EOT3_G06-GENERAL-SCIENCE- INSPIRE

Alshawamkeh School-Science department

2023 - T3

UNIT 2 LESSON 1 : **INHERITANCE**

- **Page 10 – Page 13 – Page 15**

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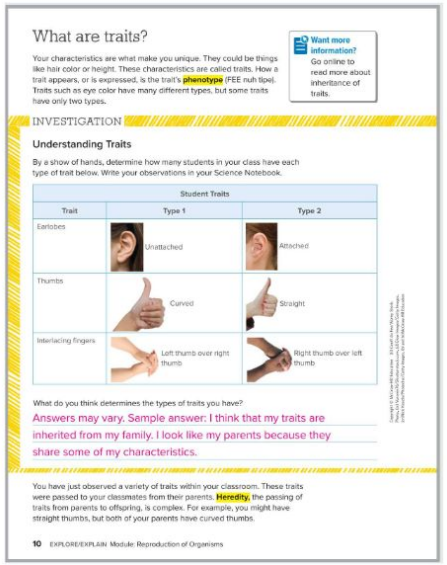


What are traits?

Your characteristics are what make you unique. They could be things like hair color or height. These characteristics are called traits. How a trait appears, or is expressed, is the trait's **phenotype** (FEE nuh tipe). Traits such as eye color have many different types, but some traits have only two types.

Want more information? Go online to read more about inheritance of traits.

INVESTIGATION

Understanding Traits

By a show of hands, determine how many students in your class have each type of trait below. Write your observations in your Science Notebook.

Student Traits

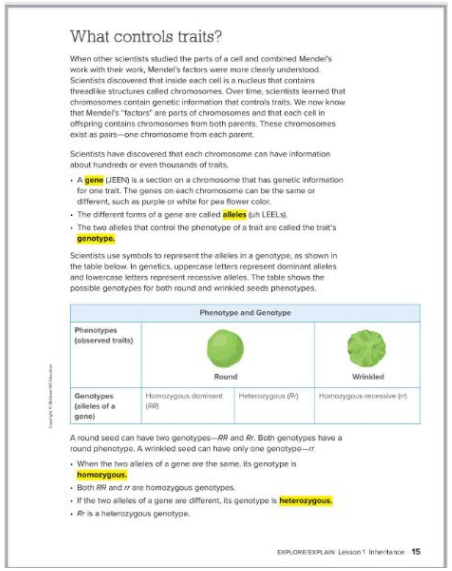
Trait	Type 1	Type 2
Earlobes	Unattached	Attached
Thumbs	Curved	Straight
Interlacing fingers	Left thumb over right thumb	Right thumb over left thumb

What do you think determines the types of traits you have?

Answers may vary. Sample answer: I think that my traits are inherited from my family. I look like my parents because they share some of my characteristics.

You have just observed a variety of traits within your classroom. These traits were passed to your classmates from their parents. **Heredity,** the passing of traits from parents to offspring, is complex. For example, you might have straight thumbs, but both of your parents have curved thumbs.

10 EXPLORE/EXPLAIN Module: Reproduction of Organisms



What controls traits?

When other scientists studied the parts of a cell and combined Mendel's work with their work, Mendel's factors were more clearly understood. Scientists discovered that inside each cell is a nucleus that contains threadlike structures called chromosomes. Over time, scientists learned that chromosomes contain genetic information that controls traits. We now know that Mendel's "factors" are parts of chromosomes and that each cell in offspring contains chromosomes from both parents. These chromosomes exist as pairs—one chromosome from each parent.

Scientists have discovered that each chromosome can have information about hundreds or even thousands of traits.

- A **gene** (JEEN) is a section on a chromosome that has genetic information for one trait. The genes on each chromosome can be the same or different, such as purple or white for pea flower color.
- The different forms of a gene are called **alleles** (uh LEELs).
- The two alleles that control the phenotype of a trait are called the trait's **genotype.**

Scientists use symbols to represent the alleles in a genotype, as shown in the table below. In genetics, uppercase letters represent dominant alleles and lowercase letters represent recessive alleles. The table shows the possible genotypes for both round and wrinkled seeds phenotypes.

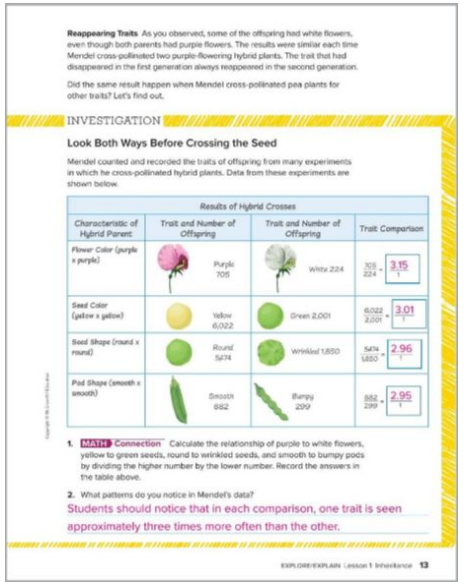
Phenotype and Genotype

Phenotypes (observed traits)	Round	Wrinkled
Genotypes (alleles of a gene)	Homozygous dominant (*RR*)	Heterozygous (*Rr*) / Homozygous recessive (*rr*)

A round seed can have two genotypes—*RR* and *Rr*. Both genotypes have a round phenotype. A wrinkled seed can have only one genotype—*rr*.

- When the two alleles of a gene are the same, its genotype is **homozygous.**
- Both *RR* and *rr* are homozygous genotypes.
- If the two alleles of a gene are different, its genotype is **heterozygous.**
- *Rr* is a heterozygous genotype.

EXPLORE/EXPLAIN Lesson 1 Inheritance 15



Reappearing Traits As you observed, some of the offspring had white flowers, even though both parents had purple flowers. The results were similar each time Mendel cross-pollinated two purple-flowering hybrid plants. The trait that had disappeared in the first generation always reappeared in the second generation.

Did the same result happen when Mendel cross-pollinated pea plants for other traits? Let's find out.

INVESTIGATION

Look Both Ways Before Crossing the Seed

Mendel counted and recorded the traits of offspring from many experiments in which he cross-pollinated hybrid plants. Data from these experiments are shown below.

Results of Hybrid Crosses

Characteristic of Hybrid Parent	Trait and Number of Offspring	Trait and Number of Offspring	Trait Comparison
Flower Color (purple x purple)	Purple 705	White 224	705 / 224 = 3.15 / 1
Seed Color (yellow x yellow)	Yellow 6,022	Green 2,001	6,022 / 2,001 = 3.01 / 1
Seed Shape (round x round)	Round 5,474	Wrinkled 1,850	5,474 / 1,850 = 2.96 / 1
Pod Shape (smooth x smooth)	Smooth 882	Bumpy 299	882 / 299 = 2.95 / 1

1. **MATH Connection** Calculate the relationship of purple to white flowers, yellow to green seeds, round to wrinkled seeds, and smooth to bumpy pods by dividing the higher number by the lower number. Record the answers in the table above.

2. What patterns do you notice in Mendel's data?

Students should notice that in each comparison, one trait is seen approximately three times more often than the other.

EXPLORE/EXPLAIN Lesson 1 Inheritance 13

What are traits?

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a trait appears, or is expressed, is the trait's **phenotype** . Trats such as eye color have many different types , but same traits have only two types.

Student Traits		
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What do you think determines the types of traits you have?

I think that my traits are inherited from my family. I look like my parents because they share some of my characteristics.

Heredity, the passing of traits from parents to offspring, is complex.

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Reappearing Traits :

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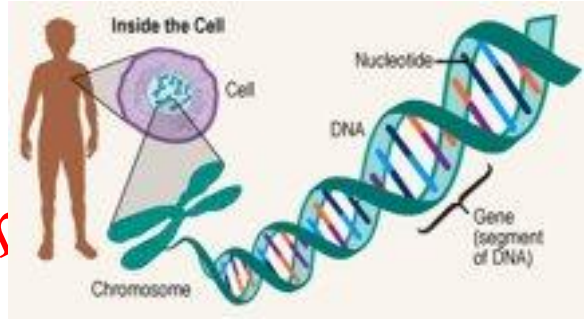
What patterns do you notice in Mendel's data?

In each comparison, one trait is approximately three times more often then others.

What controls traits?

Scientists discovered that inside each cell is a structures called **chromosomes**.
Chromosomes contain genetic information that controls traits. Each cell in offspring contains chromosomes from both parents.
These chromosomes exist as pairs-one chromosome from each parent.



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- A **gene** is a section on a chromosome that has genetic information for one trait.
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What controls traits?

✔When the two alleles of a gene are the same, the genotype is **homozygous**

✔ If the two alleles of a gene are different, the genotype is **heterozygous**

Phenotype and Genotype			
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Genotypes (alleles of a gene)	Homozygous dominant (*RR*)	Heterozygous (*Rr*)	Homozygous recessive (*rr*)

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homozygous:
RR

heterozygous:
Rr

rr

1) Which of the following is NOT an example of a trait?

- **A)** eye color
- **B)** ear shape
- **C)** species
- **D)** body height

Correct Answer

C) species

9) A scientist crossed two fruit flies in a lab. She was studying the transmission of the alleles that affect wing shape. The dominant allele, *C*, is the allele for curly wings, and the recessive allele, *c*, is the allele for straight wings. She knew that one of the parent flies was heterozygous and had curly wings (*Cc*). Half of the offspring from the cross had curly wings, and the other half had straight wings. Identify the genotype and phenotype of the second parent fly. State the evidence that supports your response.

Explanation

The second parent fly has the genotype (*cc*) and straight wings. The evidence that supports this is that half of the offspring had straight wings. For that to happen, half of the offspring had to receive a recessive allele from both parents. When one of the parents is heterozygous, the other parent must be homozygous recessive for this to occur.

