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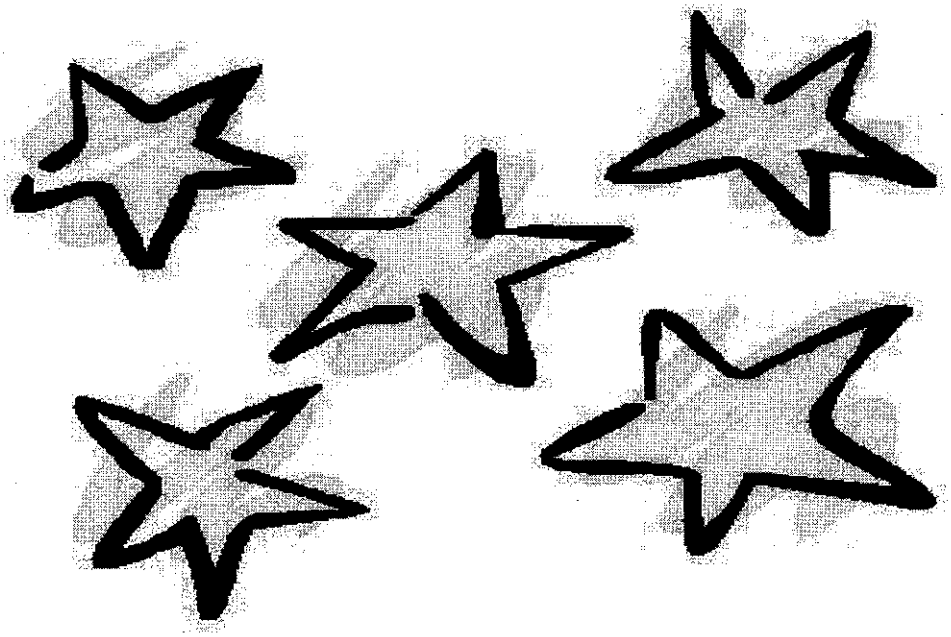
8th Grade Science



To Proficiency and Beyond!

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8th Grade Daily Science Assignments:

Day 1. Read and answer questions from Sexual and Asexual Reproduction Fact Sheet

Day 2. Use Genetics, Mitosis and Meiosis, and Evolution and Mutations Student Guides to Create Vocabulary Flashcards – define and use word in a sentence. You can use flashcards to play any of the vocabulary games on Vocabulary Game Sheet: offspring, sexual reproduction, asexual reproduction, genetic variation, chromosome , gene , DNA, inherit, mitosis, meiosis , dominant, recessive, genotype , phenotype, allele, budding, vegetative propagation, heterozygous, homozygous, eukaryote, prokaryote

Day 3. Read and answer questions to L82A Sexual and Asexual Reproduction. Use flashcards to play Concentration Game

Day 4. Work L82A Independent Practice worksheets

Day 5. Using student guides as help answer questions 1-6 and 9-11 on Mitosis and Meiosis Question Sheet

Day 6. Work Meiosis I worksheets

Day 7. Read and answer questions from the Pioneer Plants and The Story of Peas reading passages

Day 8. Work L82B Independent Practice worksheets

Day 9. Work Genetics Review

Day 10. Read and answer questions from Genes and Gene Mutations and Positive, Negative or Neutral Sheet

GENETICS

The student will investigate and understand that organisms reproduce and transmit genetic information to new generations. Key concepts include

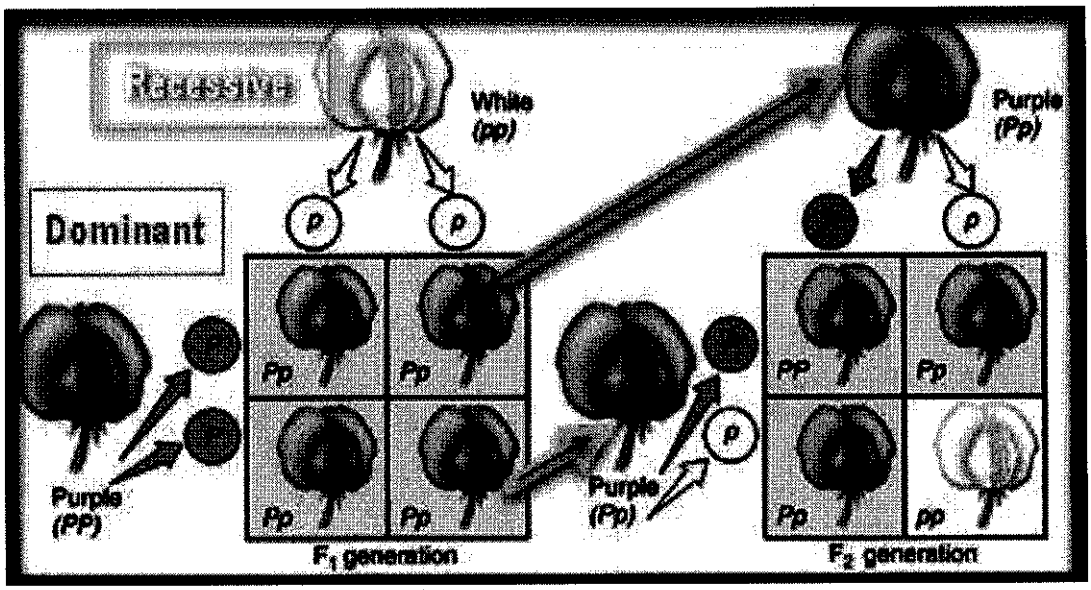
- **the structure and role of DNA**
- **the function of genes and chromosomes**

- **genotypes and phenotypes**
- **characteristics that can and cannot be inherited**
- **genetic engineering and its applications**
- **historical contributions and significance of discoveries related to genetics**

DNA

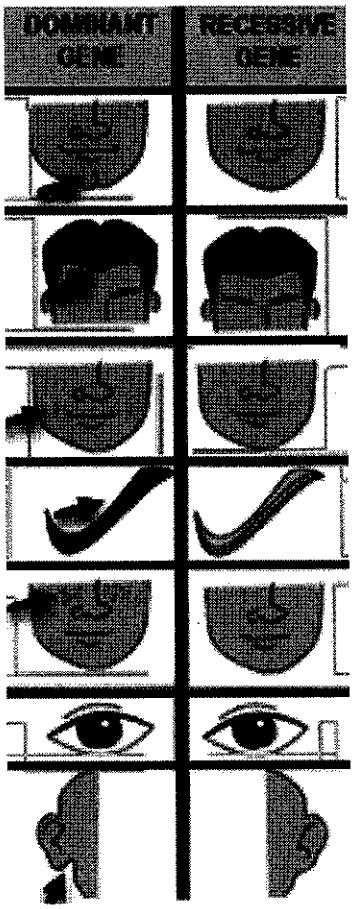
- **DNA** is a **double helix** molecule
- DNA is a molecule that includes different components — **sugars, nitrogenous bases,** and **phosphates.** The arrangement of the **nitrogenous bases** within the **double helix** forms a **chemical code.**
- **Chromosomes** are strands of **tightly wound DNA. Genes** are sections of a chromosome that carry the code for a **particular trait.** An **allele** is an **alternate form** of a gene.

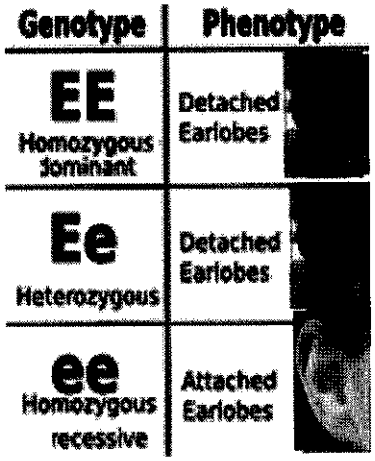
- *recognize the appearance of DNA as a double helix in shape*
- *explain that DNA contains **coded instructions** that store and pass on genetic information from one generation to the next.*
- *explain the necessity of DNA replication for the continuity of life.*
- *explain the relationship among genes, chromosomes, and alleles.*



