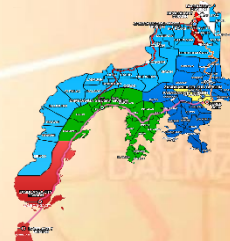




Republic of the Philippines
Department of Education
Regional Office IX, Zamboanga Peninsula



Zest for Progress
Zeal of Partnership

Science Grade 8

Quarter 4 - Module 4

How Do I Look Like?



Name of Learner: _____

Grade & Section: _____

Name of School: _____



What I Need to Know

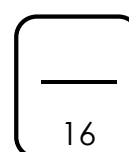
This module was designed, developed, and written with you. It is here to help and guide you to master the concepts behind **how to predict phenotypic expressions of traits following the simple patterns of inheritance (S8LT-IVf-18)**. The language used easily recognizes the diverse vocabulary level of students. The lessons are based and arranged to follow the course's standard sequence or MELC's provided by the DepEd. After answering this module, you are expected to:

1. describe the law of segregation;
2. predict the phenotype and genotype of the sample organism; and
3. interpret the ratio of the phenotypic expression.

Have you seen children who look very much like their parents? Sometimes you hear people say that a child has the father's height, the mother's nose, the grandfather's eyes, and the grandmother's mouth. Compare your facial features and other characteristics with those of the other members of your family. Are there differences or variations in characteristics among you? What characteristics or traits were transmitted to you by your parents? How were they transmitted? The transmission of characteristics from parents to offspring is known as **heredity**.



What's In



Activity 1: PMAT

1. Differentiate meiosis from mitosis by completing the table below.

Basis of Comparison	Mitosis	Meiosis
1. Number of daughter cells produced		
2. Number of chromosomes is halved. (Yes/No)		
3. Pairing of homologous chromosomes take place. (Yes/No)		
4. The daughter cells produced are always identical in terms of genetic material. (Yes/No)		

2. Label the following stages of Meiosis I and II.

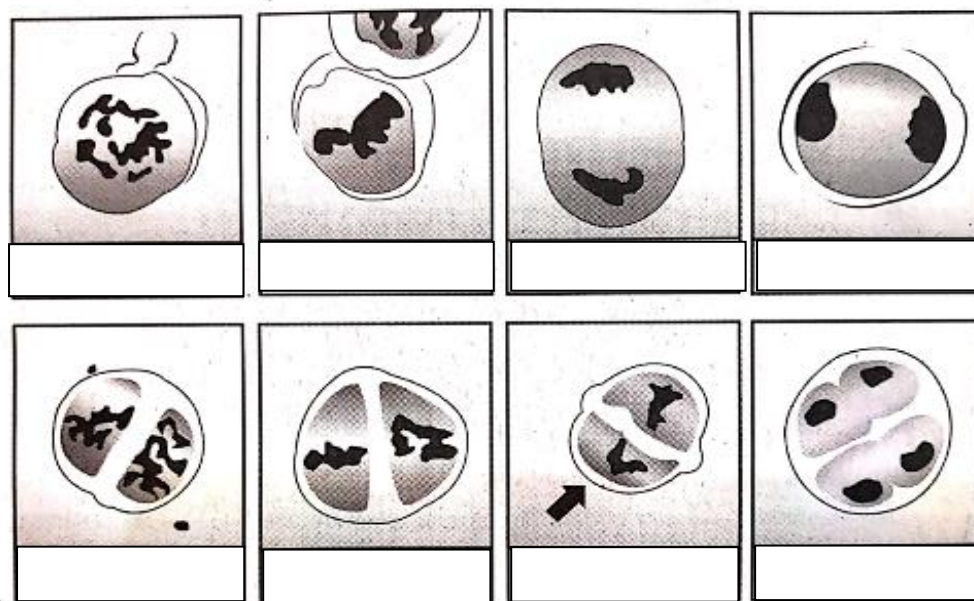
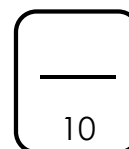


Figure 1. Stages of Meiosis
(Retrieved from Science 8 Learner's Material)



What's New

Activity 2: Tossing coins and probability



Objectives:

After performing this activity, the students should be able to predict the outcomes of crosses based on the principle of probability.