4) The study of _____ is called genetics.

- **A)** heredity
- **B)** dominance
- **C)** pea plants
- **D)** mutations

Correct Answer

A) heredity

3) A child looks more like one parent than the other because a child only inherits chromosomes from one parent.

- True
- False

Correct Answer

False

2) Bird A has the genotype *Ll* for bill length, and Bird B is *LL*. The bills of their offspring would be:

Bird A Bird B

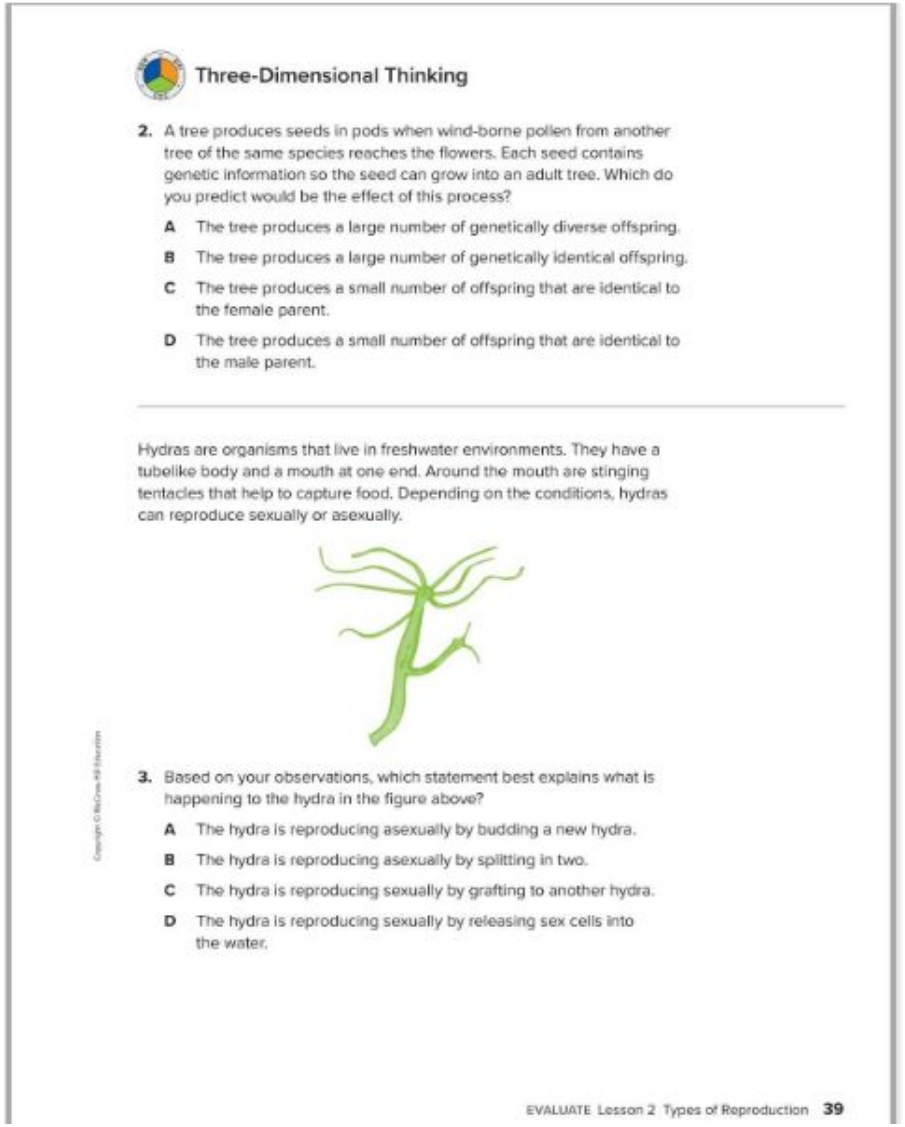
- **A)** long in 100% of the offspring.
- **B)** short in 100% of the offspring.
- **C)** long in 50% of the offspring.
- **D)** short in 75% of the offspring.

Correct Answer

A) long in 100% of the offspring.

UNIT 2: LESSON 2 TYPES OF REPRODUCTION

- **Page 39**



Three-Dimensional Thinking

2. A tree produces seeds in pods when wind-borne pollen from another tree of the same species reaches the flowers. Each seed contains genetic information so the seed can grow into an adult tree. Which do you predict would be the effect of this process?

A The tree produces a large number of genetically diverse offspring.

B The tree produces a large number of genetically identical offspring.

C The tree produces a small number of offspring that are identical to the female parent.

D The tree produces a small number of offspring that are identical to the male parent.

Hydras are organisms that live in freshwater environments. They have a tubelike body and a mouth at one end. Around the mouth are stinging tentacles that help to capture food. Depending on the conditions, hydras can reproduce sexually or asexually.

3. Based on your observations, which statement best explains what is happening to the hydra in the figure above?

A The hydra is reproducing asexually by budding a new hydra.

B The hydra is reproducing asexually by splitting in two.

C The hydra is reproducing sexually by grafting to another hydra.

D The hydra is reproducing sexually by releasing sex cells into the water.

EVALUATE Lesson 2 Types of Reproduction 39

Three-Dimensional Thinking

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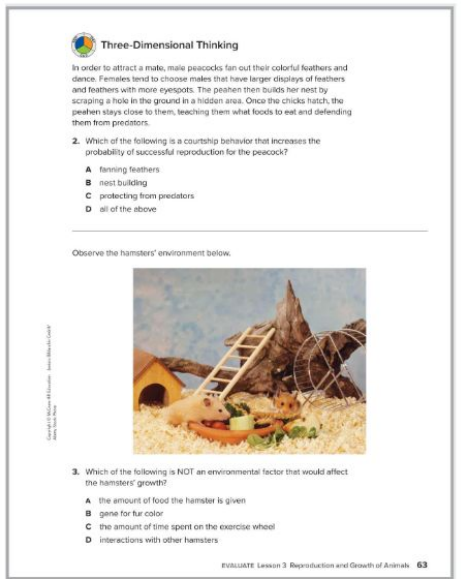
UNIT 2 :LESSON 3
REPRODUCTION OF ANIMALS

Page 50 – Page 53 – Page 63



Three-Dimensional Thinking

In order to attract a mate, male peacocks fan out their colorful feathers and dance. Females tend to choose males that have larger displays of feathers and feathers with more eyespots. The peahen then builds her nest by scraping a hole in the ground in a hidden area. Once the chicks hatch, the peahen stays close to them, teaching them what foods to eat and defending them from predators.

2. Which of the following is a courtship behavior that increases the probability of successful reproduction for the peacock?

A fanning feathers
B nest building
C protecting from predators
D all of the above

Observe the hamsters' environment below.

3. Which of the following is NOT an environmental factor that would affect the hamsters' growth?

A the amount of food the hamster is given
B gene for fur color
C the amount of time spent on the exercise wheel
D interactions with other hamsters

EVALUATE Lesson 3 Reproduction and Growth of Animals 63

CAREERS in SCIENCE

AMERICAN MUSEUM of NATURAL HISTORY

The Spider
Mating Dance

Meet Norman Platnick, a scientist studying spiders.

Norman Platnick is fascinated by all spider species—from the dwarf tarantula-like spiders of Panama to the blind spiders of New Zealand. These are just two of the over 1,800 species he's discovered worldwide.

How does Platnick identify new species? One way is the pedipalps. Every spider has two pedipalps, but they vary in shape and size among the over 46,000 species. Pedipalps look like legs but function more like antennae and mouthparts. Male spiders use their pedipalps to aid in reproduction.

Getting Ready When a male spider is ready to mate, he places a drop of sperm onto a sheet of silk he constructs. Then he dips his pedipalps into the drop to draw up the sperm.

Finding a Mate The male finds a female of the same species by touch or by sensing certain chemicals she releases.

Courting and Mating Males of some species court a female with a special dance. For other species, a male might present a female with a gift, such as a fly wrapped in silk. During mating, the male uses his pedipalps to transfer sperm to the female.

What happens to the male after mating? That depends on the species. Some are eaten by the female, while others move on to find new mates.

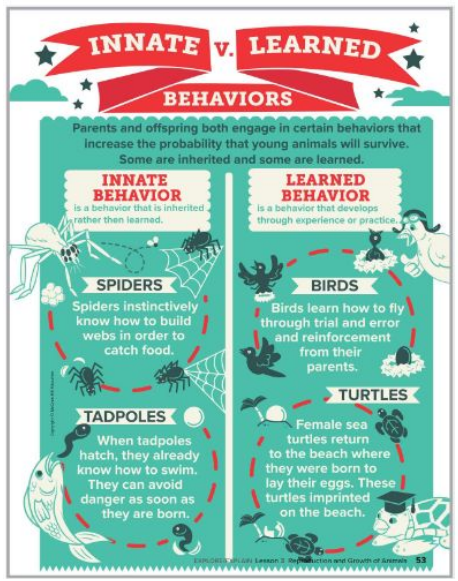
Spiders reproduce sexually, so each offspring has a unique combination of genes from its parents. Over many generations, this genetic variation has led to the incredible diversity of spiders in the world today.

Norman Platnick is an arachnologist (uh-rak-NAH-luh-just) at the American Museum of Natural History. Arachnologists are scientists who study spiders.

It's Your Turn

Research Select a species of spider and research its mating rituals. What does a male do to court a female? What is the role of the female? What happens to the spider/legs after they hatch? Use images to illustrate a report on your research.

50 ELABORATE Module: Reproduction of Organisms



INNATE v. LEARNED BEHAVIORS

Parents and offspring both engage in certain behaviors that increase the probability that young animals will survive. Some are inherited and some are learned.

INNATE BEHAVIOR is a behavior that is inherited rather then learned.

LEARNED BEHAVIOR is a behavior that develops through experience or practice.

SPIDERS
Spiders instinctively know how to build webs in order to catch food.

