Newark Board of Education

School Closure Packet

Mathematics

Grade 6

Roger León
Superintendent

2020 School Year

NAME:____

TEACHER:____

GRADE 6 SCHOOL CLOSURE PACKET

DIRECTIONS

Complete each activity in the School Closure Packet. Be sure to read all texts and complete activities thoughtfully and thoroughly.

Students are to return the completed packet to their teachers when school reopens.

Parents/Guardians, you are encouraged to assist in the following ways:

- Make a plan to complete the activities. For some activities, manipulatives are needed. If you do not have these at home, you can utilize the online manipulatives: https://www-k6.thinkcentral.com/content/hsp/math/hspmath/na/common/itools_int_9780547584997_/main.html
- Provide a time and quiet space for your child to work on these assignments.
- Help your child to complete the activities if he or she needs support.
- Review and discuss your child's responses. (Strongly urged at grades Kdg - 4)
- Provide positive feedback and praise for sincere effort and independence.
- Ensure your child understands the directions to each problem and listen to him/her read.
- Ensure that the completed packet is returned to school when school reopens

Thank you for helping your child to be successful!

Newark Board of Education	Grade 6	Mathematics

Day 1 **Lesson Module Opener Module 11 (pages 339- 340)** **1) Polygon Seek and Find:** Page 339 Why is a square a type of rhombus? What characteristics does a parallelogram have when it is not a rectangle or rhombus? What do you know about the sides of an isosceles triangle? **2) Are You Ready?:** #1- #12 Page 340 Complete these problems to review prior components and skills you will need for this module.	**Day 2** **Lesson 11-1 Day 1 (pages 341- 342): Graph Rational Numbers on the Coordinate Plane** **1) Review I Can Statement:** I can identify and graph rational number ordered pairs in all four quadrants on a coordinate plane. **2) Spark Your Learning:** "Graph Rational Numbers on the Coordinate Plane" Page 341 How do you know what direction is west? South? How do you find the coordinate pair that represents the campground? In the parentheses, how do you know which number to write first and which to write second? **3) Build Understanding:** #1 Page 342 Encourage children to use vocabulary from page 342 to generalize the characteristics of coordinates by quadrant. How do you identify coordinates of a point on a coordinate plane?
Day 3 **Lesson 11-1 Day 2 (pages 343- 348): Graph Rational Numbers on the Coordinate Plane** **1) Review I Can Statement:** I can identify and graph rational number ordered pairs in all four quadrants on a coordinate plane. **2) Step It Out:** #2 **-** #4 Pages 343-344 How do you know where the missing Vertex D will go? How do you find the coordinates of Vertex D? How do you graph the location of a fraction on the coordinate plane such as (½, -¾)? How does the fractional interval on the x- and y-axes affect the quadrants of the coordinate plane? **3) Check Understanding:** #1- #3 Page 344 **4) On Your Own:** #4 - #12 Pages 345-346 Students apply their understanding of the coordinate plane and its axes to graph two points that will form the ends of a line segment intersecting the y-axis. **5) More Practice/Homework**: # 1 - #9 Pages 347-348	**Day 4** **Lesson 11-2 Day 1 (pages 349- 352): Graph Polygons on Coordinate Plane** **1) Review I Can Statement:** I can graph the given vertices of a figure and determine the coordinates of an unknown vertex to complete the figure given the classification of the polygon **2) Spark Your Learning:** "Graph Polygons on Coordinate Plane" Page 349. What tools could you use to solve the problem? Why is this tool more strategic? What does 24 meters represent in the problem? How could you make sure the garden uses all of the fencing? What other shapes could you draw that also meet the requirements of the problem? **3) Build Understanding:** #1 - #2 Page 350 Encourage students to use the definition of polygon to determine which figures are polygons. How do you know what type of polygon a figure is? Why are the second and third figures not polygons? **4) Step it Out:** #3 - #4 Pages 351-352 Discuss the structure of the coordinate grid allows children to construct a right triangle whose base is a horizontal line and whose height is a vertical line. What is a right angle? How can you be sure two sides on a coordinate plane meet at a right angle? Is there only one way to draw a right angle that has Points A and B as vertices? Explain.