Materials Needed:

- 2 coins
- A piece of paper
- A pencil or pen

Procedure:

1. On a piece of paper, make a chart like the one given below.
(2pts. each)

	Heads (H)	Tail (h)
Total		
Percentage		
Ratio of the combinations		

2. Toss a coin. If head comes up, mark column 1; if a tail, then mark column 2. Make 50 tosses of the coin.

3. Get the total number of times each face of the coin appears. Calculate the percentage of the appearance of each face. To compute the percentage:

$$\text{Percentage of appearance (face)} = (\text{total} / 50) \times 100\%$$

Q1. What is the ratio of heads to tails? (2 pts.) _____

4. Let us assume that the coin represents the genotype of parents, and each face is an allele, with the head as the dominant allele (H) and the tail as the recessive allele (h).

Q2. What is the ratio of the gametes of this parent with heterozygous genotype? (2pts.) _____



What is it

Mendelian Genetics

Gregor Mendel was an Augustinian Monk in a monastery in Brunn, Austria- Hungarian Empire (now Brno, Czech Republic). He was interested in investigating how individual traits were inherited. Mendel chose the garden pea (*Pisum sativum*) for his experiments.

When he has pure-breeding plants, Mendel began cross-pollinating peas with contrasting traits. The pure-breeding peas constituted the **parental or P₁ generation**. All offspring of these crosses resembled one another. The offspring of the parental cross is called the **first filial (F₁) generation**. In Mendel's experiments, the F₁ generations are also called **hybrids** because they resulted from a cross between two pure breeding plants.

Table 1 shows the six pure-breeding crosses.

Table 1. Results of Mendel's crosses between pure-breeding pea plants.

Characters Studied	Parents		First Filial (F₁) Generations
Seed Shape	Round	Wrinkled	Round
Seed Color	Green	Yellow	Yellow
Seed coat color	Colored	White	Colored
Pod Shape	Inflated	Constricted	Inflated
Pod Color	Green	Yellow	Green
Stem length	Long	Short	Long

When the plants from the F₁ generation were crossed with each other or self-pollinated, the offspring (**F₂ or the second filial generation**) were of two types.

Based on the results of his experiments, Mendel hypothesized that there was a factor in the plants which controlled the appearance of a trait. These factors are what we call **genes** today.

Since two alternative expressions of a trait (e.g., round or wrinkled seed) were possible, he hypothesized that traits were controlled by a pair of genes, now called **alleles**.

Table 2. Results of Mendel's crosses between hybrid plants.

Characters Studied	Hybrid	F₂ Generation Produced by self- Pollinating F₁ Hybrids.		Observed Ratio
Seed Shape	Round	Round	Wrinkled	2.96:1
Seed Color	Yellow	Green	Yellow	3.01:1
Seed coat color	Colored	Colored	White	3.15:1
Pod Shape	Inflated	Inflated	Constricted	2.95:1
Pod Color	Green	Green	Yellow	2.82:1
Stem length	Long	Long	Short	2.84:1

Based on the results for the f₁ generations, the trait for round seed is the **dominant trait**. The trait of wrinkled seeds, which did not appear in the F₁ generation, is called the **recessive trait**. Its appearance was either prevented or hidden by the dominant trait. This is known as the **principle of dominance**: *The dominant trait dominates or prevents the expression of the recessive traits.*

Law of Segregation

In Mendel's experiments, the pure-breeding parent plants had two identical genes for a trait: round seed= RR, wrinkled seed= rr. Mendel hypothesizes that: *The pair of genes segregate or separate from each other during gamete formations.* This is now known as the **Law of Segregation**.