BIRDS
Birds learn how to fly through trial and error and reinforcement from their parents.

TADPOLES
When tadpoles hatch, they already know how to swim. They can avoid danger as soon as they are born.

TURTLES
Female sea turtles return to the beach where they were born to lay their eggs. These turtles imprinted on the beach.

EXPLORE/EXPLAIN Lesson 3: Reproduction and Growth of Animals 53

The Spider

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How does Platnick identify new species? the **pedipalps**. Every spider has two pedipalps, but they vary in shape and size Pedipalps look like legs but function are antennae and mouthparts. Male spiders use their pedipalps to aid in reproduction.

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Getting Ready When a male spider is ready to mate, he places a drop of sperm onto a sheet of silk he constructs. Then he dips his pedipalps into the drop to draw up the sperm.

The Spider

- **Finding a Mate :** by touch or by sensing certain chemicals she releases.
- **Courting and Mating :** with a special **dance or** present a female with a **gift**, such as a fly wrapped in silk.
- **During mating,** the male uses his pedipalps to transfer sperm to the female.
- **the male after mating:** Some are eaten by the female, while others move on find new mates.

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Word Bank

chemicals species offspring genes variation

1. *How does a male spider find a mate?* Sample response: Male spiders find mates by sensing certain chemicals released by the females. They also find mates by touch.

2. *There are more than 40,000 known species of spiders. How does sexual reproduction lead to genetic variation?* Sample response: Spiders reproduce sexually, so each offspring has a new and unique combination of genes. With each generation, there is more genetic variation in the population, which leads to species diversity.

1.What is an innate behavior?

a behavior that is inherited rather than learned

2, What is a learned behavior?

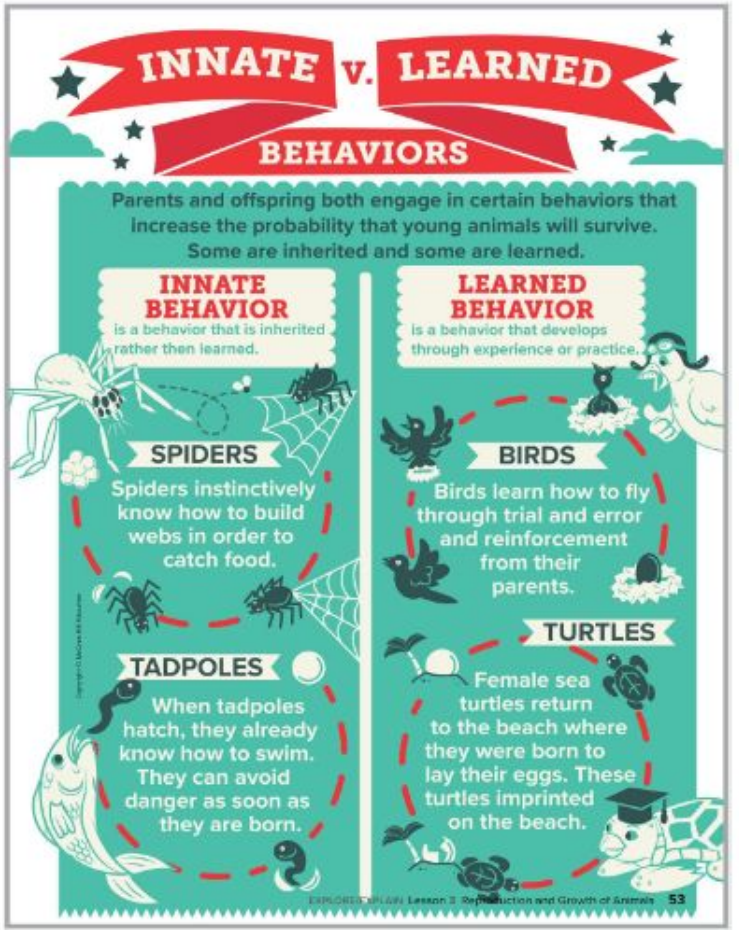
a behavior that develops through experience or practice

3. What is a benefit of innate behavior?

young animals know how to do innate behaviors as soon as they are born, so they can protect them or help them survive even if the animals are very young or no other animals are around to teach them.

4. What is a benefit of learned behavior?

learned behavior allows for animals to adapt to unique environments or situations



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2. Which of the following is a courtship behavior that increases the probability of successful reproduction for the peacock?

- **A** fanning feathers
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- **D** all of the above

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3. Which of the following is NOT an environmental factor that would affect the hamsters' growth?

- **A** the amount of food the hamster is given
- gene for fur color
- **C** the amount of time spent on the exercise wheel
- **D** interactions with other hamsters

1) Of the following, which is NOT a courtship behavior?

- **A)** birds singing
- **B)** fireflies lighting up
- **C)** frogs croaking
- **D)** dogs digging

Correct Answer

D) dogs digging

6) Tadpoles survive hatching in water because they are born knowing how to swim. This is an example of _____.

- **A)** learned behavior
- **B)** innate behavior
- **C)** social behavior
- **D)** none of the above

Correct Answer

B) innate behavior

3) Innate behavior increases the survival of young animals because it allows an animal to respond to a stimulus without choosing the proper response.

- True
- False

Correct Answer

True

7) The mating season for white-tailed deer is just two to three months long. Male deer grow antlers before each breeding season. They use their antlers to fight each other to establish dominance in bachelor herds and earn the right to mate with certain females. Scientists claim that this aggressive behavior increases the chances of successful reproduction for the entire deer population. Which statement best supports this claim?

- **A)** Healthier male deer are able to grow larger antlers.
- **B)** Healthier males are better able to protect their young.
- **C)** This behavior extends the length of the mating season.
- **D)** This behavior gives healthier males a better chance to mate.

Correct Answer

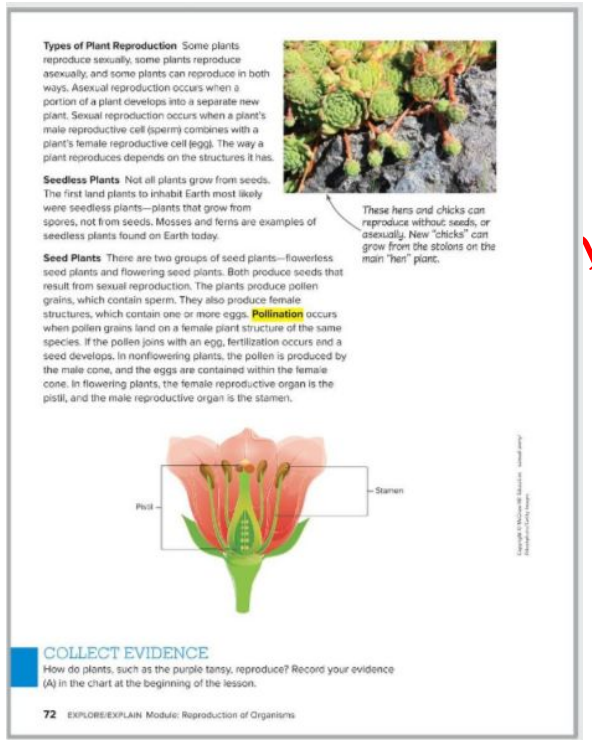
D) This behavior gives healthier males a better chance to mate.

Baby whales are born in water tail first. Immediately afterwards, the mother whale pushes the baby to the surface for its first breath. What kind of behavior is this?

innate behavior

UNIT 2 :LESSON 3
REPRODUCTION OF PLANT

Page 72– Page 75



Types of Plant Reproduction Some plants reproduce sexually, some plants reproduce asexually, and some plants can reproduce in both ways. Asexual reproduction occurs when a portion of a plant develops into a separate new plant. Sexual reproduction occurs when a plant's male reproductive cell (sperm) combines with a plant's female reproductive cell (egg). The way a plant reproduces depends on the structures it has.

Seedless Plants Not all plants grow from seeds. The first land plants to inhabit Earth most likely were seedless plants—plants that grow from spores, not from seeds. Mosses and ferns are examples of seedless plants found on Earth today.

These hens and chicks can reproduce without seeds, or asexually. New "chicks" can grow from the stolons on the main "hen" plant.

Seed Plants There are two groups of seed plants—flowerless seed plants and flowering seed plants. Both produce seeds that result from sexual reproduction. The plants produce pollen grains, which contain sperm. They also produce female structures, which contain one or more eggs. **Pollination** occurs when pollen grains land on a female plant structure of the same species. If the pollen joins with an egg, fertilization occurs and a seed develops. In nonflowering plants, the pollen is produced by the male cone, and the eggs are contained within the female cone. In flowering plants, the female reproductive organ is the pistil, and the male reproductive organ is the stamen.

Pistil — Stamen

COLLECT EVIDENCE

How do plants, such as the purple tansy, reproduce? Record your evidence (A) in the chart at the beginning of the lesson.

72 EXPLORE/EXPLAIN Module: Reproduction of Organisms

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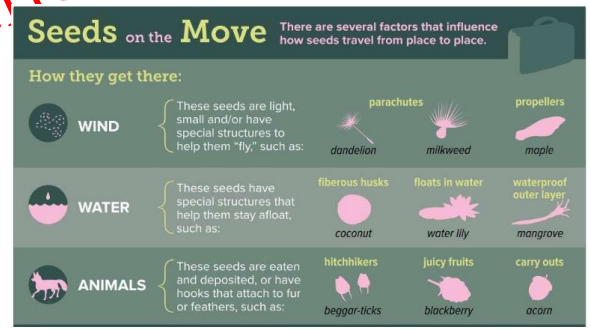

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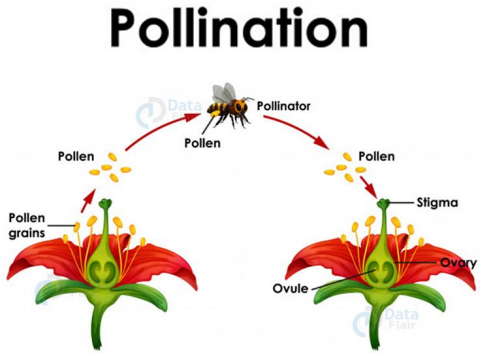

- **Pollination** occurs. when pollen grains land on a female plant structure of the same species

If the pollen joins with an egg, fertilization occurs and a seed develops.