	4) Extra Practice: Khan Academy: Quadrilateral on a Coordinate Plane
Day 5 **Lesson 11-2 Day 2 (pages 352- 356) Graph Polygons on Coordinate Plane** **1) Review I Can Statement:** I can graph the given vertices of a figure and determine the coordinates of an unknown vertex to complete the figure given the classification of the polygon. **2) Check Understanding:** #1 Page 352 Classify polygons by the number of sides. **3) On Your Own:** #2 - #9 Pages 353-354 **4) More Practice/Homework**: # 1- #10 Pages 355-356	**Day 6** **Lesson 11-3 Day 1 (pages 357- 360) Find Distance on the Coordinate Plane** **1) Review I Can Statement:** I can find the distance between two points with the same x- or y-coordinate across quadrants and use a scale in real-world problems to find actual distances. **2) Spark Your Learning:** “Find Distance on the Coordinate Plane” Page 357. What does 200 meters represent in the problem? How does the compass rose help you solve the problem? **3) Build Understanding:** #1 Page 358 Encourage children to use the symmetry of the coordinate grid to place reflection of points in the correct location across axes. Why does the x-coordinate change sign after a reflection across the y-axis? Why does the y-coordinate change sign after a reflection across the x-axis? **4) Step It Out**: #2- #3 Pages 359-360 In task 2, remind children to use the absolute value to find the distance between two points and distance must be positive. What is the direction of the line between Points F and G? What does it mean to find the absolute value of a number? Why must you find the absolute values of distances before adding coordinates? In task 3, how far is each store from the y-axis in units and miles? Why do you add the absolute value of the x-coordinates to find the distance between the two warehouses? If you get a negative number to describe the distance, why do you know you have made a mistake?
Day 7 **Lesson 11-3 Day 2 (pages 360- 364) Find Distance on the Coordinate Plane** **1) Review I Can Statement:** I can find the distance between two points with the same x- or y-coordinate across quadrants and use a scale in real-world problems to find actual distances. **2) Check Understanding:** #1 - #3 Page 360 **3) On Your Own:** #4 - #13 Pages 361- 362 Students solve real-world distance problems using the coordinate plane. **4) More Practice/Homework**: #1-#11 Pages 363-364	**Day 8** **Lesson 11-4 Day 1 (pages 365- 367): Find Perimeter and Area on the Coordinate Plane** **1) Review I Can Statement:** I can find the perimeter and area of polygons in the coordinate plane. **2) Step It Out:** #1- #4 “Find Perimeter and Area on the Coordinate Plane” Pages 365- 367 In task 1, what is perimeter? How can you find the perimeter of this rectangle? In task 2, how can you find the area of the rectangle? How can you find the base and height of the rectangle? Can you calculate the area of the rectangle by considering side *DE* to be the base instead? Explain. In task 3, why do you subtract the absolute values of the coordinates to find the length of each

	side? In task 4, how does the shaded area relate to the coordinates shown?
Day 9 **Lesson 11-4 Day 2 (pages 367- 372) Find Perimeter and Area on the Coordinate Plane** **1) Review I Can Statement:** I can find the perimeter and area of polygons in the coordinate plane. **2) Check Understanding:** #1 - #2 Page 367 Use the diagram to answer the questions. **3) On Your Own:** #3 - #11 Pages 368- 370 **4) More Practice/Homework**: #1-#14 Pages 371-372	**Day 10** **Lesson Module 11 Review (pages 373- 374)** **1) Vocabulary:** #1 - #7 Page 373 Students should review the vocabulary terms for this module. **2) Concepts and Skills:** #8 - 21# Page 373- 374 Use tools and strategies from this module to complete the review.
Day 11 **Lesson Module Opener Module 15 (pages 463-464)** **1) Dot Plot Logic:** Page 463 How can you find the length of Creek Trail? How can you find the length of Pine Trail? How do you know the length of Ridge Trail cannot be 2 ⅝ miles? What is the total length of the trails in the park? **2) Are You Ready?:** #1- #13 Page 464 Complete these problems to review prior components and skills you will need for this module.	**Day 12** **Lesson 15-1 (pages 465- 470): Explore Mean as Fair Share** **1) Review I Can Statement:** I can find both the fair share and the balance point of a data set using a model or a number line. **2) Spark Your Learning:** "Explore Mean as Fair Share" Page 465. Which tool could you use to solve the problem? The florist has 4 different types of flowers. Does the problem state how the flower types should be distributed among the 10 bouquets? Explain. The florist has a total of 124 flowers for 10 bouquets. Why is the solution not equal to 124 divided by 10 or 12.4 flowers? **3) Build Understanding:** #1- #2 Pages 466-467 In task 1, compare the illustration of seashells in Part A with the sketch you drew for Part B. What do you notice? If the three friends find other numbers of shells, is it always possible for the shells to be shared fairly among them with no shells left over? Explain. Use an example to support your answer. In task 2, what numbers from task 1 will you use to make your dot plot? How do you determine the distance from each number in task 1 to the fair share numbers? How is the balance point related to the distance from each point to the fair share? **4) Check Understanding:** #1-#3 Page 467 **5) On Your Own:** #3-#5 Page 468 Students construct a data set that has a specific balance point and number of values. **6) More Practice/Homework**: #1-#10 Pages 469-470