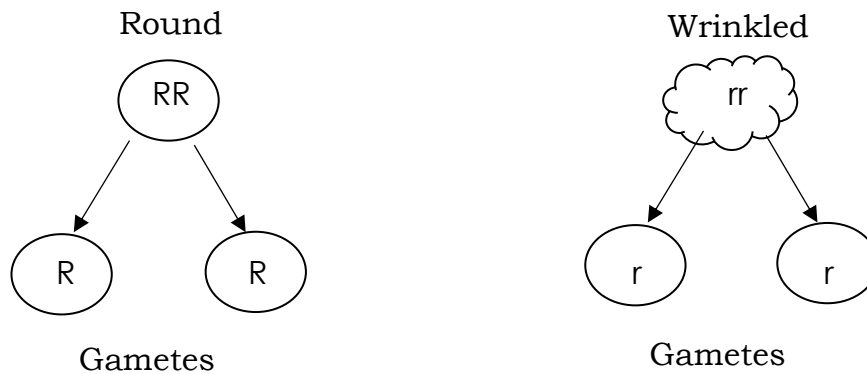


Figure 2. Gamete formation of pure-breeding round- and wrinkled seed-bearing pea plants.

Following Mendel's reasoning, a pure-breed, round seeded parent plant has an allelic combination or **genotype** of RR while a pure breed, wrinkled parent plant has a genotype of rr . Individuals that are pure-breeding for a particular character, therefore, have identical alleles. These individuals have a **homozygous genotype**.

Now recall what we have learned in meiosis. During anaphase 1 of meiosis 1, the chromosome pairs separate and move to opposite poles. Now, remember that a pair of alleles govern a trait. Each allele is found in a chromosome of a chromosome pair. In other words, the chromosomes serve as a vehicle for these alleles. So, when these chromosomes segregate during anaphase I, the alleles they carry also segregate. This becomes the chromosomal basis of Mendel's first law.

At fertilization, when gametes formed during gametogenesis by RR and rr plants unite, all the zygotes will have the genotype Rr . An individual with contrasting alleles (a dominant and recessive allele) for a particular character is said to have a heterozygous genotype. However, Rr individuals will still produce round seeds because of the presence of dominant allele R . These will be just as round as all the seeds produced by the RR parents. The expression of the genotype of an individual for a particular character is referred to as its **phenotype**.

Punnett Square

Mendel's crosses can be recorded in a chart called a Punnett square. The Punnett square helps us to predict the outcome of a given cross. It allows us to determine the possible combinations of genes in a cross. Look at figure 3. How many kinds of genotypes and phenotypes are possible in this cross between Rr (Round) x Rr (Round).

	R	r
R	RR	Rr
r	Rr	rr

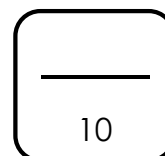
Genotypic Ratio: $\frac{1}{4}$ RR: $\frac{1}{2}$ Rr: $\frac{1}{4}$ rr

Phenotypic Ratio: $\frac{3}{4}$ round: $\frac{1}{4}$ wrinkled

Figure 3. Punnett Square method to solve a hybrid cross.



What's More



Activity 3: Comparing genotypic and phenotypic ratios for a typical Mendelian trait

Objective:

After performing this activity, you should be able to solve for the phenotypic and genotypic ratios of any given cross.

Procedure:

Let D= dominant allele and d= recessive allele, while DD, Dd, and dd represent the homozygous dominant, heterozygous dominant, and homozygous recessive genotype, respectively. For each type of cross, determine the genotypic and phenotypic ratios, respectively. The first cross was already done for you.

Cross	Genotypic Ratio	Phenotypic Ratio
1. DD x DD	100% DD	100 % homozygous dominant
2. DD x Dd		
3. DD x dd		
4. Dd x Dd		
5. Dd x dd		
6. dd x dd		



What I Have Learned

25

Activity 4: Filling up the Punnett square for a dihybrid cross

Objective:

At the end of this activity, you should be able to use a Punnett square when solving for dihybrid crosses.

Procedure:

Given the cross $RrYy \times RrYy$, copy and fill up the Punnett square below. Base your answer to the given questions on the completed diagram.

$\begin{matrix} \text{♀} & \text{♂} \end{matrix}$	RY	Ry	rY	ry
Ry	RRYy			
RY				
rY				
ry				

Q1. What are the male gametes? Female gametes? (2pts.)