Seedless Plants

- Not all plants grow from seeds.
- Plants that do not produce seeds are called **seedless plants.**
- The first land plants to inhabit Earth most likely were seedless plants
- They produce either by **asexual reproduction or by producing spores.**
- Mosses and ferns are examples of seedless plants found on Earth ~~today.~~

There are two groups of seed plants:

- flowerless seed plants
- flowering seed plants.

✔ Both produce seeds that result from sexual reproduction.

✔ The plants produce pollen grains, which contain sperm.

✔ They also produce female structures, which contain one or more eggs.

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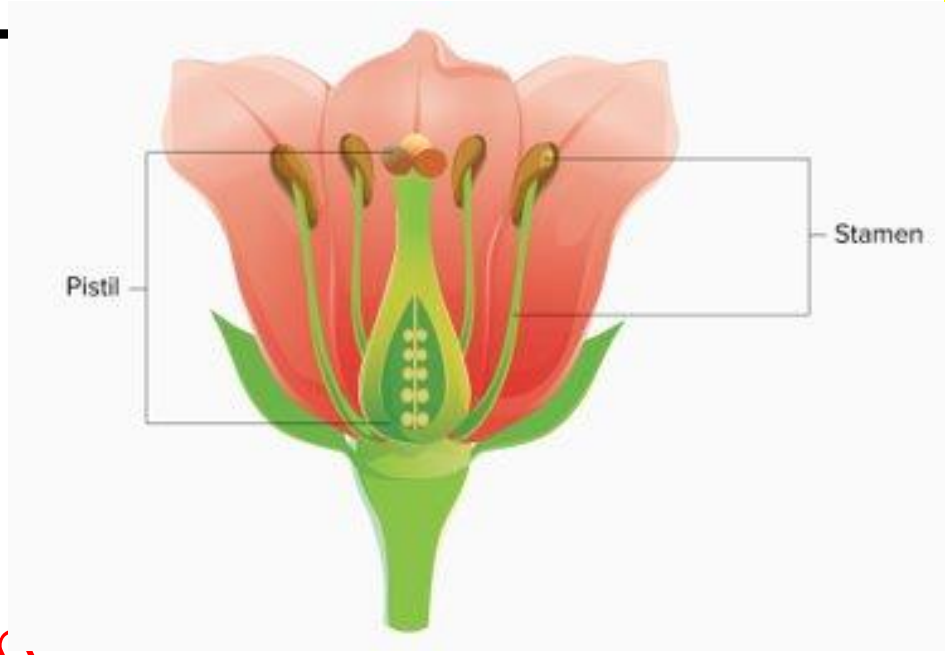
- **Flowering plants:**
  - ✔ The **female** reproductive organ is **the pistil**, and
  - ✔ The **male** reproductive organ is **the stamen**.
- **Nonflowering plants:**



- ✔ The **pollen** is produced by the male cone, and
- ✔ The **eggs** are contained with the female cone.

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What type of plant is shown? a flowering plant

How does it reproduce? sexual reproduction

Which structure contains eggs? the pistil

Which structure contains sperm? the stamen

Seeds on the Move

There are several factors that influence how seeds travel from place to place.

How they get there:

WIND

These seeds are light, small and/or have special structures to help them "fly," such as:

- parachutes
  - dandelion
  - milkweed
- propellers
  - maple

WATER

These seeds have special structures that help them stay afloat, such as:

- fiberous husks
  - coconut
- floats in water
  - water lily
- waterproof outer layer
  - mangrove

ANIMALS

These seeds are eaten and deposited, or have hooks that attach to fur or feathers, such as:

- hitchhikers
  - beggar-ticks
- juicy fruits
  - blackberry
- carry outs
  - acorn

1. What characteristics help a seed get dispersed by wind?

Small size, light weight, structure that catch the wind

2. What characteristics help a seed get dispersed by water?

Structure that help them float and protect them from water

3. What characteristics help a seed get dispersed by animals?

Hooks that attach to fur or feather, ease of being carried, juicy fruits

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1) Seedless plants grow from _____.

Correct Answer

spores

3) Which part of a flower is the male reproductive organ?

- **A)** ovary
- **B)** pistil
- **C)** stamen
- **D)** sepal

Correct Answer

C) stamen

4) Which is the most likely description of a seed that is dispersed by wind?

- **A)** It can float.
- **B)** It has a thick, hard shell.
- **C)** It has a waterproof coating.
- **D)** It is small and light.

Correct Answer

D) It is small and light.

5) _____ are plant structures that are colorful and may have specific odors to attract pollinators.

Correct Answer

Flowers

8) Which would provide the most reliable data about the genetic factors that affect plant growth?

- **A)** two plants of different species grown in the same conditions
- **B)** three plants of different species, each given a different amount of light
- **C)** one plant grown in ideal environmental conditions
- **D)** two plants of the same species grown in the same environmental conditions

Correct Answer

A) two plants of different species grown in the same conditions

9) Name three ways seeds can be dispersed.

wind, water, animals

Fill in the Blank

Complete the text. Use the words below.

fertilization **grains** **spores** **transport**

Since plants are anchored into the ground and cannot usually move, they must come up with ways to increase the probability of **(1)** fertilization. Many plants reproduce through seeds. One way plants **(2)** transport their seeds is through wind. Another method of plant reproduction is through pollination, where **(3)** grains of pollen are carried from one plant to another. Some plants are seedless, so they use **(4)** spores for reproducing.

True or False

Indicate if the following statements are true or false. If they are false, explain why.

Example: Flowering plants usually use **spores** to reproduce.

False. They usually use seeds.

1. Fish often inhabit deserts.

   False. Fish live in water, which is not usually found in deserts.

2. I can use my nose to detect if someone is brewing coffee.

   True

3. Two stamens must come together in plants in order to carry out fertilization.

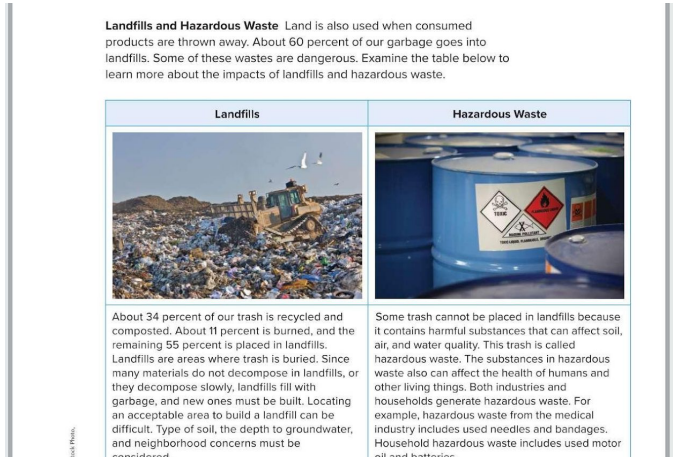
   False. Pollen must join with an egg in order to carry out fertilization.

4. Another word for transport is carry.

   True

UNIT 4 - LESSON 1 - IMPACT ON LAND

Page 10 -Page 14 – Page 21 - Page 25



Landfills and Hazardous Waste Land is also used when consumed products are thrown away. About 60 percent of our garbage goes into landfills. Some of these wastes are dangerous. Examine the table below to learn more about the impacts of landfills and hazardous waste.

Landfills	Hazardous Waste
About 34 percent of our trash is recycled and composted. About 11 percent is burned, and the remaining 55 percent is placed in landfills. Landfills are areas where trash is buried. Since many materials do not decompose in landfills, or they decompose slowly, landfills fill with garbage, and new ones must be built. Locating an acceptable area to build a landfill can be difficult. Type of soil, the depth to groundwater, and neighborhood concerns must be considered.	Some trash cannot be placed in landfills because it contains harmful substances that can affect soil, air, and water quality. This trash is called hazardous waste. The substances in hazardous waste also can affect the health of humans and other living things. Both industries and households generate hazardous waste. For example, hazardous waste from the medical industry includes used needles and bandages. Household hazardous waste includes used motor oil and batteries.

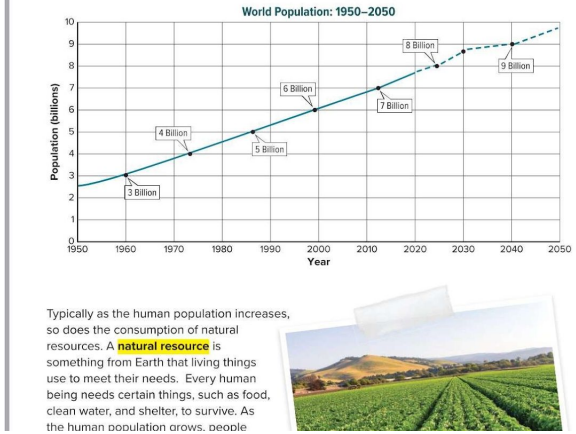
Humans are cutting down forests for resources. More resources are needed as populations increase. Cutting down forests results in the destruction of habitats. If a species depends on a certain environment to live successfully, and that environment is destroyed, the species will not flourish. This results in a decline of the species and throws off the balance of the ecosystem.

Impact of Deforestation As you calculated in the previous activity, a significant amount of forests have been reduced globally. An increased need for resources produced by trees, or the land on which the trees grow, has led to a decrease in the amount of forests.