Day 13

Lesson 15-2 (pages 471- 476): Find Measures of Center

1) Review I Can Statement:
I can find and interpret the mean, median, and mode of a set of data.

2) Spark Your Learning: "Find Measures of Center" Page 471 What tool could you use to solve this problem? Think back to the previous lesson, what did you learn about balance points in that lesson? Can you always use fair shares to evenly distribute items? Why or why not? Why might you want a single number to describe multiple heights?

3) Build Understanding: #1 Page 472 How could one nickel be added to one stack to make the median and mode different from each other? What is meant by "average"?

4) Step It Out: #2 Page 473 Why is it useful to make a dot plot to display the data? Compare the three measures of center. How do you explain their differences?

5) Check Understanding: #1- #2 Page 473

6) On Your Own: #3-6 Page 474 Students determine the most useful measure of center for a given data set.

7) More Practice/Homework: #1-#12 Pages 475-476

Day 14

Lesson 15-3 (pages 477- 482): Choose a Measure of Center

1) Review I Can Statement:
I can find the mean, median, and mode for a given data set and determine the best measure of center to describe the data set.

2) Step It Out: "Choose a Measure of Center" #1- #2 Pages 477- 478 In task 1, If another student had downloaded 0 songs that week, would 0 have been an outlier? Explain. What strategies did you use to solve this problem? In task 2, how do you explain the outlier in this data set? Why is it useful to make a dot plot of the data? Freddy claims that if the outlier is removed from the data set, the mean becomes a useful measure of center. How do you evaluate Freddy's claim?

3) Check Understanding: #1- #2 Page 478

4) On Your Own: #3- #7 Pages 478-479 Students describe a data set that meets certain criteria for its measure of center and evaluate the effect of an outlier on this data set.

5) More Practice/Homework: #1-#9 Pages 481-482

Day 15

Lesson Module 15 Review (pages 483- 484)

1) Vocabulary: #1- #5 Page 483 Students should review the vocabulary terms for this module.

2) Concepts and Skills: #6- #17 Pages 483- 484 Use tools and strategies from this module to complete the review.

Newark Board of Education

School Closure Packet

Science

Grade 6

Roger León
Superintendent

2020 School Year

NAME:_______________________________________

TEACHER:____________________________________

GRADE 6 SCHOOL CLOSURE PACKET

DIRECTIONS

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Parents, you are encouraged to assist in the following ways:

- Make a plan to complete the activities.
- Provide a time and quiet space for your child to work on these assignments.
- Help your child to complete the activities if he or she needs support.
- Review and discuss your child's responses. (Strongly urged at grades Kdg - 4)
- Provide positive feedback and praise for sincere effort and independence.
- Encourage daily reading of 10 minutes of a self-selected book.
- Read to your child, listen to him/her read, or share the reading. (Strongly urged at grades Kdg - 4)
- Ensure that the completed packet is returned to school when school reopens!

Thank you for helping your child to be successful!

IQWST	Grade 6	Science----Instructional Plan

Day 1

Task: Read the article- How The Eye Works, independently.

Response Questions: Answer the response questions using the article.

- **NEWSELA Article:**
    - https://newsela.com/read/lib-multimedia-gfx-eye-diagram/id/2000003294/?collection_id=2000000156

Day 2

Task: Read the article- Experiment Optics and Optical illusions. independently.

Response Questions: Answer the response questions using the article.

