 plants. And in each case, 75 percent of F2 plants had one value of the characteristic and 25 percent had the other value. Based on these observations, Mendel formulated his first law of inheritance. This law is called the **law of segregation**. It states that there are two factors controlling a given characteristic, one of which dominates the other, and these factors

separate and go to different gametes when a parent reproduces.

Questions

1. What did Mendel do in his first experiment?

2. What was the outcome of the F1 generation in Mendel's first experiment?

3. What was the outcome of the F2 generation in Mendel's first experiment?

4. Did Mendel repeat his initial experiment with other characteristics? What were his results?

5. Explain the law of segregation. Discuss the reasoning Mendel used to develop this law.

Lesson 6.1: Multiple Choice

Name_____ Class_____ Date_____

Circle the letter of the correct choice.

1. Why did Mendel choose to work with the garden pea plant?

    (a) Because the pea plant is easy to work with.
    (b) Because pea plants are fast growing.
    (c) Because the pea plant has a number of characteristics, each with only two forms.
    (d) all of the above

2. In Mendel's first experiment

    (a) the F1 displayed all purple-flowered plants.
    (b) the F1 displayed all white-flowered plants.
    (c) the F2 displayed all purple-flowered plants.
    (d) the F2 displayed half purple-flowered and half white-flowered plants.

3. The law of independent assortment states that

    (a) two factors of the same characteristic separate into different gametes.
    (b) there are dominant and recessive factors.
    (c) factors controlling different characteristics are inherited independently of each other.
    (d) there are two factors that control inheritance.

4. Looking at your dog will give information concerning

    (a) the dog's genotype.
    (b) the dog's phenotype.
    (c) the dog's recessive alleles.
    (d) the dog's heterozygous alleles.

5. Which sentence is correct?

    (a) Different alleles of the same gene are located at the same locus on different homologous chromosomes.
    (b) Different alleles of the same gene are located at different loci on different homologous chromosomes.
    (c) Different genes of the same alleles are located at the same locus on different homologous chromosomes.
    (d) Different alleles of the same gene are located at different loci on the same chromosome.

6. An *Aa* individual

    (a) has a homozygous genotype.
    (b) has a heterozygous phenotype.
    (c) has a heterozygous genotype.
    (d) has a homozygous phenotype.

7. In Mendel's initial experiments, an example of the F2 generation would be

    (a) 75 round seed plants to 25 wrinkled seed plants
    (b) 75 green seed plants to 25 yellow seed plants
    (c) 75 white-flowered plants to 25 purple-flowered plants
    (d) all of the above

8. Which of the following is part of the law of segregation? (1) there are two factors controlling a given characteristic, (2) one factor is dominant over the other factor, (3) the two factors separate into different gametes.

(a) 1 and 2
(b) 1 and 3
(c) 2 and 3
(d) 1, 2, and 3

Lesson 6.1: Vocabulary I

Name_____ Class_____ Date_____

Match the vocabulary word with the proper definition.

Definitions

_____ 1. the science of heredity

_____ 2. an organism with two alleles of the same type

_____ 3. an organism with two different alleles

_____ 4. different version of a gene

_____ 5. states that there are two factors controlling a given characteristic, one of which dominates the other, and these factors separate and go to different gametes

_____ 6. states that factors controlling different characteristics are inherited independently of each other

_____ 7. expressed allele in a heterozygote

_____ 8. allele that is not expressed in a heterozygote

_____ 9. the offspring of cross-pollination

_____ 10. fertilization process in the sexual reproduction of plants

_____ 11. the alleles an individual inherits

_____ 12. the expression of an organism's genotype

Terms

a. allele

b. dominant allele

c. genetics

d. genotype

e. heterozygote

f. homozygote

g. hybrid

h. law of independent assortment

i. law of segregation

j. phenotype

k. pollination

l. recessive allele

Lesson 6.1: Vocabulary II

Name_____ **Class**_____ **Date**_____

Fill in the blank with the appropriate term.

1. Mendel's discoveries formed the basis of _____, the science of heredity.

2. A(n) _____ is an alternative form of a gene.

3. _____ plants are a good choice to use by Mendel because they are fast growing and easy to raise.

4. Characteristics of organisms are controlled by _____ on chromosomes.

5. The law of _____ states that factors controlling different characteristics are inherited independently of each other.

6. In Mendel's first experiment, the F1 generation flowers were all _____ in color.

7. In all of Mendel's first experiments, in the F2 generation, for every _____ purple-flowered plants, there was an average of _____ white-flowered plant.