What's the impact? Deforestation leads to loss of animal habitats, which can lead to the endangerment or extinction of a species. In tropical rain forests—complex ecosystems that can take hundreds of years to replace—deforestation is a serious problem. Tropical rain forests are home to an estimated 50 percent of all species on Earth.

In addition, deforestation affects the atmosphere. Trees remove carbon dioxide from the atmosphere during photosynthesis. Rates of photosynthesis decrease when large areas of trees are cut down, and more carbon dioxide remains in the atmosphere.

People also clear land for development and agriculture. Let's investigate the impact of agriculture on land resources.



Typically as the human population increases, so does the consumption of natural resources. A **natural resource** is something from Earth that living things use to meet their needs. Every human being needs certain things, such as food, clean water, and shelter, to survive. As the human population grows, people

How does a growing population impact Earth?

- Scientists estimate that there were about 300 million humans on Earth a thousand years ago.
- Today there are more than 7 billion humans on Earth, as shown in the graph below.
- By 2050, there could be more 9 billion.

- As the human population increases, use of natural resources often increases as well.
- A **natural resource** *is something from Earth that living things use to meet their needs.*
- Natural resources include food, clean water, and shelter.
- Land is a resource.

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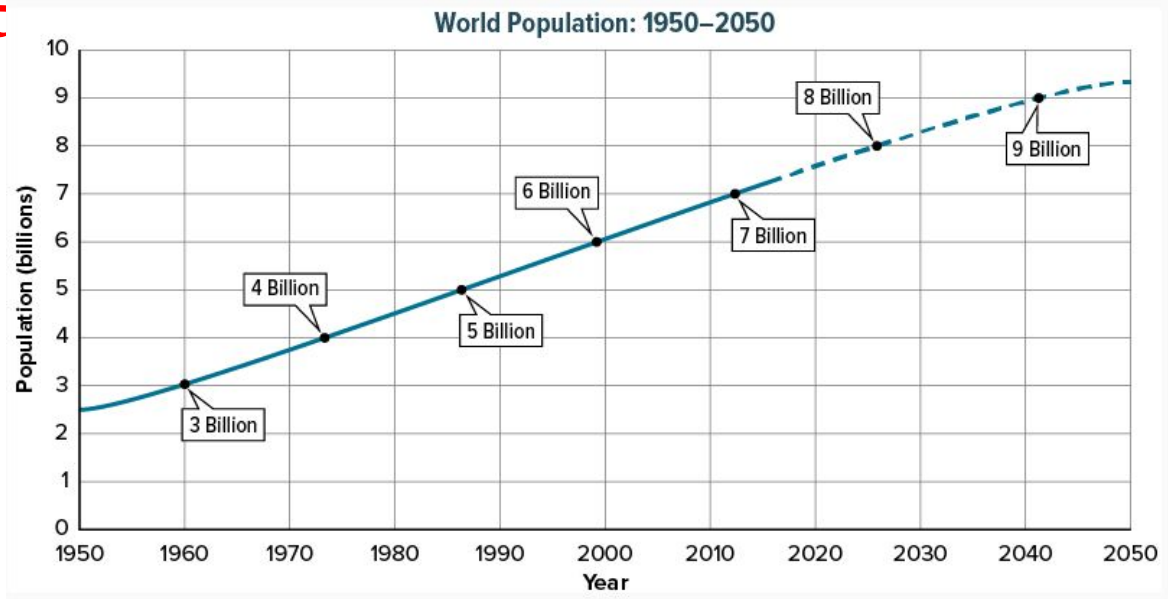

Impact of Deforestation

- ✔ A significant amount of forests have been reduced globally.
- ✔ As human population increases, more resources from trees are needed and more deforestation occurs.
- ✔ In tropical rain forests, deforestation is a serious problem. Scientists estimate that 50 percent of all the species on Earth live in tropical rain forests. Deforestation destroys habitats, which can lead to species' extinction.
- ✔ Deforestation also can affect soil quality. Plant roots hold soil in place. Without these natural anchors, soil erodes.
- ✔ In addition, deforestation affects air quality. Remember that when trees undergo photosynthesis, they remove carbon dioxide from the air. When there are fewer trees on Earth, more carbon dioxide remains in the atmosphere.

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ENVIRONMENTAL Connection

Next, research how cutting old growth forests of North America's Pacific Northwest impacts the northern spotted owl and ultimately the biodiversity and viability of this natural system. Record your findings below.

Answer : Humans are cutting down forests for resources. More resources are needed as populations increase. Cutting down forests results in the destruction of habitats. If a species depends on a certain environment to live successfully, and that environment is destroyed, the species will not flourish. This results in a decline of the species and throws off the balance of the ecosystem.

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Landfills and Hazardous Waste

- ✔ Land is also used when garbage is thrown away in landfills.
- ✔ The majority of our garbage goes into landfills.
- ✔ This includes some dangerous wastes.

Landfills

- ✔ About 34 percent of trash is recycled and composted.
- ✔ About 11 percent is burned.
- ✔ The remaining 55 percent is placed in landfills.
- ✔ Landfills are areas where trash is buried.
- ✔ Trash is covered by soil to keep it from blowing away.
- ✔ Special liners help prevent pollutants from leaking into soil and groundwater supplies.
- ✔ When landfills fill with trash, new ones must be built.
- ✔ Locating an acceptable area to build a landfill can be difficult.

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Hazardous Waste

- ✔ *Some trash cannot be placed in landfills because it contains harmful substances that can affect soil, air, and water quality.* This trash is called **hazardous waste**.
- ✔ The substances in hazardous waste also can affect the health of humans and other living organisms.
- ✔ Industries and households generate hazardous waste.
- ✔ Hazardous waste from the medical industry includes used needles and bandages.
- ✔ Household hazardous waste includes used motor oil and batteries.

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Pollution

- ✔ Runoff that contains chemicals from landfills, mines, and farms can pollute and affect the quality of soil and water.
- ✔ **Pollution** *is the contamination of the environment with substances that are harmful to life.*
- ✔ Pollution can destroy many plants and animals.

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✔ **Why is it important to keep hazardous waste like this from seeping into the groundwater?**

Answer : Groundwater is used as a source for drinking water, so preventing pollutants from entering groundwater helps to protect people's health.

THREE-DIMENSIONAL THINKING

Explain what **effect** trash disposal can have on Earth's systems.

Answer : Pollution leakage into soil and water can affect Earth's geosphere and hydrosphere. This can be hazardous to Earth's biosphere and can be devastating to many plant and animal species.

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Reduce, Reuse, Recycle

- Individuals can have a big impact on land-use issues by practicing the three Rs—reusing, reducing, and recycling.
- Using an item for a new purpose is **reusing.** For example, you might have made a bird feeder from a used plastic milk jug.
- **Reducing** is using fewer resource You can turn off the lights when you leave a room to reduce your use of electricity.

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- ✔ Making a new product from a used product is **recycling**.

- Plastic containers can be recycled into new plastic products.
- Recycled aluminum cans are used to make new aluminum cans.
- Using recycled paper to make new paper reduces deforestation.
- It also reduces the amount of water used during paper production.

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- ✔ Another way people can lessen their environmental impact is composting.
- ✔ **Compost** is a mixture of decaying organic matter, such as leaves, food scraps, and grass clippings.
- ✔ It improves soil quality by adding nutrients to soil.
- ✔ Composting and reusing, reducing, and recycling help reduce the amount of trash that ends up in landfills.

2) Which is NOT a negative consequence of clearing land during deforestation?

- **A)** increase in the number of endangered species
- **B)** increase in the amount of photosynthesis
- **C)** increase in the amount of carbon dioxide in the atmosphere
- **D)** increase in the chance of flooding in an area.

Correct Answer

B) increase in the amount of photosynthesis

3) Which describes an effect of recycling?

- **A)** Recycling increases land usage.
- **B)** Recycling decreases land usage.
- **C)** Recycling increases pollution.
- **D)** Recycling stops land from being used.

Correct Answer

B) Recycling decreases land usage.

4) A group of students designs a model landfill. The purpose of the design is to keep as much liquid as possible in the landfill. Which best describes a step the students should do as they plan their model?

- **A)** They should decide what kind of liquid to pour on the model.
- **B)** They should compare their model with another group's.
- **C)** They should decide how to collect the liquid that runs out of the model.
- **D)** They should see how many landfills there are in the United States.

Correct Answer

C) They should decide how to collect the liquid that runs out of the model.

5) Composting means piling up grass and leaves so they can be allowed to gradually decompose. Which describes an impact that composting has on land?

- **A)** a decrease in the amount of plastics recycled
- **B)** a decrease in the amount of land used for landfills
- **C)** a decrease in the amount of groundwater in an area
- **D)** a decrease in the amount of land used for farming

Correct Answer

B) a decrease in the amount of land used for landfills

6) A new law requires that all newspapers in the nation to use recycled paper. This law will mean that 500,000 trees each week will be saved. Which describe this law's impact on the nation's forests?

- **A)** negative: the amount of carbon dioxide in the air will decrease
- **B)** negative: the amount of soil in the area will decrease
- **C)** positive: the amount of erosion will increase
- **D)** positive: biodiversity will increase

Correct Answer

1) Which describes a step people can take to help minimize the effects of using land for agriculture?

- **A)** use more land for farms
- **B)** increase the number of different pesticides used
- **C)** remove crops quickly to increase erosion of soil
- **D)** plant crops that attract many different kinds of insects

Correct Answer

D) plant crops that attract many different kinds of insects

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1) Deforestation can lead to _____.

- ○ **A)** loss of animal habitats
- ○ **B)** soil erosion
- ○ **C)** increases in Earth's average surface temperature
- ○ **D)** all of the above

Correct Answer

D) all of the above

10) When forests disappear, _____ , the number of different organisms in an ecosystem will likely _____.

Correct Answer

biodiversity
decrease

11) Which **best** describes something that would decrease the amount of carbon dioxide in the atmosphere?