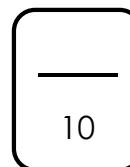
Q2. What proportion of the offspring will have the following phenotype: RY, Ry, rY and ry? (2pts.)

Q3. How many kinds of genotypes will the offspring have? (3pts.)

Q4. What is the probability that an individual will have a genotype of RRyy? RrYy? Rryy? RRYy? (3pts.)



What I Can Do



Activity 5: I can do more!

Directions: Tell whether the statement is true or false based on the result shown in the Punnett square by checking the boxes on the side. Check **YES** if the statement is TRUE and **NO** if the statement is FALSE. (2 points each)

Dominant Allele (B): Blue eyes

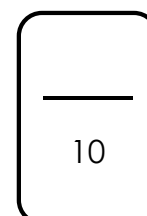
Recessive allele (b): brown eyes

Parental Genotype		♂	
		B	b
♀	B	BB	Bb
	b	Bb	Bb

- | | | |
|--|------------------------------|-----------------------------|
| 1. The father's genotype is homozygous. | <input type="checkbox"/> YES | <input type="checkbox"/> NO |
| 2. The mother has blue eyes. | <input type="checkbox"/> YES | <input type="checkbox"/> NO |
| 3. One of their children has brown eyes. | <input type="checkbox"/> YES | <input type="checkbox"/> NO |
| 4. One of their children's genotype is homozygous. | <input type="checkbox"/> YES | <input type="checkbox"/> NO |
| 5. The father's genotype is heterozygous. | <input type="checkbox"/> YES | <input type="checkbox"/> NO |



Assessment



Set A

Directions. Encircle the letter of the best answer.

- An allele is:
 - A different form gene that controls a certain trait
 - A dominant trait
 - A recessive trait
 - A heterozygous genotypic.
- The pair of genes segregated from each other during gamete formation is known as?
 - Heterozygous genotype
 - Homozygous genotype.
 - Law of segregation
 - Mendelian genetics

3. Genotype refers to the _____ of an individual.
 - A. Actual physical appearances
 - B. Dominant allele
 - C. Genetic makeup
 - D. Recessive allele
4. Gregor Mendel was:
 - A. An English physicist who carried out research with Mendeleev.
 - B. An Australian monk who is interested in investigating elements.
 - C. Interested in investigating how individual traits were inherited
 - D. The father of modern physics.
5. Phenotype refers to the _____ of an individual.
 - A. Actual physical appearance
 - B. Dominant allele
 - C. Genetic make-up
 - D. Recessive allele

For Items 6-10. Complete the Punnett square for a cross between a black chicken (BB) and a white chicken (WW). Give the phenotype and genotype of the offspring in the F₁ generation.

Key:

BB- black

WW- white

BW- checkered

	W	W
B	BW	
B		

Phenotypic ratio: _____

Genotypic ratio: _____

Set B

Directions: Encircle the letter of the best answer

10

1. The chart used by Mendel to determine the possible outcome of genes among offspring given the genotypes of the parents.

- A. Gene chart
- B. Heredity Chart
- C. Phenotypic Chart
- D. Punnett Square

2. The factors that control the appearance of traits.

- A. Alleles B. Chromosomes C. Heredity D. Genes

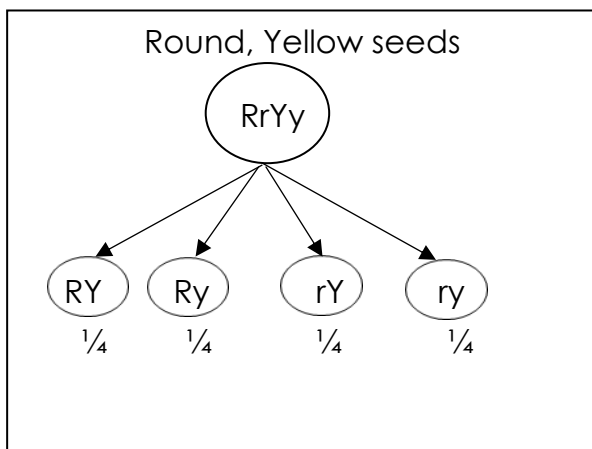
3. If the trait of an organism appeared in the F₁ generation, it is called _____.