- NEWSELA Article:
    - https://newsela.com/read/lib-experiment-optics-optical-illusions/id/37030/?collection_id=2000000156

Day 3

Task: Read the article- Eyes In The Animal kingdom, (workbook pgs 29-33) independently.

Response Questions: Answer the response questions using the article.

- Article
    - Eyes In the Animal Kingdom

Day 4

Task: Read the article- What Is The Visible Light Spectrum? independently.

Response Questions: Answer the response questions using the article.

- NEWSELA Article:
    - https://newsela.com/read/lib-visible-light-spectrum/id/2000001026/?collection_id=2000000156

Day 5

Task: Read the article- What Is The Visible Light Spectrum? independently.

Response Questions: Answer the response questions and draw a model using the article.

- Article:
    - Three forms of Matter

Day 6

Task: Read the article- Phase Changes Between States of Matter , independently.

Response Questions: Answer the response questions using the article.

- NEWSELA Article
    - https://newsela.com/read/lib-phase-changes-states-of-matter/id/54593/?collection_id=2000000156

Day 7

Task: Read the article- In What Ways Do People Use Detectors) independently.

Response Questions: Answer the response questions using the article.

- Article
  - In what ways do people use detectors?

Day 8

Task: Read the article-How Can I Model The Things Gases Do? independently.

Response Questions: Answer the response questions using the article.

- Article
  - How can I model the things gases do?

Day 9

Task: Read the article- independently.

Response Questions: Answer the response questions using the article.

- Article
  - Why is the periodic table of elements important?

Day10

Task: Read the article- What Kinds Of Particles Do I Breathe and What Are They Made Of? independently.

Response Questions: Answer the response questions using the article.

- Article
  - What kinds of particles do I breathe, and what are they made of?

Day 11

Task: Read the scenario.

Response Questions: Use the model to help you answer the scenario using details and evidence. Use the text to help support your response.

- Article
  - How can I make particles move faster?

Day 12

Task: Read the scenario.

Response Questions: Use the model to help you answer the scenario using details and evidence. Use the text to help support your response.

- Article
  - How can the volume of a balloon change without removing or adding air?

Notes From Your Teacher:

IQWST	Grade 6		Science--Instructional Plan

Day 13 **Task:** Read the article- The Water Cycle, independently. **Response Questions**: Answer the response questions using the article. • NEWSELA Article ○ https://newsela.com/read/natgeo-elem-water-cycle/id/44436/?collection_id=2000000156	**Day 16**
Day 14 **Task:** Read the article- The Water Cycle, independently. **Response Questions**: Answer the response questions using the article. • NEWSELA Article ○ https://newsela.com/read/natgeo-elem-water-cycle/id/44436/?collection_id=2000000156	**Day 17**
Day15 **Task:** Read the article- Matter and Energy: Evaporation and Condensation independently. **Response Questions**: Answer the response questions using the article.	**Day 18**

- NEWSELA Article
  - https://newsela.com/read/elem-sci-evaporation-condensation/id/31875/?collection_id=2000000156

Notes From Your Teacher:

Inside an eyeball

PresentSavedShareHidePrintAdd To Text Set

By Newsela staff

Published:12/17/2019

Read the following article and answer the response questions.

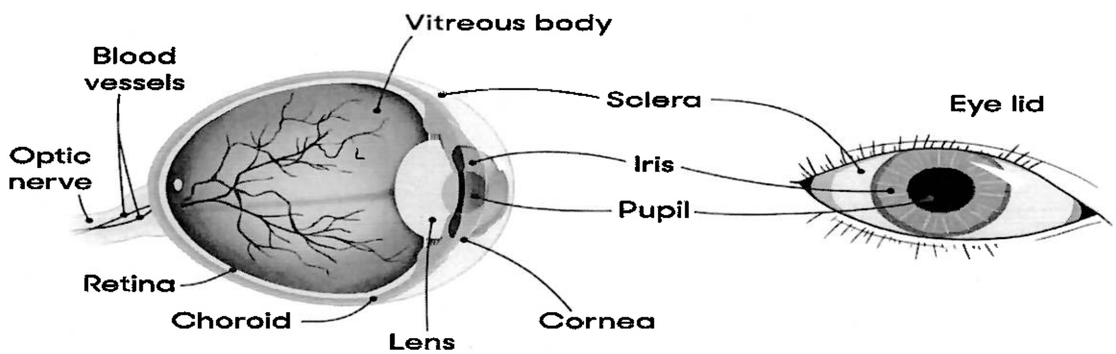


Image 1. (Right) A normal view of the eye showing the eyelid, pupil, iris, and sclera. (Left) A cross section of the eye that shows each part of the eye from the cornea at the surface to the optic nerve at the back of the eye. Illustration: Newsela staff

