LIVE WORKSHEET – SECOND TERM

SCIENCE - 6TH GRADE (2019-2020)

Answer each question of this workshop with the sources of information that are in the last page of this file.

INTRODUCTION TO GENETICS

1. Genetics is the science of studying how living things pass on characteristics (or traits) and its variations in their cell make-up from one generation to the other. Simply, it is the study of how living things inherit features like eye-color, nose shape, height and even behavior from their parents. Genetics is probably one of the most exciting lessons in biology but at the same time, it can be a bit confusing because there are many new words to learn and understand genetics. Match the following concepts with their definitions:

Dominant allele:	a weaker allele
Allele:	two different genes for the same trait (Example: Tt)
Phenotype:	physical appearance or genetically inherited feature
Heterozygous:	the likelihood of an occurrence
Recessive allele:	stronger allele that may mask a weaker allele
Homozygous:	the passing of traits from parents to offspring
Gene:	the genetic constitution of an organism or the genes that an organism has to determine the phenotype
Probability:	a gene of a particular trait
Trait:	an inherited characteristic of an organism

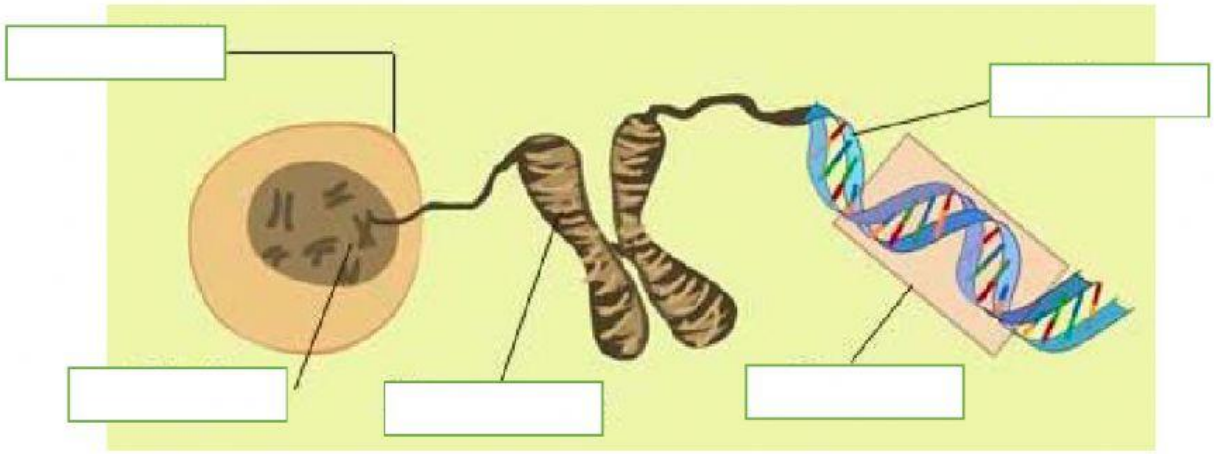
Heredity:	two identical genes for the same trait (Example: TT or tt)
Genotype:	the segment of DNA that determines a particular trait

2. Read the text and complete the diagram.

So, what is a gene?

Genes are instruction manuals in our body. They are molecules in our body that explain the information hidden in our DNA, and supervises our bodies to grow in line with that information. It is believed that each cell in our body contains over 25,000 genes, all working together. These genes carry specific biological codes or information that determine what we inherit from our parents. Genes are also a small section of Deoxyribonucleic Acid (DNA), a chemical that has a genetic code for making proteins for living cells. Proteins are the building blocks for living things. Almost everything in our body, bones, blood and muscles are all made up of proteins, and it is the job of the genes to supervise protein production. Genes are not things we see with our bare eyes. They can only be seen with powerful microscopes, and they are thread-like in nature, found in our chromosomes. The diagram below shows how a gene is represented.

Label the parts of the diagram:



HISTORY OF GENETICS

3. Use the following words to fill in the following passage: Punnett, phenotype, recessive trait, Gregor Mendel, genotype, traits, genes, alleles, dominant trait, and codominance.