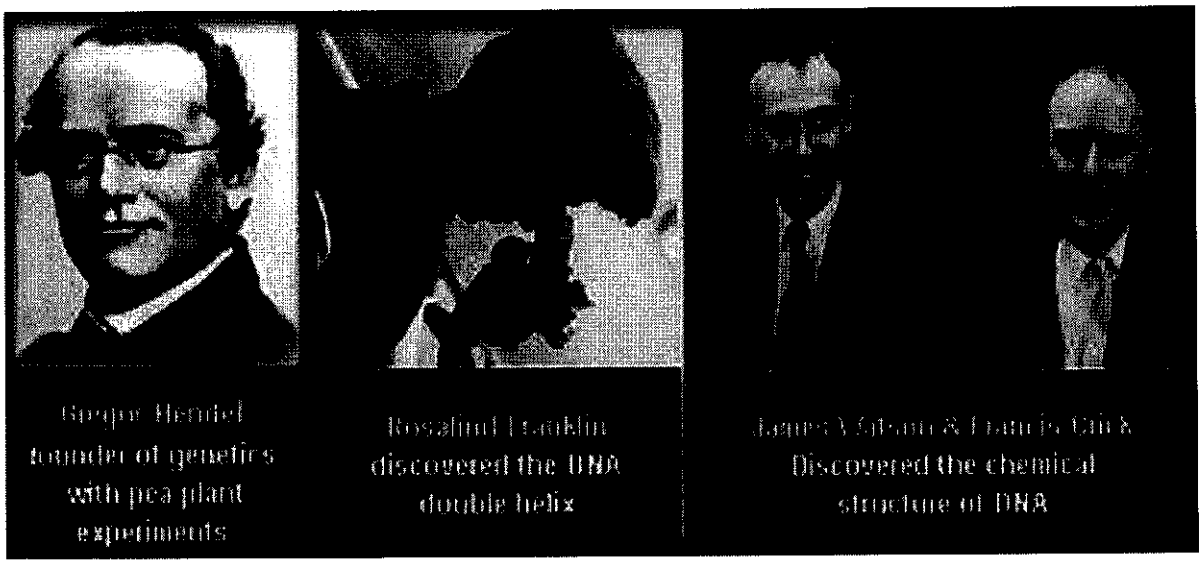
GENETIC INHERITANCE

- The basic laws of **Mendelian genetics** explain the transmission of most **traits** that can be **inherited** from generation to generation.
- A **Punnett square** is a model used to predict the possible combinations of inherited factors resulting from single trait crosses.
- *demonstrate variation within a single genetic trait.*
- *distinguish between dominant and recessive traits.*
- *use Punnett squares to predict the possible combinations of inherited factors resulting from single trait crosses.*



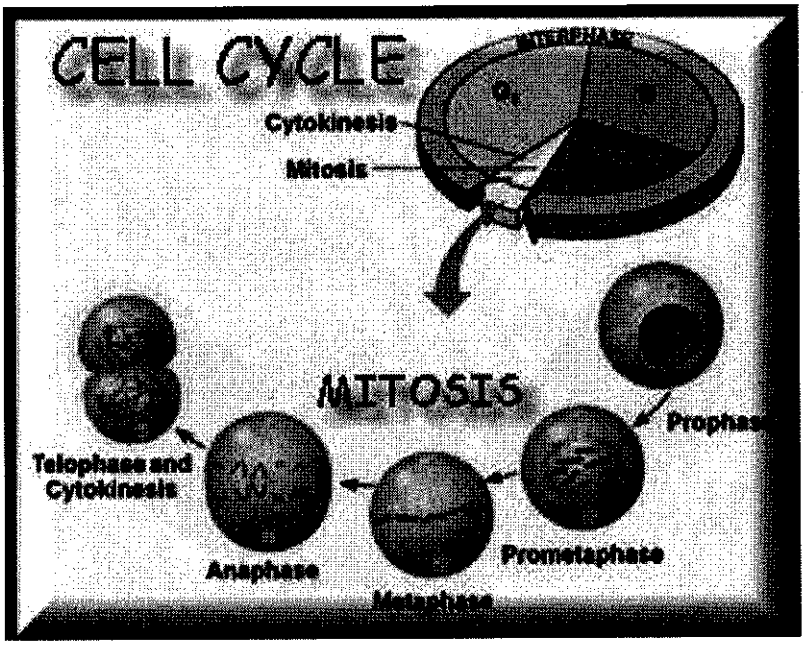


- **Dominant traits** mask the expression (**phenotype**) of **recessive traits**.
- **Genotype** is the specific combination of dominant and recessive gene forms.
- Traits that are expressed through genes can be **inherited**.
- *distinguish between genotype and phenotype.*
- *differentiate between characteristics that can be inherited and those that cannot be inherited.*
- Characteristics that are acquired through environmental influences, such as injuries or practiced skills, cannot be inherited.
- In **genetic engineering**, the **genetic code** is manipulated to obtain a desired product.
- **Genetic engineering** has numerous practical applications in medicine, agriculture, and biology.



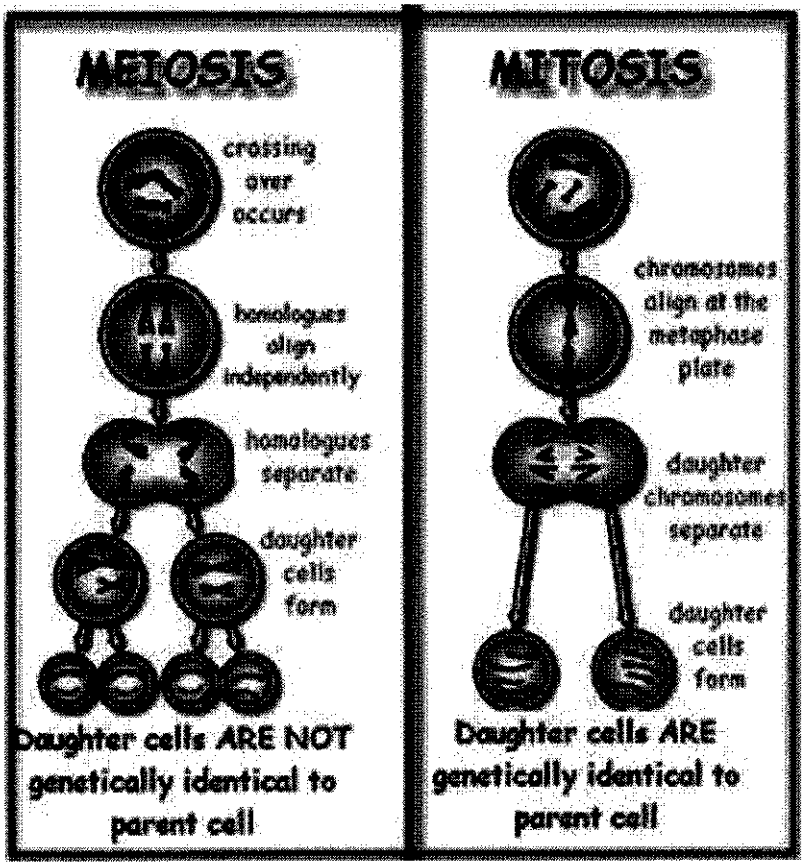
- *identify aspects of genetic engineering and supply examples of applications. Evaluate the examples for possible* ***controversial*** *aspects.*
- *describe the contributions of* ***Mendel, Franklin, Watson,*** *and* ***Crick*** *to our basic understanding of genetics.*

Mitosis and Meiosis Study Guide



CELL CYCLE

- Cells go through a life cycle known as the **cell cycle.**
  - The phases of the cell cycle are **interphase, mitosis, and cytokinesis.**
    - *know the* ***steps in the cell cycle, including the phases of mitosis***

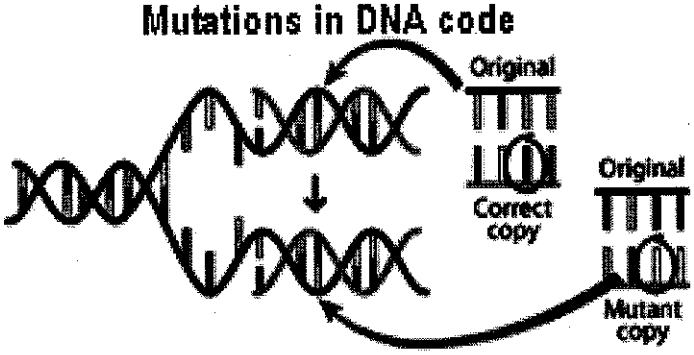


- The purpose of **mitosis** is to produce **new cells** for growth and repair that are **identical to the parent cell.**
- The purpose of **meiosis** is to produce **reproductive (sex) cells** that carry **half the genetic material** of the parent.
  - *Know the purpose of and difference between **mitosis** and of **meiosis.***

L.8.4.B
EVOLUTION

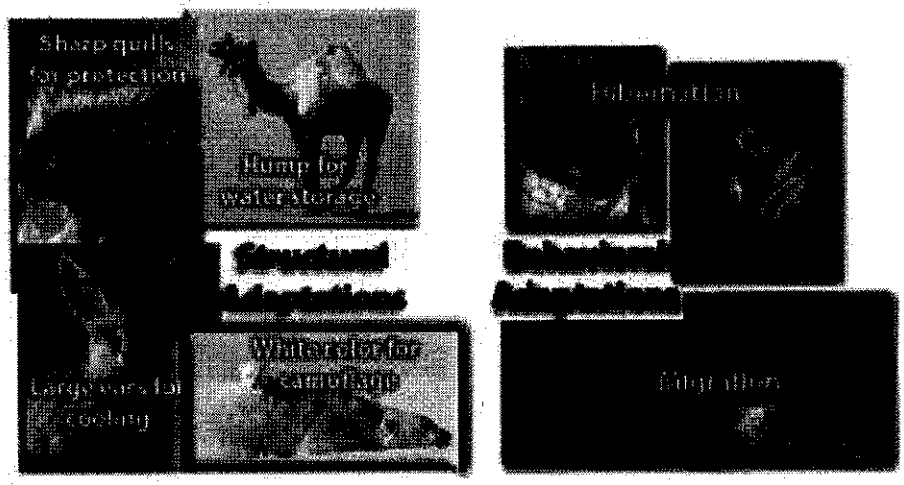
The student will investigate and understand that populations of organisms change over time. Key concepts include

a. **the relationships of mutation, adaptation, natural selection, and extinction**
b. **evidence of evolution of different species in the fossil record**
c. **how environmental influences, as well as genetic variation, can lead to diversity of organisms.**