- A. Dominant B. Homozygous C. Heterozygous D. Recessive

4. Given that R is dominant trait for round and r is a recessive trait for wrinkled, the cross in parental genotypes of Rr and Rr will have _____ of its phenotypes.

- A. $\frac{3}{4}$ round and $\frac{1}{4}$ wrinkled
B. $\frac{1}{2}$ round and $\frac{1}{2}$ wrinkled
C. $\frac{1}{4}$ round and $\frac{3}{4}$ wrinkled
D. All round

For item number 5 refer to the given diagram.



5. What are the phenotypes of the given organism?

- A. $\frac{1}{2}$ round, $\frac{1}{2}$ wrinkled seed
B. $\frac{1}{4}$ round, $\frac{3}{4}$ wrinkled seed
C. $\frac{3}{4}$ round, $\frac{1}{4}$ wrinkled seed
D. All round.

For items 6-10. What are the possible offspring when you cross homozygous round green pea seed (RV) and homozygous wrinkled pea seed (rv)? Show your solution using a Punnett square.

	RV	RV
rv	RrVv	
rv		

What is the phenotypic ratio of the offspring? _____

What is the genotypic ratio of the offspring? _____



Additional Activities

—
10

Directions: Read the statement below carefully. Indicate whether the statement is true or false. Write **TRUE** if the statement is true and if the statement is **FALSE**, **change the underlined word(s)** to make the statement TRUE. (2 points each)

- _____ 1. Sex cells are also known as gametes.
- _____ 2. Gregor Mendel used a tomato plant for his experimentation in Law of Segregation.
- _____ 3. Genes is the study of heredity and variation.
- _____ 4. Heredity is the transmission of characteristics from parents to offspring.
- _____ 5. The offspring of the parental cross is called the second filial (F₂ generation).

Answer Key- Gr8Q4W4 Science

Q4. 1:4:1:1

Q3. 4

Q2. $\frac{1}{4}$ RY, $\frac{1}{4}$ RY, $\frac{1}{4}$ rY, $\frac{1}{4}$ rY

Q1. Male gametes- rY, rY Female gametes- RY, RY

RY	RY	Ry	rY	ry
RY	RRYY	RRYy	RrYY	RrYy
Ry	RRYY	RRYy	RrYY	RrYy
rY	RrYY	RrYy	rrYY	rrYy
ry	RrYY	RrYy	rrYY	rrYy

What I have Learned

Genotypic Ratio	Phenotypic Ratio
2. $\frac{1}{2}$ DD, $\frac{1}{2}$ Dd	75 % homozygous dominant, 25 % heterozygous dominant
3. 100 % Dd	100 % heterozygous dominant
4. $\frac{1}{4}$ DD, $\frac{1}{2}$ Dd, $\frac{1}{4}$ dd	25 % homozygous dominant, 50 % heterozygous dominant, 25 % homozygous recessive
5. $\frac{1}{2}$ Dd, $\frac{1}{2}$ dd	50 % heterozygous dominant, 50 % homozygous recessive
6. 100 dd	100 % homozygous recessive

What's More

Yes, No

Yes, No

No, Yes

2. 2, 4

Prophase II, Metaphase II, Anaphase II, Telophase II

1. Prophase I, Metaphase I, Anaphase I, Telophase I

What's In

What I Can Do

1. No

2. Yes

3. No

4. Yes

5. Yes

Assessment

Set A

1. A

2. C

3. C

4. C

5. A

	W	
B	BW	BW
B	BW	BW
	W	

Phenotypic ratio- 100 % checkered chicken
Genotypic ratio: 100% BW

SET B

1. D

2. D

3. A

4. A

5. A

	RV	
rv	RrVv	RrVv
rv	RrVv	RrVv
	RV	

Phenotypic ratio- 100 % round green pea
Genotypic ratio: 100% RrVv

ADDITIONAL ACTIVITIES

1. True
2. Garden Pea
3. Genetics
4. True
5. First Filial (F1) generation

References

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