- ○ **A)** increasing the size of a landfill
- ○ **B)** decreasing the size of a wetland
- ○ **C)** increasing the size of a national forest
- ○ **D)** decreasing the size of an oil spill

Correct Answer

C) Increasing the size of a national forest

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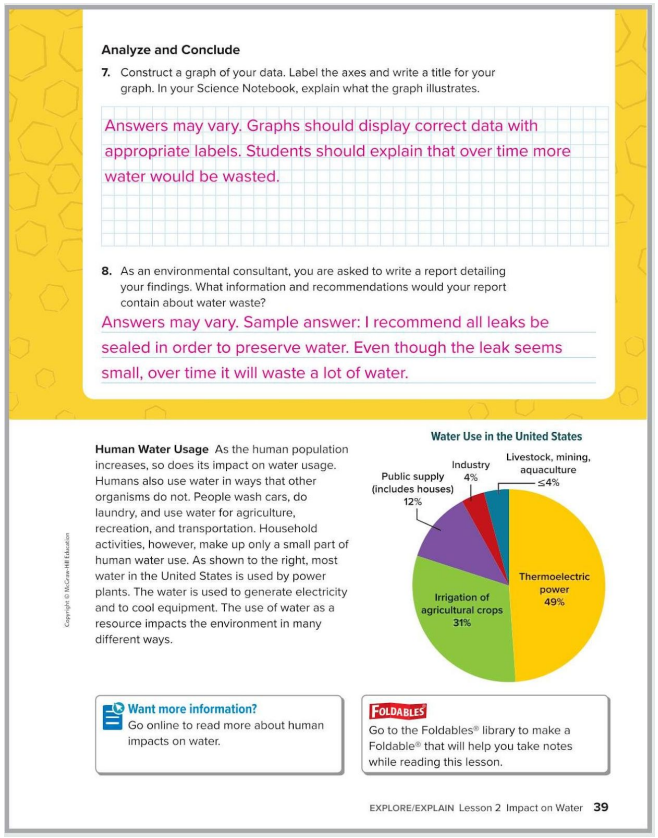
UNIT 4 LESSON 2 : IMPACT ON WATER

Page 39 – Page 41



Analyze and Conclude

7. Construct a graph of your data. Label the axes and write a title for your graph. In your Science Notebook, explain what the graph illustrates.

Answers may vary. Graphs should display correct data with appropriate labels. Students should explain that over time more water would be wasted.

8. As an environmental consultant, you are asked to write a report detailing your findings. What information and recommendations would your report contain about water waste?

Answers may vary. Sample answer: I recommend all leaks be sealed in order to preserve water. Even though the leak seems small, over time it will waste a lot of water.

Human Water Usage As the human population increases, so does its impact on water usage. Humans also use water in ways that other organisms do not. People wash cars, do laundry, and use water for agriculture, recreation, and transportation. Household activities, however, make up only a small part of human water use. As shown to the right, most water in the United States is used by power plants. The water is used to generate electricity and to cool equipment. The use of water as a resource impacts the environment in many different ways.

Water Use in the United States

Want more information? Go online to read more about human impacts on water.

FOLDABLES Go to the Foldables® library to make a Foldable® that will help you take notes while reading this lesson.

EXPLORE/EXPLAIN Lesson 2 Impact on Water 39

4. How did your rankings compare with those of your classmates?

Answers will vary; most students will discard more paper than anything else, but may vary in plastics, glass, metal, and food waste.

5. List two simple ways that you and your classmates can reduce your consumption of Earth's materials.

Students may suggest carrying their lunch to school in reusable containers; reusing old clothing as cleaning rags; or using both sides of notebook paper.

Reduce, Reuse, Recycle Developed countries such as the United States use more natural resources than other regions. Ways to conserve resources include reducing the use of materials, and reusing and recycling materials.

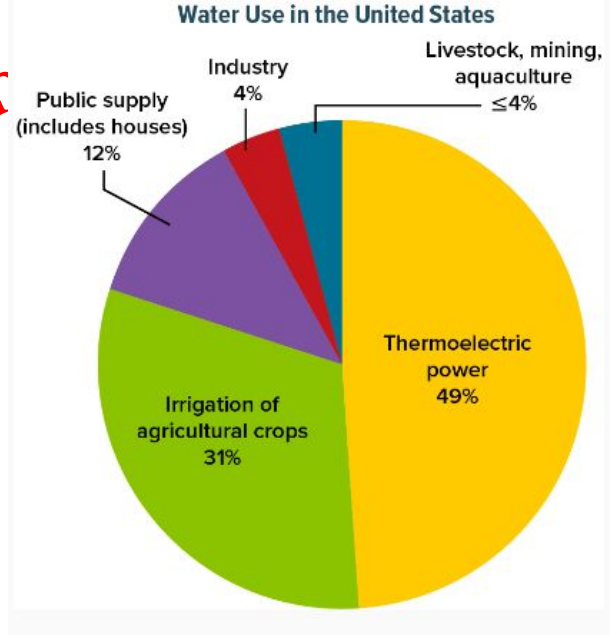
Reusing an item means finding another use for it instead of throwing it away. Using material again is called recycling. When you recycle wastes such as glass, paper, plastic, steel, or tires, you help conserve Earth's land resources. You can use yard waste and vegetable scraps to make rich compost for gardening, reducing the need for synthetic fertilizers. Compost is a mix of decayed organic material, bacteria, other organisms, and small amounts of water. Reducing means limiting the amount used initially.

The human population explosion already has had an effect on the environment and the organisms that inhabit Earth. It's unlikely that the population will begin to decline in the near future. To make up for this, resources must be used wisely. Conserving resources by reducing, reusing, and recycling is an important way that you can make a difference.

EXPLORE/EXPLAIN Lesson 1 Impact on Land 25

How do humans use water?

- As the human population increases, so does the impact on water.
- Humans use water in ways that other organisms do not.
- People wash cars, do laundry, and use water for agriculture, recreation, and transportation.
- The graph below shows some ways that people use water.
- Notice that most water in the United States is used by power plants.
- The water is used to generate electricity and to cool equipment.
- The use of water as a resource impacts the environment in many different ways.



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Case Study: The Aral Sea

Ultimately, the loss of the Aral Sea altered the regional climate and led to many health and economic problems. The human modifications to this natural system produced severe environmental consequences.

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Changing the Flow of Surface Water

- Streams and rivers are often dammed to create reservoirs that store water.
- For example, the Hoover Dam in Nevada was built to control water flow and flooding along the Colorado River.
- A large reservoir, Lake Mead, was built behind the dam.
- Freshwater from Lake Mead is used for recreation, drinking water, irrigation, and hydroelectric power.

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- Dams have many useful purposes.
- But dams can also impact the environment and the biodiversity of the ecosystems around the river.
- Dams can increase soil erosion along the banks of streams.
- They also interfere with the migration of fish such as salmon.
- In addition, dams can slow the flow of a river.
- The Colorado River is nearly dry before it reaches the ocean.

5) Which correctly describes something that can have both a positive and negative impact on the environment?

- **A)** building a dam
- **B)** picking up litter
- **C)** decreasing the use of chemical fertilizers
- **D)** using less water at home

Correct Answer

A) building a dam

4) Which describes an effect of laws like the U.S. Clean Water Act and the Safe Drinking Water Act?

- **A)** They have helped people to eliminate water pollution.
- **B)** They are a step toward reducing water pollution.
- **C)** They result in an increase in water pollution.
- **D)** They cause a decrease in the amount of water on Earth.

Correct Answer

B) They are a step toward reducing water pollution.

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UNIT 4 LESSON 3 : IMPACT ON THE ATMOSPHERE

- Page 66 – Page 68

CFCs In the 1970s, scientists suggested that CFCs could destroy ozone in the upper atmosphere. Studies revealed a thinning of the ozone layer, particularly over Antarctica.

All of the CFCs in the atmosphere are a result of human activity. CFCs are released from products such as old refrigerators and air conditioners, and propellants in aerosol cans. Ozone in the upper atmosphere absorbs harmful UV rays from the Sun. CFCs react with sunlight and destroy ozone molecules. As a result, the ozone layer thins and more UV rays reach Earth's surface. This, in turn, can harm the tissues of plants and animals.

While CFCs indirectly harm organisms, another form of pollution has a direct effect on Earth's biosphere. Let's explore.

INVESTIGATION

As a Matter of Fact

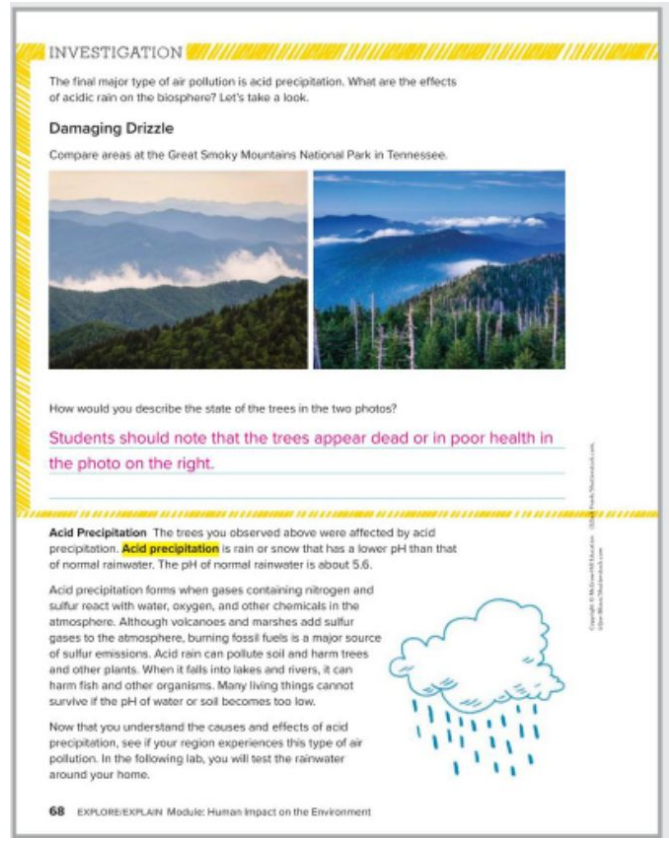
Compare areas along the Yangtze River in China.