CAUSES OF EVOLUTIONARY CHANGES

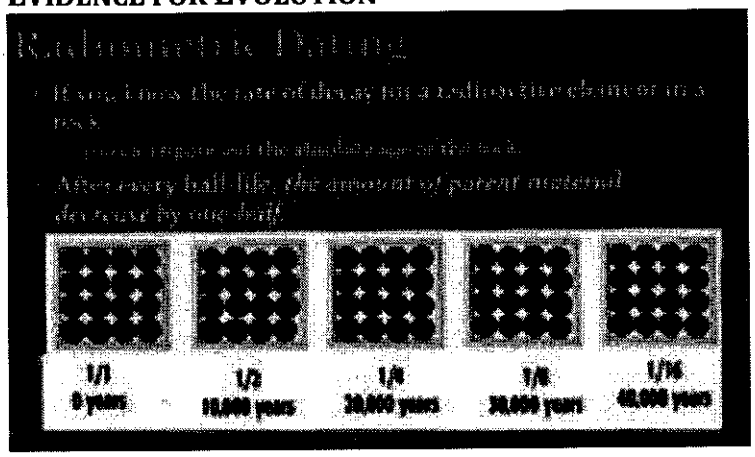
- The mechanisms through which **evolution** takes place are a related set of processes that include **mutation, adaptation, natural selection,** and **extinction.** This results in changes in populations of organisms over time.
  - **Mutations** are **inheritable** changes because a mutation is a change in the **DNA code.**

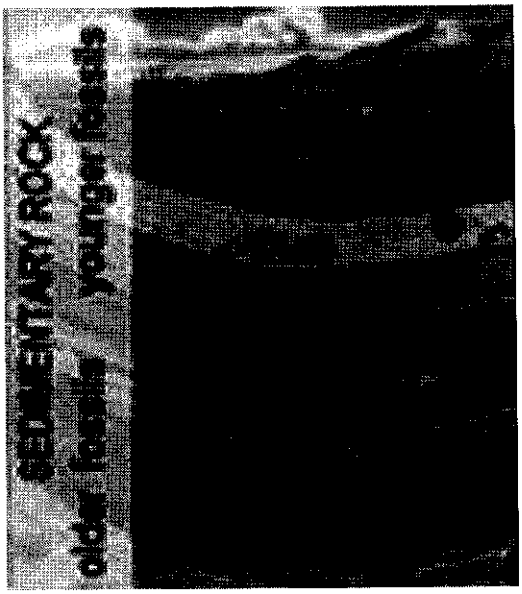


  - **Adaptations** are structures, functions, or behaviors that enable a species to **survive.**
  - **Natural selection** is the survival and reproduction of the individuals in a population that exhibit the **traits that best enable them to survive** in their environment.
- A **mutation** may result in a **favorable** change or adaptation in **genetic information** that improves a species' ability to exist in its environment, or a mutation may result in an **unfavorable** change that does not improve or impedes a species' ability to exist in its environment.
- Individuals of a population each exhibit a **range of variations** in a trait as a result of the variations in their genetic codes. These variations **may or may not help them survive** and reproduce in their environment.

- If a species does not include traits that enable it to survive in its environment or to **survive changes** in the environment, then the species may become **extinct.**

EVIDENCE FOR EVOLUTION





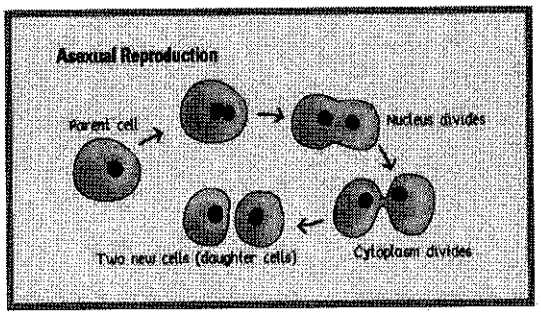
- The **evidence for evolution** is drawn from a variety of sources of data, including the **fossil record, radiometric dating, genetic information**, the **distribution** of organisms, and anatomical and developmental **similarities** across species.
  - *describe and explain how **fossils are records of organisms and events** in Earth's history.*

Reading Science

Name: _____ Date: _____

Reproduction

1 Reproduction is a process by which an organism or organisms produce young, or offspring. All organisms reproduce. If they didn't, not a single species would survive past a single generation. Reproduction allows organisms to pass on their traits, or characteristics, to their offspring. Traits include such things as eye color, fur texture, or height. There are two ways that organisms may reproduce. They may reproduce asexually or sexually.



2 In asexual reproduction, the offspring result from a single organism. The offspring inherit their genes from that single parent. In sexual reproduction, offspring result from the combining of genes (genetic information) from two separate organisms of different sex: one male and one female. No matter the type of reproduction, the parent or parents pass on their traits through their genetic material, or DNA.

3 In asexual reproduction, one parent makes an exact copy of itself. There is no fusion of gametes (sperm and egg). The parent directly passes its genetic material to its offspring. Therefore, the offspring have the exact same traits as their parent. All of the offspring also have the exact same traits as each other. This means the offspring are all the same, or uniform. Think of it as making a copy on a copy machine. The parent is like the piece of paper you put into the machine. The offspring are like the copies that come out. The offspring, like the copies, all look like their parent and like each other.

4 There are different forms of asexual reproduction. Prokaryotic organisms (single-celled organisms), such as bacteria, go through a process called binary fission. First, a single-celled bacterium makes a copy of the DNA it has in its cell. Then, the bacterium splits in half, forming two cells. Each cell gets a copy of the original DNA. Eukaryotic organisms (multicellular organisms) reproduce asexually in several ways. Fungi, such as mushrooms, form spores. Spores are tiny reproductive structures that contain a copy of the parent DNA. Some organisms reproduce by budding. In budding, a smaller version of the parent organism grows out of the parent. Eventually, it separates from the parent and begins to function on its own. This would be similar to another person growing out of your body!

Reading Science

5 Plants can reproduce asexually through a process called vegetative propagation. This is a big term, but it basically means that an entire new plant can grow out of a part of the parent plant. For example, if you removed a part of the stem and leaf of certain plants and put it in water, it would form roots and grow to be an adult plant. It would be an exact genetic copy of its parent. Bacteria, fungi, and plants are not the only organisms that reproduce asexually. In some animals, like fish, reptiles, and amphibians, an unfertilized egg can develop into a full-grown adult. This offspring would have a copy only of the female's DNA.

6 Unlike asexual reproduction, sexual reproduction requires a male and a female. Each parent contributes half of his or her genetic material, or DNA, to the offspring. The female contributes her DNA in an egg cell. The male contributes his DNA in a sperm cell. When the egg and sperm combine, they form the new offspring. The offspring may look similar to their parents, but they are not exact copies. Why does this happen? It happens because the offspring have a unique combination of their parents' traits. This is why organisms that reproduce sexually have offspring that may have different traits.

7 Unless offspring are identical twins (a single fertilized gamete that divided in two), an offspring may be different from its siblings. Parents may pass on dominant traits or recessive traits to their offspring. If a parent contributes a dominant trait, then the offspring will most likely have that trait. If a parent contributes a recessive trait, that trait may not be seen if there is a dominant trait present. For example, suppose the father in a human family has brown eyes, but his wife has blue eyes. Among their children, it is most likely that the dominant brown-eyed trait will occur. The recessive blue-eyed trait may occur, but it is less likely.

1. Which of the following statements is NOT true?

A. Only prokaryotes can reproduce asexually.
B. Only eukaryotes can reproduce asexually.
C. Plants can reproduce asexually.
D. Asexual reproduction does not require two parents.

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2. In which form of reproduction does the offspring result from a single organism?

A. Sexual reproduction
B. Asexual reproduction
C. Both of these
D. None of these

Reading Science

3. What is the main difference between sexual and asexual reproduction that does not include parents?
   - **A.** Other than parents, there is no difference.
   - **B.** The difference is the way that genetic information is transferred to the offspring.
   - **C.** Creating offspring that may be identical twins is the difference.
   - **D.** Only prokaryotes reproduce asexually.

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4. Which of the following statements is FALSE about sexual reproduction?
   - **A.** It requires a male and a female organism.
   - **B.** The offspring have a combination of the male and female parents' DNA.
   - **C.** The offspring of the parents is not a genetic copy of either parent.
   - **D.** All of the offspring will be exactly the same.

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5. What is the main outcome of asexual reproduction with regard to offspring?
   - **A.** The offspring are all males.
   - **B.** The offspring are all females.
   - **C.** The offspring have the exact same traits as the parent.
   - **D.** None of the offspring survive.

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6. Which of the following statements best represents the main point of this reading?
   - **A.** Parents make offspring during sexual and asexual reproduction.
   - **B.** Sexual reproduction creates genetic variation in offspring, and asexual reproduction creates genetically identical offspring.
   - **C.** Only prokaryotes have the ability to reproduce asexually.
   - **D.** Eukaryotes can reproduce only sexually and need male and female organisms for this.