8. *BB* would be a _____ genotype.

9. The _____ refers to the organism's characteristics, such as purple or white flowers.

10. *Cc* would be a _____ genotype.

11. The position of a gene on a chromosome is called its _____.

12. The law of _____ states that there are two factors controlling a given characteristic and these factors separate and go to different gametes.

Lesson 6.1: Critical Writing

Name_____ **Class**_____ **Date**_____

Thoroughly answer the question below. Use appropriate academic vocabulary and clear and complete sentences.

Describe dominant and recessive alleles, providing examples from Mendel's work.

6.2 Mendelian Inheritance

Lesson 6.2: True or False

Name_____ **Class**_____ **Date**_____

Write true if the statement is true or false if the statement is false.

_____ 1. The rules of probability apply to genetics.

_____ 2. If an individual has a *Gg* genotype, half of his gametes should have the *G* allele, and the other half should have the *g* allele.

_____ 3. A Punnett square is a chart that allows you to easily determine the expected genotypes in the offspring of two parents.

_____ 4. In a cross between two homozygous dominant individuals, 25% of the offspring may have the recessive phenotype.

_____ 5. A parent cell makes gametes through the process of mitosis.

_____ 6. It is entirely likely for a gene to have more than two alleles.

_____ 7. Incomplete dominance occurs when the recessive allele is not completely dominant.

_____ 8. Your height and skin color are not just due to your genes.

_____ 9. In a cross between an individual homozygous dominant for two characteristics and an individual homozygous recessive for the same characteristics, all of the F1 offspring will have the dominant phenotypes.

_____ 10. All genetics is fairly straightforward and follows the patterns Mendel observed in pea plants.

_____ 11. Codominance occurs when, essentially, there is no recessive allele.

_____ 12. If one parent is *MM* and the other parent is *mm*, the only possible phenotype of their offspring is *Mm*.

_____ 13. The probability of inheriting either an A, B, or O allele for blood type from your parent is 33.33%.

_____ 14. In any cross between two heterozygous parents, half the offspring should have the dominant phenotype and half the offspring should have the recessive phenotype.

_____ 15. When you toss a coin in the air, it should turn up tails 50% of the time.

Lesson 6.2: Critical Reading

Name_____ **Class**_____ **Date**_____

Read these passages from the text and answer the questions that follow.

Using a Punnett Square

A **Punnett square** is a chart that allows you to easily determine the expected percents of different genotypes in the offspring of two parents. An example of a Punnett square for pea plants is shown below. In this example, both parents are heterozygous for flower color (*Bb*). The gametes produced by the male parent are at the top of the chart, and the gametes produced by the female parent are along the side. The different possible combinations of alleles in their offspring are determined by filling in the cells of the Punnett square with the correct letters (alleles).

Punnett Square. This Punnett square shows a cross between two heterozygotes. Do you know where each letter (allele) in all four cells comes from? *(Image courtesy of CK-12 Foundation and under the Creative Commons license CC-BY-NC-SA 3.0.)*

Predicting Offspring Genotypes

In the cross shown in the figure above, you can see that one out of four offspring (25 percent) has the genotype *BB*, one out of four (25 percent) has the genotype *bb*, and two out of four (50 percent) have the genotype *Bb*. These percents of genotypes are what you would expect in any cross between two heterozygous parents. Of course, when just four offspring are produced, the actual percents of genotypes may vary by chance from the expected percents. However, if you considered hundreds of such crosses and thousands of offspring, you would get very close to the expected results — just like tossing a coin.

Predicting Offspring Phenotypes

You can predict the percents of phenotypes in the offspring of this cross from their genotypes. *B* is dominant to *b*, so offspring with either the *BB* or *Bb* genotype will have the purple-flower phenotype. Only offspring with the *bb* genotype will have the white-flower phenotype. Therefore, in this cross, you would expect three out of four (75 percent) of the offspring to have purple flowers and one out of four (25 percent) to have white flowers. These are the same percents that Mendel got in his first experiment.

Questions

You may use Punnett squares to answer the following questions.

1. What are the percents of genotypes you would expect in any cross between two heterozygous parents? Use the letters *B* and *b* in your answer.

2. What are the percents of phenotypes you would expect in any cross between two heterozygous parents? Use the genotypes and phenotypes in the reading above.