We see things because of light bouncing off objects. The outer layer of the eye is the cornea and it bends light as it passes into the pupil. The iris controls the amount of light that can pass through the pupil. It contracts and makes the pupil smaller to limit light. It expands and makes the pupil bigger to let more light in. Through the pupil, light reaches the lens, which focuses light toward the retina at the back of the eye. Here, cells detect light and send signals to the brain along the optic nerve. The brain converts these signals into an image.

There are other parts of the eye that help it function. The white part that we can see is called the sclera. It holds the eye's shape. The vitreous body is a gel that fills the eye. It keeps the retina in place. The choroid is how the retina gets nutrients from the blood.

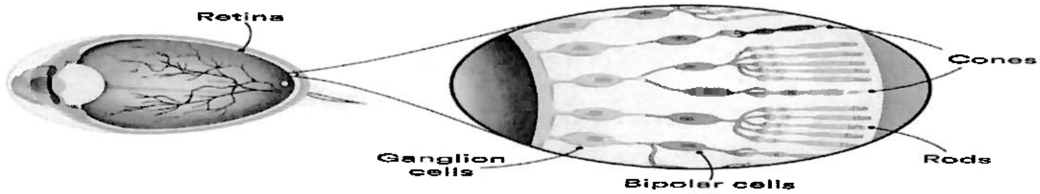


Image 2. The retina layer of the human eyeball contains the key cells for sight. Illustration: Newsela staff.

Questions

1. **What are the four conditions needed to see?**

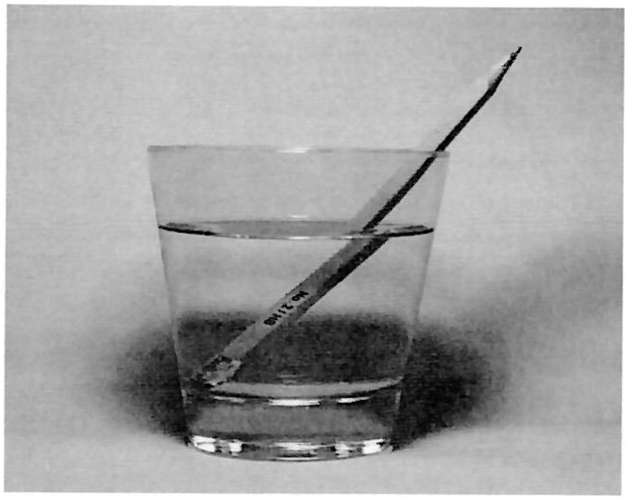
2. **What part of the eyes helps to control the amount of light that passes through the pupil?**

3. **Explain how the retina works.**

Name______________________________________Date________________________

Read the following article. Answer the response questions.

What Is Light Made Of?



Light gets bent when it passes, for example, between air and water. This leads to the optical illusion of objects looking broken. Photo from Pixabay. [click to enlarge]

Visible light is a series of electromagnetic waves. These waves make up a small part of the electromagnetic spectrum, which includes many kinds of energy waves. You may be familiar with some of these, such as radio waves, microwaves and X-rays. The light that humans can see is made of waves that are about 0.000014 to 0.000027 inches, or 360 to 700 nanometers, long.

Light does all kinds of interesting things, like reflect off surfaces, particularly if they are smooth. Light can also refract, or bend as it moves from one kind of material to another, such as from air to water. Refraction is the reason why a pencil sticking out of a glass of water looks bent.

How Do Our Eyes Perceive Light?

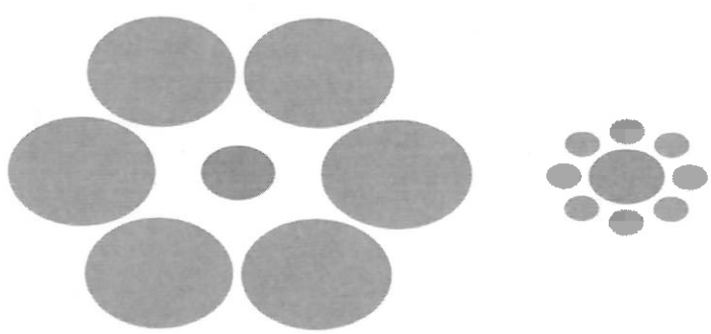
The eye has a lens that focuses light onto a light-sensitive surface at the back of the eyeball. This surface is called the retina. The retina sends nerve impulses to the brain, which interprets the impulses as images.