Independent Practice

Name: _____ Date: _____

Part I: Fill in the Blank

Directions: Write the correct vocabulary word on the line to make the statement true.

1. A type of reproduction in which one cell splits into two identical ones; the same as division in cells
2. In reproduction, genetic material is passed on from two parent organisms, creating a new organism that is similar to the parents. Since they are not identical, the has .
3. is when one cell divides into two, while in , one cell divides into four.
4. In alleles, the trait is the most common, but a trait can show up if there is no different allele present.
5. When the offspring is identical to the parents, it is reproduction, but if there is variation, then it is reproduction.
6. Offspring growing off the parent organism is called .
7. When one plant produces identical offspring, it is called .
8. The different versions of genes are known as , which are found in a fixed spot on the .
9. Fungi are eukaryotes and reproduce through .

Independent Practice

Part II: Alike and Different

Directions: Write how each pair of words are alike and different.

1. Sexual and asexual reproduction

   Alike:

   Different:

2. Recessive and dominant alleles

   Alike:

   Different:

3. Chromosome and allele

   Alike:

   Different:

4. Mitosis and meiosis

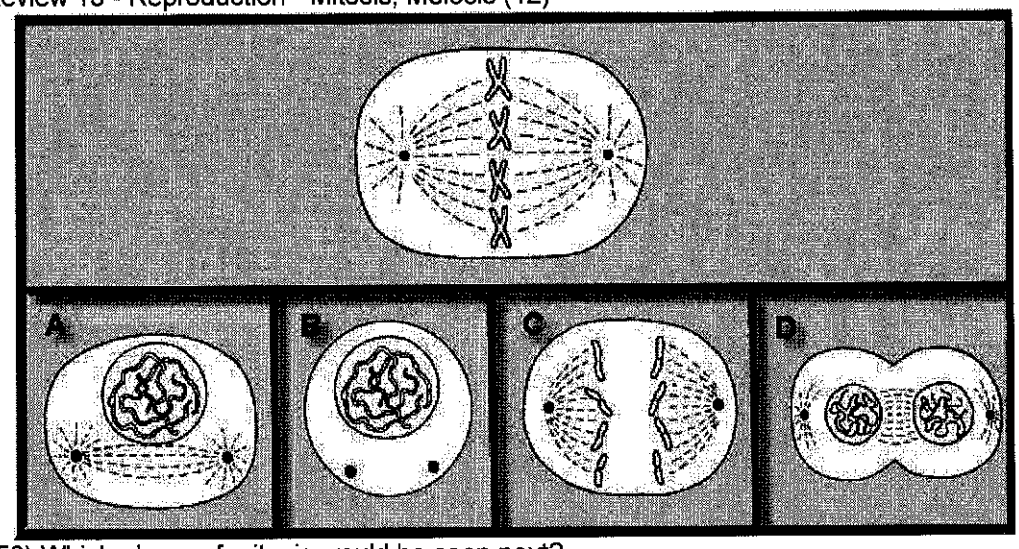
   Alike:

   Different:

Name _____ Date _____

BIO SOL Review 13 - Reproduction - Mitosis, Meiosis (12)

a.



2. (2006-50) Which phase of mitosis would be seen next?
   A **B** **C** **D**

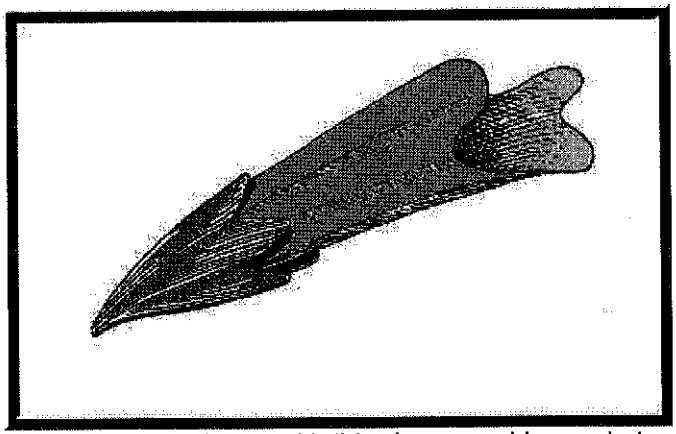
3. (2006-12) Meiosis is the process by which gametes are produced. In which of the following human organs does meiosis occur?
   a. Skin
   b. Pancreas
   c. Liver
   d. Testis

4. (2001-9) The reduction of the chromosome number during meiosis is most important for:
   a. keeping the amount of DNA in the cell at a minimum level
   b. preventing the nucleus from becoming larger with each cell division
   c. maintaining the chromosome number during sexual reproduction
   d. allowing the growth of the cell without increasing the DNA content

5. (2003-36) Which of these types of reproduction provides the most protection to developing offspring of land-dwelling animals? (1 point)
   a. An egg with a leathery shell
   b. An egg in a mass of jelly
   c. An egg carried internally
   d. An egg in an eggshell

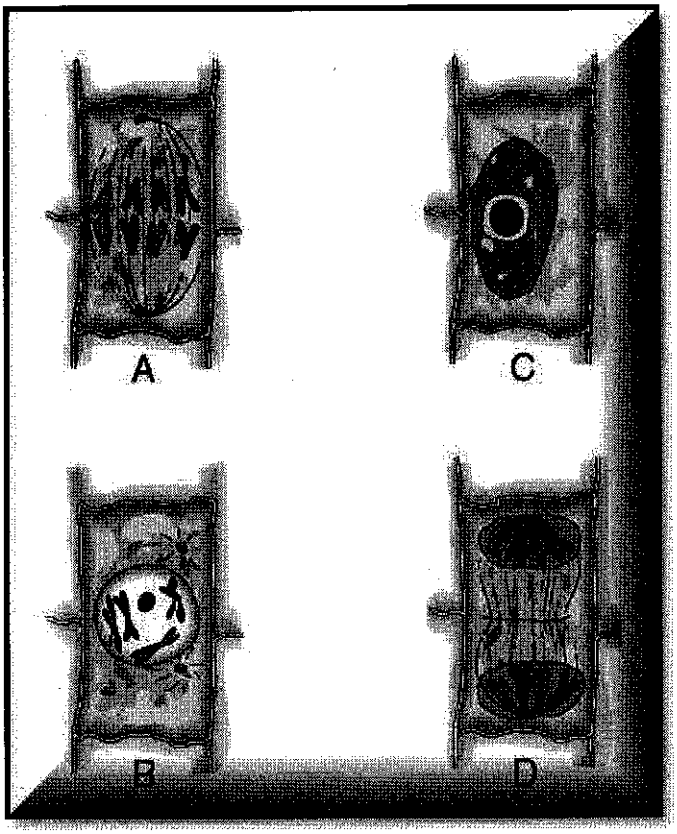
6. (2003-7) The jimsonweed Datura stramonium, normally has 12 chromosomes in the body cells. How many chromosomes will an egg cell of the weed have? (1 point)
   a. 6 chromosomes
   b. 12 chromosomes
   c. 24 chromosomes
   d. 18 chromosomes

7. (2004-30) The process of DNA replication is necessary before a cell — (1 point)
   a. codes for RNA molecules
   b. modifies lysosome enzymes
   c. divides into two cells
   d. makes a protein

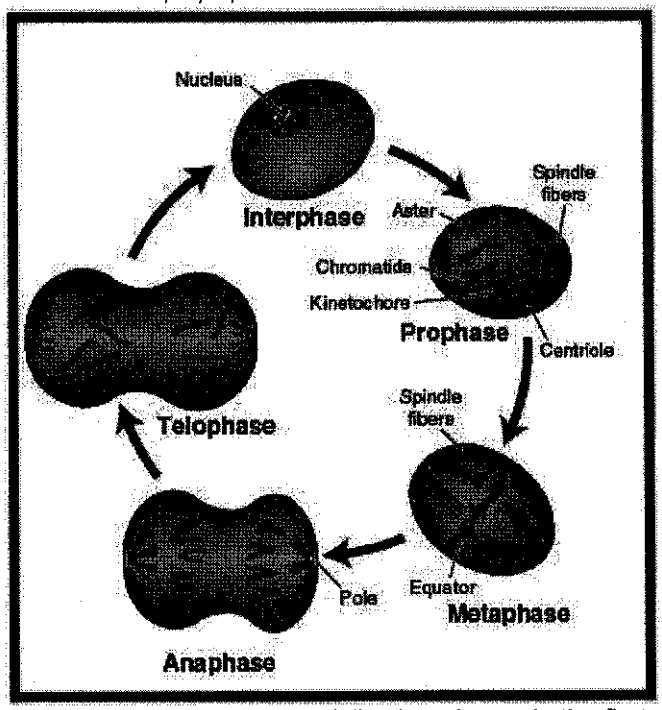


8. (2001-28) A flower with this shape would use what type of pollinator? (1 point)
   a. Mammal
   b. Wind
   c. Rain
   d. Hummingbird