The Story of Gregor Mendel

Our story begins in a monastery in Austria in the 1800s. _____, the "father of genetics," conducted many experiments on his garden plants. He was particularly interested in studying pea plants because of their short growing time and many varieties. Mendel noticed that certain _____ in pea plants were passed on from parents to offspring. He also noticed that sometimes a trait seemed to disappear in between generations. He wanted to find out why. After many experiments, in which he crossed plants with different traits, he noticed similar results. He noticed that sometimes traits showed up and other times they did not. For example, when he crossed a true-breeding purple-flowered plant with a true-breeding white-flowered plant, the first generation of plants were all purple. White flowers had disappeared! Mendel called the trait that always showed up the _____. He called the trait that did not show up the _____. When he allowed the plants of the first generation to self-pollinate, the next generation had 75% purple flowers and 25% white flowers. He concluded that each plant had two sets of instructions for each trait, one from each parent. Today we know that _____, found on chromosomes, determine traits. Each gene has two or more different forms called _____. When studying genetics today, we can set up _____ squares. The squares contain the possible allele combinations that might occur when crossing two pea plants. The inherited combination of alleles (PP, pp, or Pp) is called the _____. The organism's appearance, such as flower color, is called the _____. It was later discovered that in certain organisms neither trait was dominant and a mixing or blending of the dominant and recessive trait occurred. In this case, both traits are present. This is called _____. In 1864, Mendel published his results, but unfortunately it wasn't until after he died that he was recognized for his work on genetics.

4. Based on the previous information, fill in the blanks:

A pea plant has _____ and both male and female reproductive organs. These concepts are important to understand Mendel's experiments: Gametes are male and female sex cells. Pollination is the transfer of pollen (_____ gametes) from a _____ reproductive organ to a _____ reproductive organ in a plant. Mendel allowed pollination to occur within the _____ flower

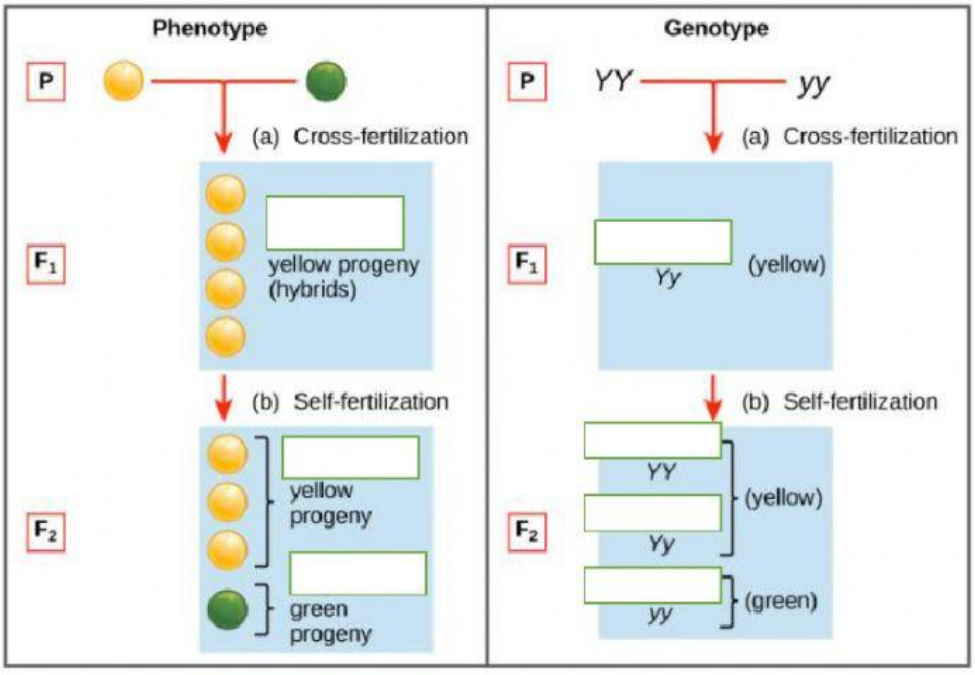
(called _____) or between _____ flowers for his experiments (called _____). Fertilization occurs when the male gamete unites with the female gamete to form a _____ (a fertilized cell). In the case of pea plants, the _____ becomes a _____. Mendel conducted crosses between pea plants to compare traits: 1. _____: when only one trait is compared at a time (like eye color) and 2. _____: when two traits are compared at a time (like eye & hair color). There are symbols to represent the different generations analyzed: P1= _____ Parental generation (parents), F1= _____ First filial generation (children), F2= _____ Second filial generation (grandchildren).