How would you describe the atmosphere in the above locations? What might cause the differences you observed?

The air appears clear in the photo on the left, and smoky in the photo on the right; dust and smoke from industrial processes.

Particulate Matter The mix of both solid and liquid particles in the air is called **particulate matter.** Solid particles include smoke, dust, and dirt. These particles enter the air from natural processes, such as volcanic eruptions and forest fires. Human activities, such as burning fossil fuels at power plants and in vehicles, also release particulate matter. Inhaling particulates can cause asthma, bronchitis, and lead to heart attacks. It can also interfere with the processes of cellular respiration and photosynthesis in plants.

66 EXPLORE/EXPLAIN Module: Human Impact on the Environment



INVESTIGATION

The final major type of air pollution is acid precipitation. What are the effects of acidic rain on the biosphere? Let's take a look.

Damaging Drizzle

Compare areas at the Great Smoky Mountains National Park in Tennessee.

How would you describe the state of the trees in the two photos?

Students should note that the trees appear dead or in poor health in the photo on the right.

Acid Precipitation The trees you observed above were affected by acid precipitation. **Acid precipitation** is rain or snow that has a lower pH than that of normal rainwater. The pH of normal rainwater is about 5.6.

Acid precipitation forms when gases containing nitrogen and sulfur react with water, oxygen, and other chemicals in the atmosphere. Although volcanoes and marshes add sulfur gases to the atmosphere, burning fossil fuels is a major source of sulfur emissions. Acid rain can pollute soil and harm trees and other plants. When it falls into lakes and rivers, it can harm fish and other organisms. Many living things cannot survive if the pH of water or soil becomes too low.

Now that you understand the causes and effects of acid precipitation, see if your region experiences this type of air pollution. In the following lab, you will test the rainwater around your home.

68 EXPLORE/EXPLAIN Module: Human Impact on the Environment

Chlorofluorocarbons(CFCs)

- Ozone in the upper atmosphere absorbs harmful ultraviolet (UV) rays from the Sun.
- Using products that contain chlorofluorocarbons (CFCs), such as old air conditioners and refrigerators,and propellants in aerosol cans, affects the ozone layer.
- CFCs react with sunlight and destroy ozone molecules.
- As a result, the ozone layer becomes thinner.
- This allows more UV rays to reach Earth's surface.
- Studies have linked increased skin cancer rates to an increase in UV rays

While CFCs indirectly harm organisms, another form of pollution has a direct effect on Earth's biosphere. Let's explore.

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As a Matter of Fact

Compare areas along the Yangtze River in China.

The air appears clear in the photo on the left, and smoky in the photo on the right; dust and smoke from industrial processes.

Particulate Matter

- *The mix of both solid and liquid particles in the air is called* **particulate matter**.
- Solid particles include smoke, dust, and dirt.
- These particles enter the air from natural processes, such as volcanic eruptions and forest fires.
- Human activities, such as burning fossil fuels at power plants and in vehicles, also release particulate matter.
- Inhaling particulate matter can cause asthma, bronchitis, and lead to heart attacks.
- It can also interfere with the processes of cellular respiration and photosynthesis in plants.

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Compare areas at the Great Smoky Mountains National Park in Tennessee.

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How would you describe the state of the trees in the two photos?

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Acid Precipitation

- **Acid precipitation** *is rain or snow that has a lower pH than that of normal rainwater.*
- The pH of normal rainwater is about 5.6.

- Acid precipitation forms when gases containing nitrogen and sulfur react with water, oxygen, and other chemicals in the atmosphere.
- Although volcanoes and marshes add sulfur gases to the atmosphere, burning fossil fuels is a major source of sulfur emissions.

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- Acid precipitation falls into lakes and ponds or onto the ground.
- It makes the water and the soil more acidic.
- Many living organisms cannot survive if the pH of water or soil becomes too low.
- Acid precipitation can kill trees and other plant life.

Type	Causes	Effects
Smog	burning of fossil fuels to provide energy for vehicles and power plants	makes air difficult to breathe; damages the tissues of plants and animals
CFCs	products such as old air conditioners and refrigerators	destroy the ozone molecules that absorb harmful UV rays
Particulate matter	burning of fossil fuels; volcanic eruptions and forest fires	asthma, bronchitis, heart attacks; interferes with the processes of cellular respiration and photosynthesis in plants
Acid Precipitation	burning of fossil fuels; sulfur from volcanoes and marshes	pollutes soil; harms trees and other plants; harms fish and other organisms

1) Which of the following causes air pollution?

- **A)** volcanic eruptions
- **B)** burning of fossil fuels
- **C)** forest fires
- **D)** all of the above

Correct Answer

D) all of the above

3) Which is NOT a result of acid precipitation?

- **A)** It can harm fish and other organisms.
- **B)** It can pollute soil killing trees and other plants.
- **C)** It can increase the chance of asthma attacks.
- **D)** It can damage buildings and statues made of some types of rocks.

Correct Answer

C) It can increase the chance of asthma attacks.

4) Decreasing the use of fossil fuels like coal and oil will decrease all of the forms of air pollution except:

- **A)** particulate matter
- **B)** photochemical smog
- **C)** acid precipitation
- **D)** CFCs

Correct Answer

D) CFCs

8) Plants need light from the sun in order to go through photosynthesis. Which type of air pollution would most likely decrease the amount of sunlight a plant can absorb?

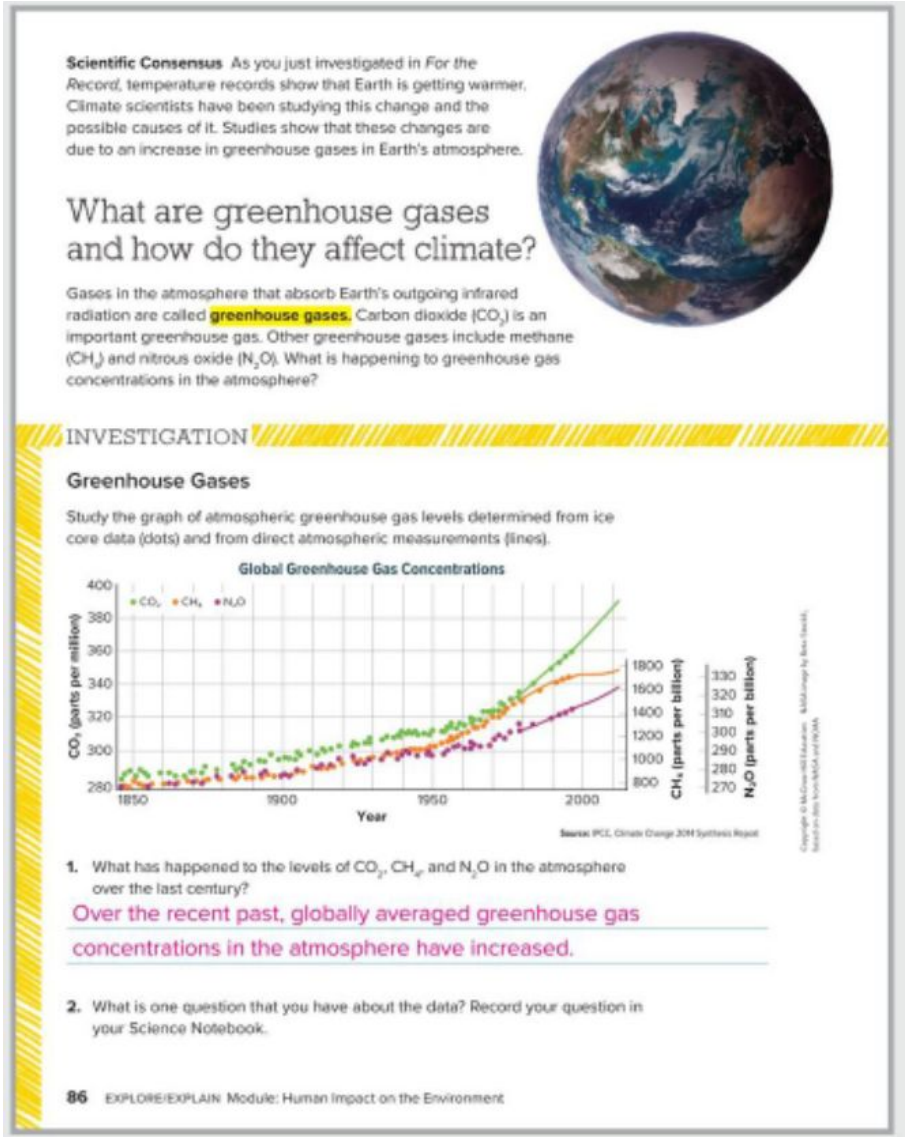
- **A)** acid precipitation
- **B)** CFCs
- **C)** particulate matter
- **D)** carbon dioxide

Correct Answer

C) particulate matter

UNIT 4 LESSON 3 : IMPACT ON CLIMATE

- Page 86



Scientific Consensus As you just investigated in *For the Record*, temperature records show that Earth is getting warmer. Climate scientists have been studying this change and the possible causes of it. Studies show that these changes are due to an increase in greenhouse gases in Earth's atmosphere.

What are greenhouse gases and how do they affect climate?

Gases in the atmosphere that absorb Earth's outgoing infrared radiation are called **greenhouse gases.** Carbon dioxide (CO_2) is an important greenhouse gas. Other greenhouse gases include methane (CH_4) and nitrous oxide (N_2O). What is happening to greenhouse gas concentrations in the atmosphere?