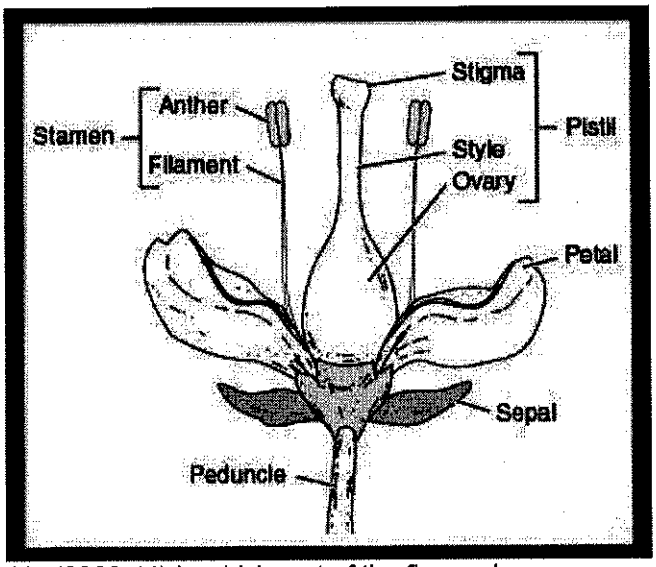
9. (2004-15) The processes of meiosis and fertilization help ensure the survival of the species by providing each generation with the same number of — (1 point)
   a. chromosomes
   b. offspring
   c. gametes
   d. body cells



10. (2001-2) What is the correct sequence for plant cell mitosis? (1 point)
    a. A, B, D, C
    b. C, B, A, D
    c. B, A, D, C
    d. D, C, B, A



11. (2005-10) Which of the following phases is the first step in mitosis? (1 point)
    a. Prophase
    b. Telophase
    c. Metaphase
    d. Anaphase



12. (2003-44) In which part of the flower does fertilization take place? (1 point)
    a. Sepal
    b. Petal
    c. Stamen
    d. Pistil

13. (2004-21) In plants, gymnosperms have cones and angiosperms have flowers. Both of these plant structures are specialized for — (1 point)
    a. water absorption
    b. photosynthesis
    c. sexual reproduction
    d. food production

Meiosis 1

Write the number for the item from the item bank in its corresponding match.

Items:

1 Chromosome information. - This is the structure in the cell nucleus that houses a cell's genetic

2 DNA - This holds an organisms hereditary information.

3 Diploid - This is an organism or cell with two sets of chromosomes.

4 Egg - This is the female reproductive cell.

5 Gamete - This is a haploid cell with half the reproductive information from the parent.

6 Haploid - This is a cell or organism having half of the diploid chromosome number, symbolized by "n".

7 Meiosis - This is a process where a parent cell divides into four sex cells with half the chromosomes.

8 Replication - This is the copying process by which a cell duplicates its DNA.

9 Sexual Reproduction - Process by which two cells from different parents unite to produce the first cell of a new organism.

10 Sperm - This is the male reproductive cell.

This is an organism or cell with two sets of chromosomes. ☐

This is a haploid cell with half the reproductive information from the parent. ☐

This is a cell or organism having half of the diploid chromosome number, symbolized by "n". ☐

This is the structure in the cell nucleus that houses a cell's genetic information. ☐

This holds an organisms hereditary information. ☐

This is a process where a parent cell divides into four sex cells with half the chromosomes. ☐

This is the copying process by which a cell duplicates its DNA. ☐

Process by which two cells from different parents unite to produce the first cell of a new organism. ☐

This is the female reproductive cell. ☐

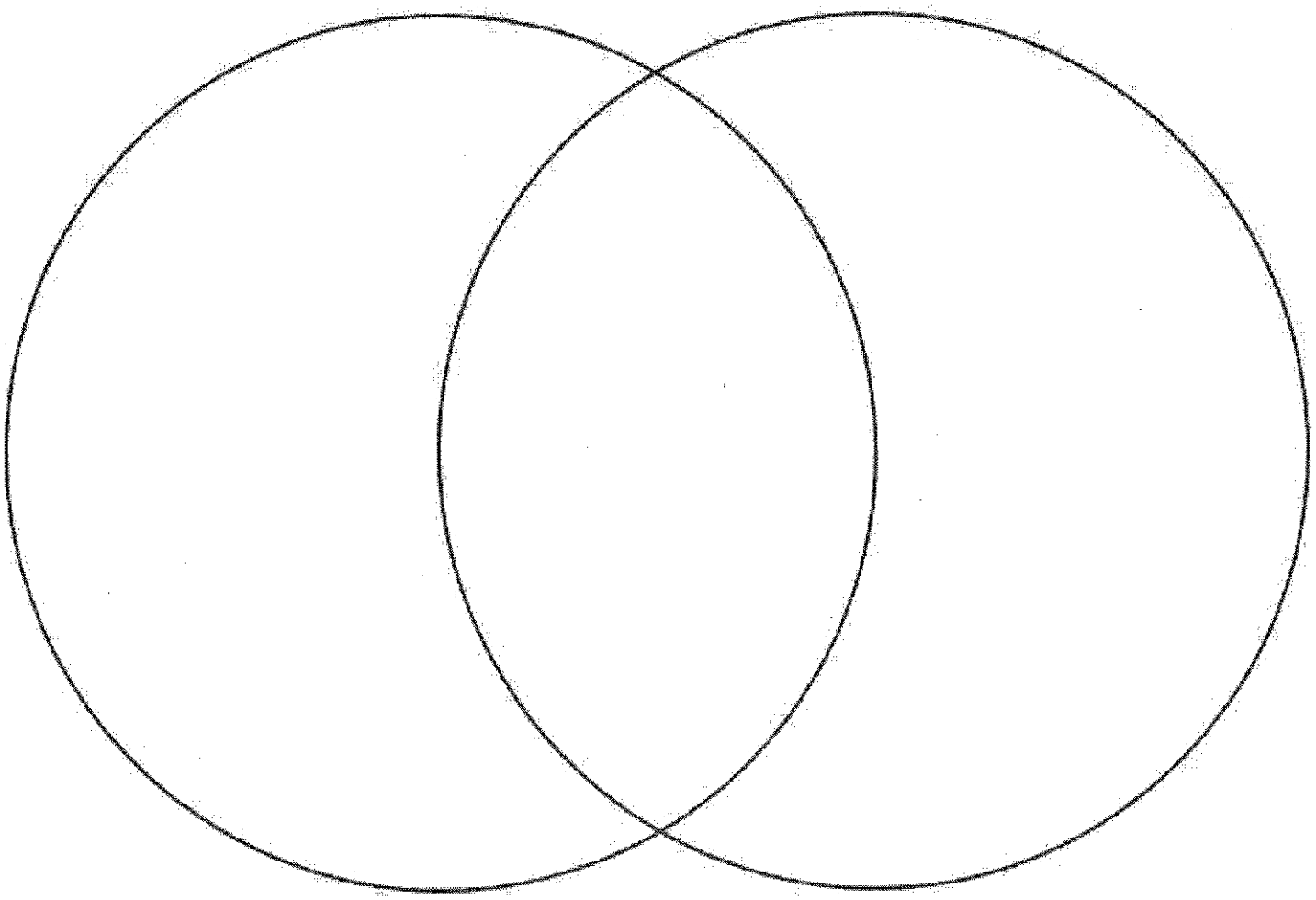
This is the male reproductive cell. ☐

Meiosis 2

Listed in the Item Bank are some key terms and expressions associated with the categories seen in the Venn Diagram. Write the number for each item into the proper area of the diagram. If an item describes more than one category, be sure to place it in the overlapping space.

Items:

1 2 Daughter cells
2 4 Daughter cells
3 Cell divides once
4 Cell divides twice
5 DNA replicates
6 Growth and repair



Reading Science

Name: _____ Date: _____

Pioneer of Plants

1 The Hawaiian Islands are the picture of a tropical paradise. There are beaches, mountains, rain forests, grasslands, and deserts to explore, often on a single island. This diversity of ecosystems has also led to a great diversity of habitats, especially with regard to plants. There are palm trees, shrubs, vines, flowering plants, and ground cover. There is even the rare Maui silver sword, found only on Maui's volcano Haleakala. Each ecosystem looks as if it is filled with its own unique plant life. It actually turns out that many of the native plant species in Hawaii are related to each other. But, how?

2 The Hawaiian Islands surfaced between 400,000 and 5 million years ago. These islands are isolated in the middle of the Pacific Ocean. They were created from a fixed magma "hot spot" in the earth. As the Pacific plate moved over this hotspot, underwater volcanoes formed. These volcanoes eventually surfaced, creating the Hawaiian Islands. The volcanic soils on these islands are rich in nutrients. As Hawaii is located near the equator, the climate is always warm, and there is frequent rainfall. These rich soils and rain provide all the requirements to support a huge variety of plant life.

3 Where did the plants on the Hawaiian Islands come from in the first place? These islands, born from undersea volcanoes, are thousands of miles from the nearest mainland. Perhaps just a few seeds found their way to Hawaii's fertile grounds by way of a bird. These few seeds grew, reproduced, and spread all over the island. And as the plants spread, they were exposed to various ecosystems. An empty (unoccupied) landscape offers a wide variety of places for the plants to grow. This is the perfect recipe for plant diversification, or ways for plants to adapt to their new surroundings.