MENDEL'S LAWS OF INHERITANCE

5. Read the text and find the percentages for each situation:

LAW OF DOMINANCE

Mendel came up with a model for the inheritance of individual characteristics, such as flower color. In Mendel's model, parents pass along "heritable factors," which we now call **genes**, that determine the traits of the offspring. Each individual has two copies of a given gene, such as the gene for seed color (*Y* gene) shown below. If these copies represent different versions, or **alleles**, of the gene, one allele—the **dominant** one—may hide the other allele—the **recessive** one. For seed color, the dominant yellow allele *Y* hides the recessive green allele *y*. Find the percentages for each situation:

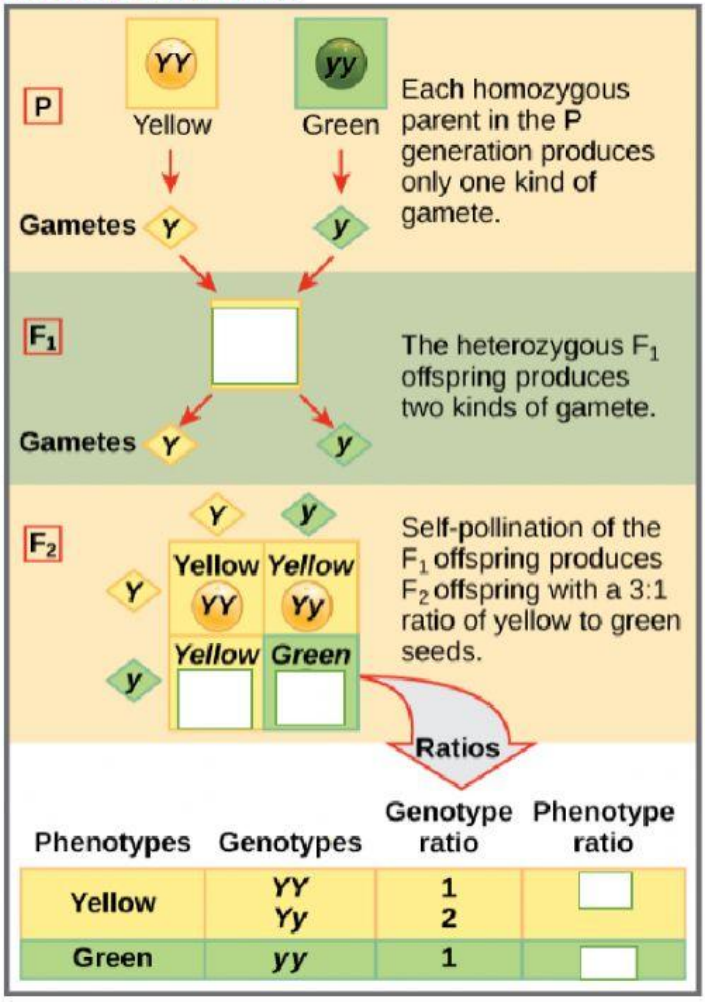


6. Read the text and identify the alleles of each zygote:

LAW OF SEGREGATION

The law of dominance doesn't explain why Mendel saw the exact patterns of inheritance he did. In particular, it doesn't account for the **3:1 ratio**. For that, we need Mendel's law of segregation.

According to the **law of segregation**, only one of the two gene copies present in an organism is distributed to each gamete (egg or sperm cell) that it makes, and the allocation of the gene copies is random. When an egg and a sperm join in fertilization, they form a new organism, whose genotype consists of the alleles contained in the gametes. The diagram below illustrates this idea, identify the alleles of each zygote and the phenotype ratio:



STEPS TO DO A PUNNETT SQUARE

7. The Punnett square is a tool used to predict the possible breeding outcomes. The basic naked p-square looks like a window pane. When given enough info about two parent organisms, we can use this window pane to predict the genotypes & phenotypes of their offspring. Identify the parts of a Punnett square:

1. Alleles (genetic contribution) of one parent

2. Alleles (genetic contribution) of the other parent

3. Offspring combinations

8. Read the example and organize the steps to do a Punnett square:

EXAMPLE: For example, let's say that for the red-thoated booby bird (I am making this up), red throat is the dominant trait and white throat is recessive. Since the "red-throat code" and the" white-throat code" are alleles (*two forms of the same gene)*, we abbreviate them with two forms of the same letter. So we use "R" for the dominant allele/trait (red throat) and "r" for the recessive allele/trait (white throat).