3. Predict the percents of genotypes you would expect in any cross between a homozygous dominant parent and a homozygous recessive parent.

4. Predict the percents of phenotypes you would expect in any cross between a homozygous dominant parent and a homozygous recessive parent.

5. Predict the percents of genotypes and phenotypes you would expect in any cross between a heterozygous parent and a homozygous recessive parent.

Lesson 6.2: Multiple Choice

Name_____ **Class**_____ **Date**_____

Circle the letter of the correct choice.

1. What is the inheritance pattern when both alleles are expressed equally in the phenotype of a heterozygote?

   (a) multiple alleles
   (b) incomplete dominance
   (c) codominance
   (d) polygenic characteristics

2. What is the inheritance pattern when the dominant allele is not completely dominant?

   (a) multiple alleles
   (b) incomplete dominance
   (c) codominance
   (d) polygenic characteristics

3. What is the inheritance pattern associated with the ABO blood type in humans?

   (a) multiple alleles
   (b) incomplete dominance
   (c) codominance
   (d) polygenic characteristics

4. In a cross between a homozygous dominant parent and a homozygous recessive parent, what is the chance of the offspring having a heterozygous genotype?

   (a) 25%
   (b) 50%
   (c) 75%
   (d) 100%

5. In a cross between a homozygous dominant parent and a homozygous recessive parent, what is the chance of the offspring having the dominant phenotype?

   (a) 25%
   (b) 50%
   (c) 75%
   (d) 100%

6. In a cross between a homozygous dominant parent and a heterozygous parent, what is the chance of the offspring having a heterozygous genotype?

   (a) 25%
   (b) 50%
   (c) 75%
   (d) 100%

7. In a cross between a homozygous dominant parent and a heterozygous parent, what is the chance of the offspring having the dominant phenotype?

   (a) 25%
   (b) 50%
   (c) 75%
   (d) 100%

8. In a cross involving two heterozygous parents, which is the chance of the offspring having the dominant phenotype?

   (a) 25%
   (b) 50%
   (c) 75%
   (d) 100%

Lesson 6.2: Vocabulary I

Name_____ Class_____ Date_____

Match the vocabulary word with the proper definition.

Definitions

_____ 1. occurs when the dominant allele is not completely dominant

_____ 2. closely associated with appearance

_____ 3. an example of a characteristic due to multiple alleles

_____ 4. controlled by more than one gene

_____ 5. the expressed allele in a heterozygote

_____ 6. cell division involved in gamete formation

_____ 7. used to determine the expected percents of different genotypes in offspring

_____ 8. an alternative form of a gene

_____ 9. chance that a certain event will occur

_____ 10. only expressed when the other allele is absent

_____ 11. occurs when both alleles are expressed equally in the phenotype of the heterozygote

Terms

a. ABO blood type

b. allele

c. codominance

d. dominant allele

e. incomplete dominance

f. meiosis

g. phenotype

h. polygenic characteristic

i. probability

j. Punnett square

k. recessive allele

Lesson 6.2: Vocabulary II

Name_____ **Class**_____ **Date**_____

Fill in the blank with the appropriate term.

1. If you toss a coin twice, you might expect to get _____ head and _____ tail.

2. A Punnett square allows you to determine the expected percents of different _____ in the offspring of two parents.

3. _____ is when both alleles are expressed equally in the phenotype of the heterozygote.

4. _____ is the chance that a certain event will occur.

5. Paired alleles always separate and go to different gametes during _____.

6. If one parent is heterozygous and the other parent is homozygous recessive, the probability that their child will be homozygous recessive is _____.

7. If a parent has a *Dd* genotype, the probability of their child inheriting a *d* allele from that parent is _____.

8. _____ dominance occurs when the dominant allele is not completely dominant.

9. Sometimes an individual's phenotype is not just due to his or her genes, but also _____-influences.

10. A cross between a homozygous dominant individual and a homozygous recessive individual will always result in a _____ individual.

11. ABO blood type in humans is a characteristic due to multiple _____.

12. When a *Bb* pea plant forms gametes, the *B* and *b* alleles segregate and go to different _____-_____.

Lesson 6.2: Critical Writing

Name_____ **Class**_____ **Date**_____

Thoroughly answer the question below. Use appropriate academic vocabulary and clear and complete sentences.

Draw a Punnett square of a cross between a homozygous dominant individual and a heterozygous individual.