4 You are most likely aware that not every plant is adapted to survive in every ecosystem. Most plants are specialists, meaning that they have special requirements for survival. They thrive in the environments that they are best adapted to but could die in the wrong environment. A cactus would die in a wetland. A palm tree would freeze during a cold winter. Some plants, however, are known as generalists. This means they are able to survive in many different ecosystems. The single pioneer (first) plant species that survived to reproduce on the Hawaiian Islands must have been a generalist.

Reading Science

5 As it turns out, many of the native species found on Hawaii came from an ancestor of the Muir tarweed plant, from the West Coast of the United States. The descendants of that pioneer tarweed adapted to the many different ecosystems found on the Hawaiian Islands. Natural selection would favor traits that were best suited for each particular ecosystem. It is easy to imagine that a single generalist species could diversify into 28 distinct specialist species on the Hawaiian Islands.

6 It is possible that some mutations in the tarweed created new traits. If the mutations were not helpful, the plants did not survive. If they were helpful, the plants thrived. The helpful mutations allowed for new generations to have traits that were better suited for the new ecosystems they spread to. Those seedlings better able to survive dry conditions (adapt to dry conditions) could thrive further from the coast. Seedlings able to adapt to wet conditions survived better where a lot of rain occurred. The plants that survived were most likely to produce offspring with the same successful set of adaptations.

7 Since that first pioneer plant, the tarweed has diversified to vines, ground cover, palm trees, and flowering plants. How do we know all these plants share a common ancestor? The first clue came from local surveys of plant diversity. Scientists found that many of the 28 tarweed species had cross-pollinated (hybridized) in the wild. The hybrid offspring were generally fertile, which is found only in very closely related organisms. Genetic material from each of the 28 species was then analyzed and compared. The DNA for the entire group was found to match very closely, almost no more than can be expected within a single, typical species. It is important to note that this did not happen overnight. It took hundreds of thousands of years for the plants to diversify into the forms we see today. However, a single tarweed ancestor diversified into 28 new and distinct species on an isolated, nutrient-rich island chain.

1. What factor makes the Hawaiian Islands the perfect place for plant species to diversify?

- **A.** The isolation of the islands
- **B.** The variety of ecosystems found on the islands
- **C.** The nutrient-rich soils
- **D.** All of the above

Reading Science

2. How might mutations have allowed for the diversification of plant life on the Hawaiian Islands?
   - **A.** The mutations were harmful, so the plants could not survive.
   - **B.** The mutations were beneficial for each new environment.
   - **C.** The mutations had no effect on species diversity.
   - **D.** The mutations made the plants greener.

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3. The hypothesis was that a species from the Pacific Rim may have been the ancestor of 28 distinct species on the Hawaiian Islands. Which of these supports this hypothesis AND could be the result of observational testing?
   - **A.** Plant seeds have been observed washed up on a Hawaiian beach after a storm.
   - **B.** A successful, fertile hybrid of a Hawaiian and mainland plant has been bred by botanists.
   - **C.** Genetic material of the Hawaiian plants showed very close similarity to a mainland species.
   - **D.** Tarweed seeds were kept in seawater for various lengths of time to represent their journey across the ocean and then planted to see if they could still germinate.

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4. Research has identified a species from the West Coast of the United States that may have been the ancestor of 28 distinct species on the Hawaiian Islands. What is this species?
   - **A.** The Muir tarweed
   - **B.** Palm trees
   - **C.** The silver sword
   - **D.** A species of vine

---

5. What is the best explanation for species diversifying to fill each new niche?
   - **A.** The plants chose the niche that they "liked" best.
   - **B.** In each niche, the fittest plants were able to leave more offspring than other plants.
   - **C.** Successive generations of plants adapted to each new niche.
   - **D.** Only some plants could get nutrients from the soils.

Reading Science

6. Why would all of the new varieties of the pioneer plant not survive in each new niche?
   - **A.** Only a finite amount of resources are available in each new ecosystem.
   - **B.** Only the fittest plants are able to access the limited resources of each ecosystem.
   - **C.** The offspring of the fitter plants would outcompete the offspring of the less fit plants.
   - **D.** All of the above are true.

The Story of Gregor Mendel and his Peas

This is the story of Gregor Mendel and how his pea experiments were used to study heredity. People had noticed for thousands of years that family resemblances were inherited from generation to generation, but no one knew how or why this pattern of heredity occurred. The study of genetics was soon created to help explain this idea of heredity. Mendel was the first person to succeed in predicting how traits would be transferred from one generation to the next. BUT, how was he able to solve this problem of heredity you ask?

Mendel loved his garden at the monastery and was extremely curious why certain plants had certain traits and others did not. He began his experiments using pea plants because they reproduced sexually (have two distinct sex cells – male and female) and both of these gametes are located in the same flower. The male gamete is in the form of pollen grains and the female gamete is in the ovule, which is located on the pistil. When pollination occurs a seed is formed. This type of fertilization occurs naturally. The gametes are tightly enclosed within the petals, preventing the pollen of other flowers to enter. The peas therefore self-pollinate. Mendel used this method of pollination but also cross pollinated. By using these two forms of pollinating, Mendel could be sure of the parents in his crosses.

Mendel studied seven traits that are specific to garden peas. Seed shape, seed color, flower color, flower position, pod color, pod shape and plant height. Although he studied seven traits, he only studied one trait at a time to control variables and analyze his data mathematically.

Mendel's first crosses were called monohybrid crosses. He started with a set of tall pea plants, from generations that had produced tall plants. He crossed this plant with a set of short pea plants, from generations that had produced short plants. The tall and short plants were a part of the *P generation*. The cross resulted in a *F_1 generation* that Mendel called the hybrid. Every one of the offspring in the F_1 generation were tall. Next he created another monohybrid cross with two of the hybrids from the F_1 generation. The cross resulted in a *F_2 generation* that consisted of 3 tall plants and 1 short plant.

From this experiment Mendel was able to conclude that there are at least two factors that control each trait. We now know these factors are genes and that they are located on chromosomes. Genes exist in alternate forms called alleles. Each of Mendel's pea plants had two alleles of the gene that determined height. A plant could have two alleles for tallness, two alleles for shortness or one allele for tallness and one for shortness. One allele is inherited from the female parent and one from the male parent.

Mendel also observed that certain traits showed up and others seemed to disappear. He deemed one of the alleles dominant and the other recessive. In the first monohybrid cross of the P generation, he crossed a tall and short plant. In the F_1 generation, all the plants were tall. Although they were all tall they had a hybrid genotype. Each offspring received one allele from the tall and one from the short. The allele for tallness masks the alleles for shortness in the pea plants. The tall allele is therefore dominant over the short allele. To show this we use the same letter for different alleles of the same gene. An uppercase letter is used for the dominant allele and a lowercase letter for the recessive. The dominant allele is always written first.

Mendel's Law of Segregation explains why hybrid offspring can occur. Two organisms can look alike, have the same phenotype, but have different genotypes. The genotypes for tall plants can be TT or Tt. The genotype of short is only tt. If the genotype is TT or tt then it is said to be homozygous or pure breed. If the genotype is Tt, it is said to be heterozygous or hybrid. The only way to get a phenotype of short is to have the alleles be tt.

In 1905, Reginald Punnett devised a short handed way of finding the expected proportion of possible genotypes in the offspring of a cross. This method is called a punnett square. It takes account of the fact that fertilization occurs randomly as Mendel's law of segregation states. If you know the genotypes of the parents you can use a punnett square to predict the possible genotypes of their offspring. Knowing the genotypes, you can also know the phenotype.

Gregor Mendel and His Peas Questions

1. Mendel was the first person to succeed in doing what? _____
2. Where was his garden? _____
3. Why did he work on pea plants? _____
4. How many traits did he study? _____
5. Why did he only study one trait at a time? _____
6. What where the characteristics of the two pea plants he crossed first?

7. What generation were they called? _____
8. After the cross, what were they called? _____
9. What were the characteristics of the plants in the first cross? (tall or short) _____
10. What happened when he crossed the "hybrid" generation plants?

11. Genes exist in alternate forms called what? _____
12. Each plant has how many alleles for each trait? _____
13. What kind of letter is used for a dominant trait? _____ Recessive trait? _____
14. Which allele is *always* written first? _____
15. If a genotype has two of the same alleles (letters), TT or tt, it is said to be what? _____
16. Can two organisms look alike but have different genotypes? _____
17. If a genotype has two different alleles (letters), Tt, it is said to be what? _____
18. Who came up with a short handed way of finding expected genotypes? _____
19. If you know the genotypes of the parents, what can you use to determine the possible genotypes of the offspring? _____
20. If you know the genotype, you will also know the what? _____

Based on your reading, fill in the blanks

21. Genotype is the _____ of an organism.
22. Phenotype is the _____ of an organism.

Independent Practice

Name: _____ Date: _____

Part I: Code Break

Directions: Read each clue and write the word or phrase using the code. Match each number under the line to the pair of letters for that number. Decide which letter to use to correctly spell the word or phrase.