Our possible genotypes & phenotypes would be like so:

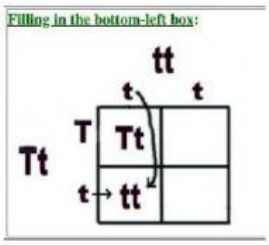
Symbol	Genotype Name	Phenotype
RR	**homozygous (pure) dominant**	**red thoat**
Rr	**heterozygous (hybrid)**	**red throat**
rr	**homozygous (pure) recessive**	**white throat**

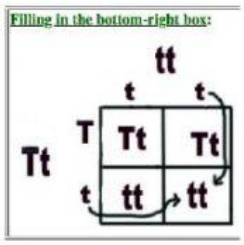
Note: Remember, we don't use "R" for red & "W" for white because that would make it two different genes which would code for two different traits, and throat color is one trait. What the genotype contains are *two codes for the same trait*, so we use *two forms of the same letter* (capital & lowercase).

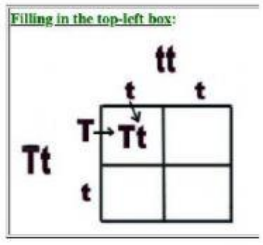
Here are the basic steps to using a Punnett Square when solving a genetics question. After you get good at this you should never miss a genetic question involving the cross of two organisms. So, organize (drag and drop) the step by step:

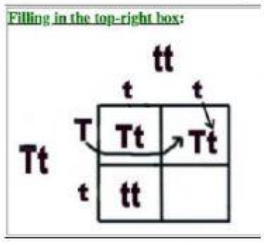
Step 1	determine the genotypes of the parent organisms
Step 2	draw a p-square
Step 3	"split" the letters of the genotype for each parent & put them "outside" the p-square
Step 4	determine the possible genotypes of the offspring by filling in the p-square
Step 5	summarize results (genotypes & phenotypes of offspring)
Step 6	bask in the glow of your accomplishment!
Step 7	write down your "cross" (mating)