INVESTIGATION

Greenhouse Gases

Study the graph of atmospheric greenhouse gas levels determined from ice core data (dots) and from direct atmospheric measurements (lines).

Global Greenhouse Gas Concentrations

Source: IPCC, Climate Change 2014 Synthesis Report

1. What has happened to the levels of CO_2, CH_4, and N_2O in the atmosphere over the last century?

Over the recent past, globally averaged greenhouse gas concentrations in the atmosphere have increased.

2. What is one question that you have about the data? Record your question in your Science Notebook.

Scientific Consensus

- ✔ Temperature records show that Earth is getting warmer.
- ✔ Climate scientists have been studying this change and the possible causes of it.
- ✔ Scientific studies show that these changes are due to an increase in greenhouse gases in Earth's atmosphere.

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Greenhouse gases

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- Carbon dioxide (CO_2) is an important greenhouse gas.
- Other greenhouse gases include methane (CH_4) and nitrous oxide (N_2O).

What is happening to the concentration of greenhouse gas in the atmosphere?

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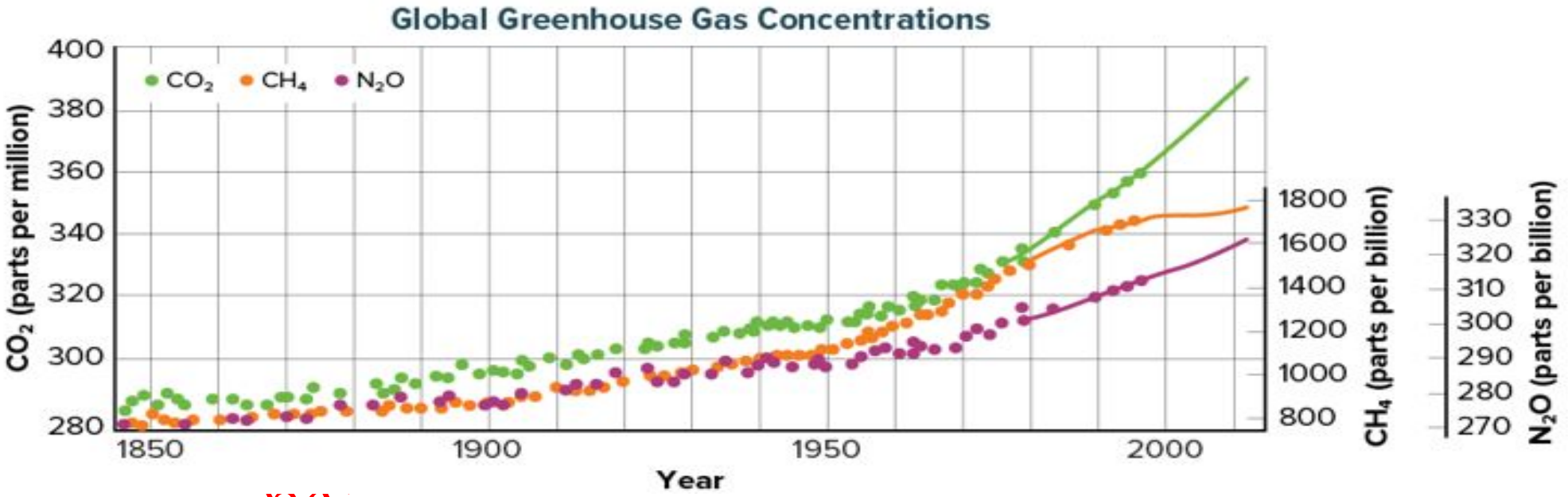
Greenhouse Gases

• Page 86

Study the graph of atmospheric greenhouse gas levels determined from ice core data (dots) and from direct atmospheric measurements



What has happened to the levels of CO_2, CH_4, and N_2O in the atmosphere over the last century?

Alsha

Over the recent past, globally averaged greenhouse gas concentrations in the atmosphere have increased.

GO ONLINE Now watch the animation ***The Greenhouse Effect*** to see how Earth's atmosphere acts a little like a greenhouse. Then answer the questions that follow.

3. What is the greenhouse effect?

The greenhouse effect is the result of trapping infrared radiation in Earth's atmosphere, which warms Earth over time.

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4. Predict the effect of an increase in greenhouse gas concentrations in the atmosphere on Earth's average air temperatures.

An increase in greenhouse gases would increase the greenhouse effect, which, in turn, would cause an increase in temperatures.

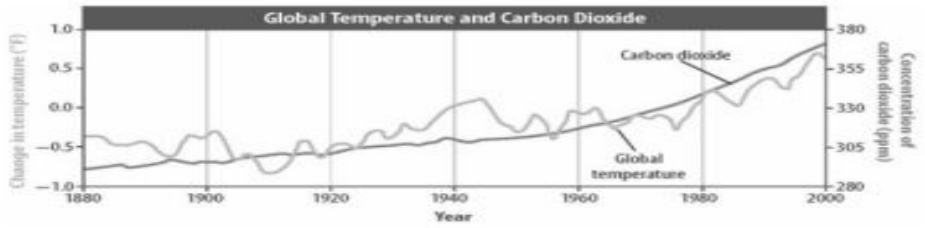
6) Which of the following is a way a 13 year old in America can help control greenhouse gases?

- **A)** plant trees
- **B)** recycle aluminum cans
- **C)** turn off electronics that are not in use
- **D)** all of the above

Correct Answer

D) all of the above

5) Examine the graph. What do the data show about the change in global temperature?

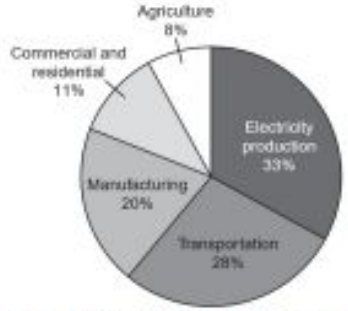


- **A)** global temperature has decreased over time, and carbon dioxide levels have quickly increased
- **B)** global temperature has varied over time, and carbon dioxide levels have decreased
- **C)** global temperature and carbon dioxide levels have slowly increased over time
- **D)** global temperature has quickly increased, and carbon dioxide level have slowly increased

Correct Answer

C) global temperature and carbon dioxide levels have slowly increased over time

7) The pie chart shows the percentage contributed by each source of all greenhouse gas emissions in the United States.



What action would have the greatest impact on reducing the amount of greenhouse gas emissions?

- **A)** Restrict the amount of livestock grown and sold for meat.

  Rationale: Agriculture accounts for only 8% of greenhouse gases; so, reducing the amount of livestock that produce greenhouse gases would be only a minor improvement.
- **B)** Tax fossil fuels purchased at gas stations more than clean-burning fuels.

  Rationale: Burning fossil fuels is a large contributor of greenhouse gases, but electricity production contributes an even greater amount.
- **C)** Install solar cells on homes and businesses to generate and store energy.

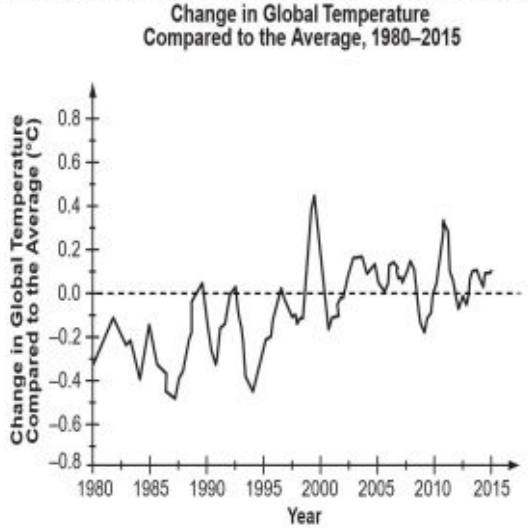
  Rationale: Electricity production is responsible for the greatest amount of greenhouse gases, so reducing its effects would have the greatest impact. Solar cells use the Sun to produce energy; therefore, there are no emissions.
- **D)** Reduce the number of goods produced for consumers and pass laws requiring people to recycle.

  Rationale: The manufacturing of goods purchased by consumers creates emissions. Recycling those goods would reduce emissions, but the manufacturing of those goods is not the biggest contributor of greenhouse gases.

Correct Answer

A) Restrict the amount of livestock grown and sold for meat.

8) The graph shows global temperature change, as measured by satellites, from 1980 to 2015.



Based on the graph, Grace claims that global temperature changes are due to natural causes. Answering which question would **best** help support Grace's claim?

- **A)** How did the satellites measure temperature in the atmosphere?

  Rationale: The various methods used by scientists for measuring temperatures in the atmosphere should have no bearing on whether or not the changes occurred naturally or by human activities.

- **B)** What was the amount of fossil fuels burned between 2000 and 2015?

  Rationale: The burning of fossil fuels would not be considered natural causes.

- **C)** What caused a decrease in the amount of carbon dioxide emissions produced by humans?

  Rationale: While understanding this would be useful, the answer would not support the student's claim.

- **D)** How has the amount of energy received from the Sun changed from 2000 to 2015?

  Rationale: Changes in solar activity, specifically the amount of radiation reaching Earth, could be a natural cause of climate change that the computer model doesn't account for.

Correct Answer

D) How has the amount of energy received from the Sun changed from 2000 to 2015?

1) Carbon dioxide is given off when gas, oil, and coal are burned.

- True
- False

Correct Answer

True

2) Climate change causes the ice in polar regions to melt. Which describes an effect of polar ice melting?

- **A)** global warming increases
- **B)** sea levels rise
- **C)** greenhouse gas emissions rise
- **D)** Earth surface temperatures decrease

Correct Answer

B) sea levels rise

4) The rise in Earth's average surface temperature during the past 10 years is often called global warming.

- True
- False

Correct Answer

False

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