AB	CD	EF	GH	IJ	KL	MN	OP	QR	ST	UV	WX	YZ
1	2	3	4	5	6	7	8	9	10	11	12	13

1. A trait that helps the organism to survive

   _ _ _ _ _ _ _ _ _
   3 1 11 8 9 1 1 6 3

2. A process where organisms with more favorable traits produce offspring that are more successful and become more abundant

   _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _
   7 1 10 11 9 1 6 10 3 6 3 2 10 5 8 7

3. The exact genetic information carried by an organism

   _ _ _ _ _ _ _ _
   4 3 7 8 10 13 8 3

4. Can be acquired or genetic

   _ _ _ _ _
   10 9 1 5 10

5. A type of artificial selection in an attempt to get favorable traits

   _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _
   10 3 6 3 2 10 5 11 3 1 9 3 3 2 5 7 4

Independent Practice

Part II: Artificial or Natural Selection?

Directions: Underneath each statement, write either "artificial selection" or "natural selection."

1. A specific group of domestic animals, having one or more similar traits, created by selective breeding and distinguishing the animals from other animals of the same species

2. An unguided process that results in less favorable traits becoming less common in following generations

3. When a breeder chooses the mating pair so the offspring have a desirable trait

4. An unguided process that results in an increase in the number or the effects of a favorable trait in following generations

5. The process by which humans breed animals and plants to favor a desirable trait

Bikini Bottom Genetics Review Name _____

1. Use your notes to complete each definition.

Purebred - Also called _____ and consists of gene pairs with genes that are the _____.

Hybrid - Also called _____ and consists of gene pairs with genes that are _____.

Genotype is the actual _____ makeup represented by _____.

Phenotype is the _____ appearance of a trait, such as a _____ body color.

2. Classify each of the following gene pairs as heterozygous (He) or homozygous (Ho).

TT _____ Bb _____ dd _____ Ff _____ Rr _____

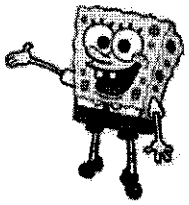
3. Give the possible genotypes for each trait based on the information provided in the chart.

Characteristic	Dominant Gene	Recessive Gene
Body Shape	Squarepants (S)	Roundpants (s)
Body Color	Yellow (Y)	Blue (y)
Eye Shape	Round (R)	Oval (r)

Purebred squarepants - _____ Blue body - _____

Hybrid round eyes - _____ Purebred roundpants - _____

Heterozygous squarepants - _____ Homozygous yellow body - _____

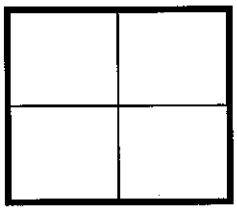


4. Give the phenotypes for each genotype based on the information provided in the chart.

SS - _____ Yy - _____ rr - _____

Rr - _____ ss - _____ YY - _____

5. Spongebob's cousin, SpongeJimBob, is a heterozygous yellow sponge. He recently married a blue sponge gal. Create a Punnett square to help you answer the questions.

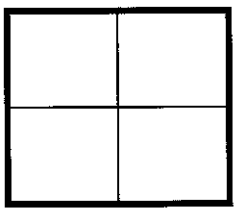


What are the possible genotypes and phenotypes for the offspring?

What percentage would be yellow? _____ %

What percentage would be blue? _____ %

6. SpongeJimBob has oval eyes, while his bride is believed to be homozygous for her round eye shape. Create a Punnett square to help you answer the questions.

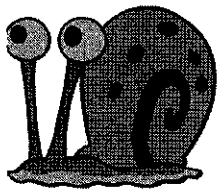


What are the possible genotypes and phenotypes for the offspring?

What percentage would have round eyes? _____ %

What percentage would have oval eyes? _____ %

Shelley, one of Gary's cousins, has a beautiful hot pink shell that is a result of incomplete dominance. The gene for a red shell is represented with an R, while W is used the gene for a white shell. A snail with both of those genes (RW) has a pink shell. Use this information to answer the questions.



7. If a snail with a red shell were crossed with one with a white shell, what color shell would the children have? Create a Punnett square to help you. Explain.

8. Sherry, who is a pink-shelled snail, would like to have kids with red shells. What type of snail would she need to marry in order for the best chance for kids with red shells? Explain your answer.

Bikini Bottom Genetics Review **Answer Key**

1. Use your notes to complete each definition.

Purebred - Also called HOMOZYGOUS and consists of gene pairs with genes that are the SAME.

Hybrid - Also called HETEROZYGOUS and consists of gene pairs that are DIFFERENT.

Genotype is the actual GENE makeup represented by LETTERS.

Phenotype is the PHYSICAL appearance of a trait, such as a YELLOW (or BLUE) body color.

2. Classify each of the following gene pairs as heterozygous (He) or homozygous (Ho).

TT Ho Bb He dd Ho Ff He Rr He

3. Give the possible genotypes for each trait based on the information provided in the chart.

Characteristic	Dominant Gene	Recessive Gene
Body Shape	Squarepants (S)	Roundpants (s)
Body Color	Yellow (Y)	Blue (y)
Eye Shape	Round (R)	Oval (r)
Nose Style	Long (L)	Stubby (l)

Purebred squarepants - SS

Blue body - yy

Hybrid round eyes - Rr

Purebred roundpants - RR

Heterozygous squarepants - Ss

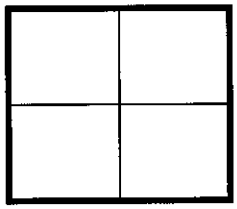
Homozygous yellow body - YY

4. Give the phenotypes for each genotype based on the information provided in the chart.

SS - Squarepants Yy – Yellow body rr – Oval eyes

Rr – Round eyes ss – Roundpants YY – Yellow body

5. Spongebob's cousin, SpongeJimBob, is a heterozygous yellow sponge. He recently married a blue sponge gal. Create a Punnett square to help you answer the questions.



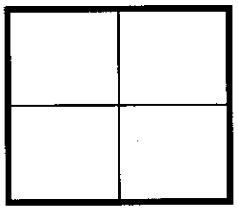
What are the possible genotypes and phenotypes for the offspring?

Yy – yellow and yy - blue

What percentage would be yellow? 50 %

What percentage would be blue? 50 %

6. SpongeJimBob has oval eyes, while his bride is believed to be homozygous for her round eye shape. Create a Punnett square to help you answer the questions.



What are the possible genotypes and phenotypes for the offspring?

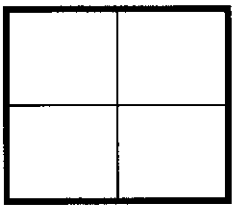
Rr - round

What percentage would have round eyes? 100 %

What percentage would have oval eyes? 0 %

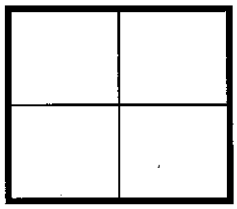
Gary's cousin, Shelley, has a beautiful hot pink shell that is a result of incomplete dominance. The gene for a red shell is represented with an R, while W is used the gene for a white shell. Shelley's shell is pink, which has the genotype is RW. Use this information to answer the questions.

7. If a snail with a red shell were crossed with one with a white shell, what color shell would the children have? Create a Punnett square to help you. Explain.



The children would all have pink shells with the genotype RW.

8. Sherry, who is a pink-shelled snail, would like to have kids with red shells. What type of snail would she need to marry in order for the best chance for kids with red shells? Explain your answer.

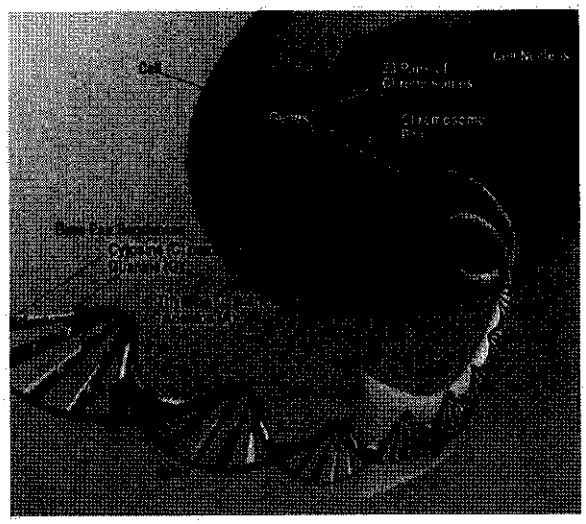


She would have a 50% chance for red-shelled children if she marries a snail with a red shell. If she married a pink-shelled snail, she would only have a 25% chance for a red-shelled kid.

Reading Science

Name: _____ Date: _____

Chromosomes, Genes, and Proteins



1 You have most likely already learned about deoxyribonucleic acid (DNA), chromosomes, and genes. You know that all three of these components have something to do with heredity in organisms. You have also learned that all living organisms contain some type of genetic material. Have you made the link that these three components are actually one and the same? Let us start at the beginning.