9. This is a representation of the step 5, so organize the way to fill-in the boxes of the p-square:





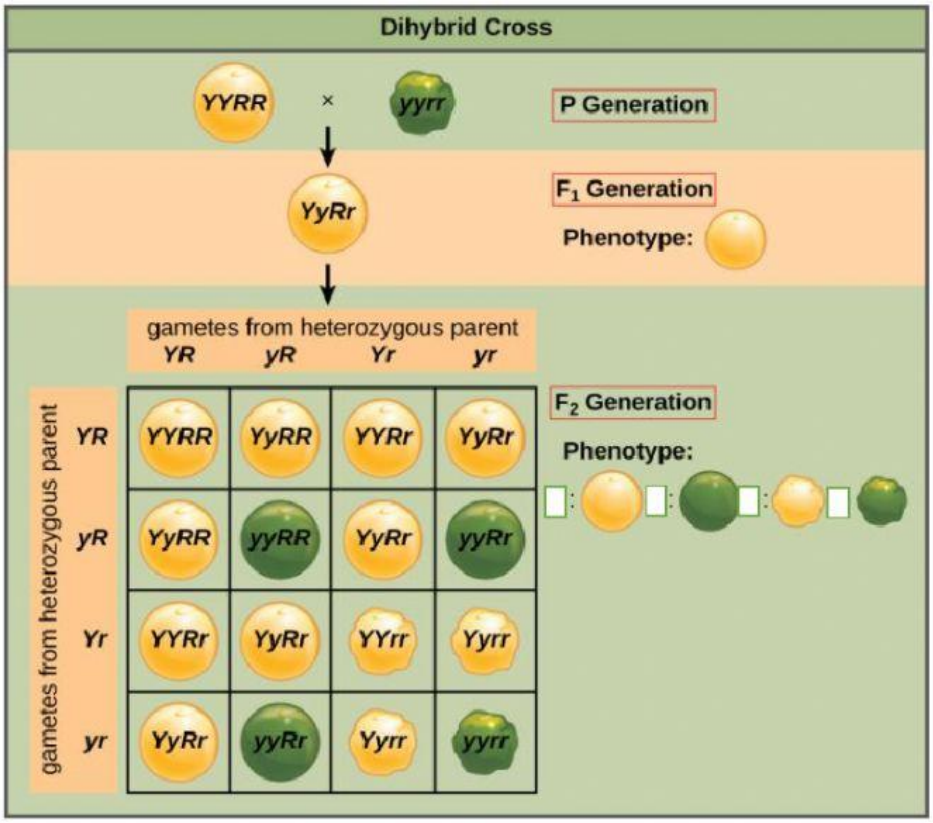




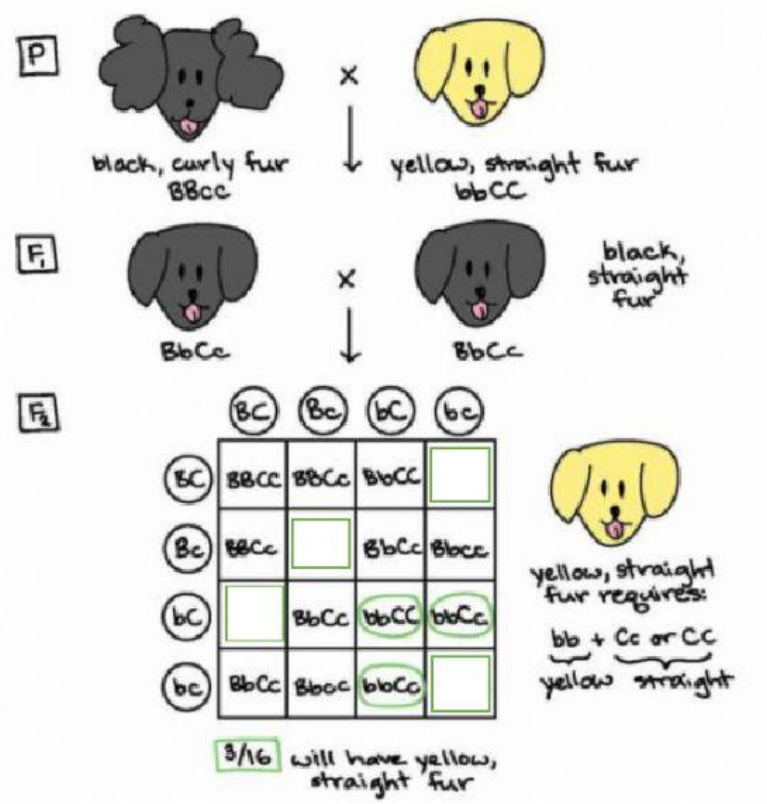
DIHYBRID CROSSES

LAW OF INDEPENDENT ASSORTMENT

10. Mendel's Law of independent assortment shows how separate genes are carried without influencing each other. A cross between two dihybrids (hybrid is an organism that has two different alleles for a trait) is known as a **dihybrid cross**. When Mendel did this cross and looked at the offspring, he found that there were four different categories of pea seeds: yellow and round, yellow and wrinkled, green and round, and green and wrinkled. These **phenotypic** categories (categories defined by observable traits) appeared in a ratio of approximately 9:3:3:1. Identify the ratio in the boxes of F2 generation:



Here's an example showing color and fur type of certain dog breeds, fill in the blanks with the corresponding alleles:



What is genetic variation?

Individuals in a population are not exactly the same. Each individual has its unique set of traits, such as size, color, height, body weight, skin color and even the ability to find food.

Characteristics or traits that are inherited are determined by genetic information. Some other traits like dialect or accent, scars, skin texture or even body weight may be determined by some external or environmental factors. These factors include: Diet, Climate, Culture, Lifestyle, Language, Accidents.

Therefore, genetic variation is possible thanks to _____. During sexual activity (_____), the male releases the _____ and the female releases the _____, and during _____ , each parent contributes a cell each.