2 What exactly is **DNA**? All organisms carry the same basic genetic code on their DNA. However, each organism is slightly different from the next, both within species and between species. These differences are due to specific changes in the nucleotide sequences found on the DNA strand. The DNA molecule is made of two long chains of chemical building blocks. These chains form a double helix structure unique to the DNA molecule. Each link on the chain includes a nucleotide, a sugar, and a phosphate group. It is the sequence of nucleotides along the DNA strand that create an organism's genetic code. These links are ordered in a way that allows the code to be copied and read. Therefore, this information can be duplicated and transferred from one generation to the next. But how is the information on the DNA strand copied and transferred? This is where chromosomes and genes come into play.

3 What exactly is a **chromosome**? A DNA strand and a chromosome are the same thing, just in different forms. A chromosome is simply a highly coiled version of a DNA strand. In order for the genetic information carried on the DNA strand to be passed from one generation to the next, the cell must first copy (replicate) the genetic material. In reproduction, the duplicated genetic material is transferred from parent to offspring. During these processes, the genetic material from the DNA strand is condensed, organized, and packaged into individual chromosomes. The structure of chromosomes makes it easier to copy the genetic material, or to transfer it to the next generation during reproduction.

Reading Science

4 What exactly is a **gene**? The gene is the basic unit of heredity. The information to set each trait of an organism (such as hair or eye color) is carried on DNA strands condensed into chromosomes in sequences known as genes. Each gene is found at a specific location (locus) along a chromosome. Keep in mind that chromosomes are simply condensed forms of DNA. Each gene is found at a specific locus on the chromosome, and it carries genetic information. In other words, each coding segment of a chromosome is a gene.

5 The information within the genes is what gives organisms their specific traits. A slight difference in the nucleotide sequence of a gene can change the trait of the organism. Why is this? Genes are blueprints that encode information for the production of proteins in an organism. These proteins make up the cells and carry out the cellular functions of the various parts of the organism. Some genes encode the specific materials for building proteins; other genes encode many different enzymes, proteins that carry out hundreds of metabolic functions within and outside the cell. Different types of proteins work together to form the various structural and functional aspects of an organism.

6 All three components together (the DNA, the chromosomes, and the genes) make up the entire genome of the organism. The genetic information is carried in the nucleotide sequence of the DNA. Each DNA molecule is condensed into separate chromosomes during reproduction, when the genetic information is passed from parent to offspring. The specific nucleotide sequences on the genes will determine the organism's unique traits.

1. Which part or factor of the DNA strand creates an organism's genetic code?

- **A.** The individual nucleotides
- **B.** The double helix structure
- **C.** The phosphate group
- **D.** The sequence of nucleotides

---

2. What exactly is DNA?

- **A.** A DNA strand is a condensed version of a chromosome.
- **B.** It is a specific location on a chromosome.
- **C.** It is a double helix structure consisting of a nucleotide sequence.
- **D.** It is a gene that codes for specific traits.

Reading Science

3. What is the best definition of a chromosome?
   - **A.** A specific locus that codes for traits
   - **B.** A nucleotide sequence on the DNA strand
   - **C.** A specific trait of an organism, such as blue eyes
   - **D.** A highly coiled version of a DNA strand

---

4. A gene is the basic unit of heredity. What is the function of genes?
   - **A.** Genes code for specific traits.
   - **B.** Genes determine the DNA sequence.
   - **C.** Genes create chromosomes.
   - **D.** Genes help with replication.

---

5. Which of the following statements is true?
   - **A.** DNA and chromosomes are found in different types of cells.
   - **B.** The specific nucleotide sequences of the genes determine the characteristics of an organism.
   - **C.** The coding segment of a chromosome is found only in animal cells.
   - **D.** Some living organisms do not have genetic material.

---

6. Which of the following statements is FALSE?
   - **A.** DNA, chromosomes, and genes work together to determine heredity in organisms.
   - **B.** Genes are found in chromosomes but not DNA.
   - **C.** Differences between organisms are due to specific changes in the nucleotide sequences.
   - **D.** Chromosomes and genes allow the information found on the DNA strand to be copied and transferred.

USA TEST PREP
Your Classroom Partner

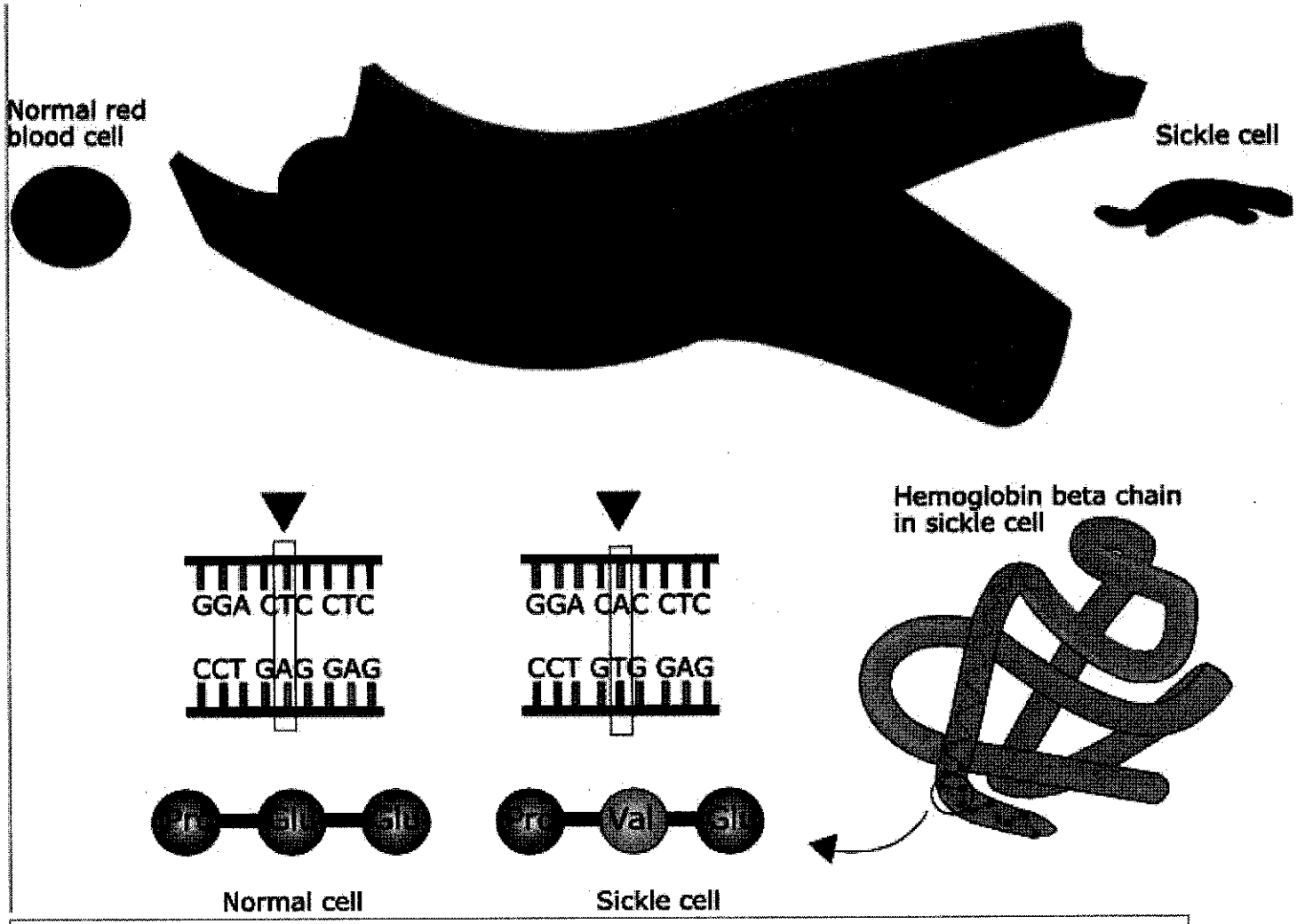
Positive, Negative & Neutral Mutations

Student Name: _____ Date: _____

Teacher Name: Jamie Loper Score: _____

For each example, classify the mutation as having positive, negative, or neutral effects.

Listed in the Item Bank are key terms and expressions, each of which is associated with one of the columns. Write the number for each item into the correct column. Order does not matter.



The effects of mutations can vary widely, from being beneficial, to having no effect, to having lethal consequences, and every possibility in between. The majority of mutations

have neither negative nor positive effects on the organism in which they occur. Sickle Cell Anemia is caused by a mutated version of the gene that helps make hemoglobin, a protein that carries oxygen in red blood cells. People with two copies of the sickle cell gene have the disease. People who carry only one copy of the sickle cell gene do not have the disease and are protected against malaria.

Items:

1. A four leaf clover is formed from a genetic mutation.
2. A mutation caused some birds to have longer beaks. This helped them be better able to get water during a drought.
3. A mutation in a single gene causes the body to produce thick, sticky mucus that clogs the lungs and blocks ducts in digestive organs.
4. A mutation in the rock pocket mice allowed them better camouflage from predators.
5. Mutations caused by silent point mutations.
6. Mutations in bacteria that allow them to survive in the presence of antibiotic drugs, leading to antibiotic-resistance.
7. Mutations in genes that regulate the cell cycle, allow cells with damaged DNA to divide.

Positive Mutation	Negative Mutation	Neutral Mutation