EXPERIMENT: Can The Eye Be Fooled?

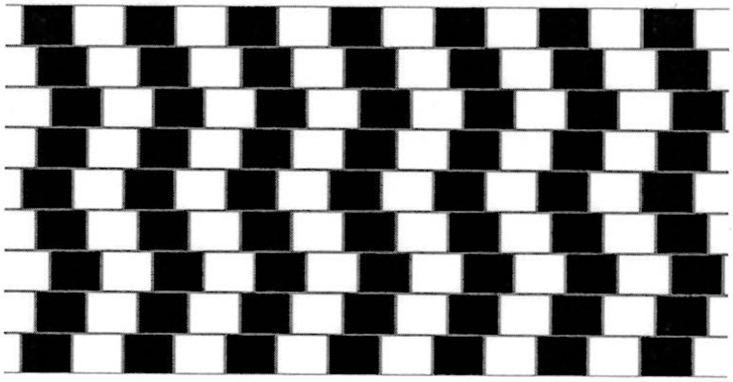
Image A. The two orange circles are actually the same size. Image from public domain. [click to enlarge]

Optical illusions occur when the brain is tricked into thinking things are not as they are. In this experiment, you will explore how people perceive images.

For each of the 3 optical illusions below, write a hypothesis about what you think people will see. For example, for image A, you can ask 10 people which circle they think is larger.



Hypothesis 1:



Hypothesis 2:

Hypothesis 3:

Ask 3 other people to view the optical illusions. Write down what they tell you that you see in the "Notes" section. Use their responses to answer the questions below.

Notes:

Person 1	**Person 2**	**Person 3**

Summary of Results Questions

1. Did people have similar reactions to the images, or were they different?

2. What conclusions, if any, can you draw about the way the eyes and the brain work together on perception?

3. Were any or all of your hypothesis correct?

4. Think about some reasons why the brain may cause people to see an illusion, and form a hypothesis.

Reading 4.1 – Eyes in the Animal Kingdom

Getting Ready

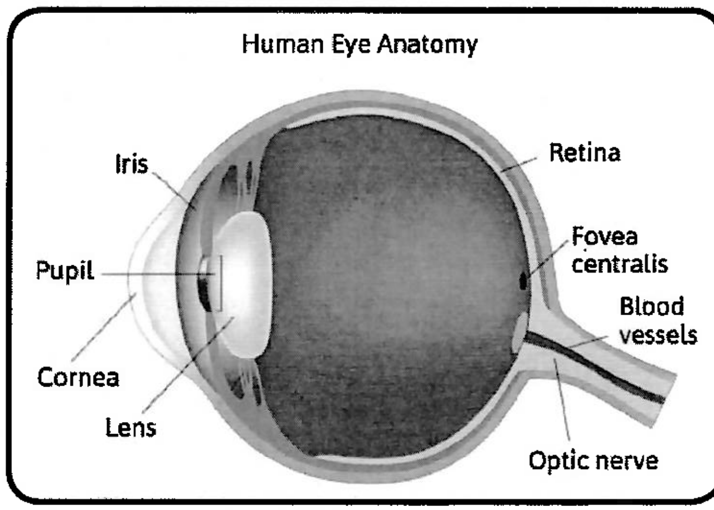
Try this at home. Go into a small room with a mirror, like a bathroom. Look closely in the mirror at your eyes; then turn off the light and make the room as dark as possible. If you cannot make the room dark, shut your eyes and cover them with your hands. Wait for several seconds, and then turn the lights on as you continue to look at your eyes in the mirror.

What changes do you notice in your eyes immediately after you turn the light on? Why do you think this change happens?

Do you think the same change happens to animals' eyes? In this reading, you will learn why your eyes look different depending on whether the lights are on or off. You will also learn whether animals' eyes do something similar or different.

How Do My Eyes Sense Light?

In class, you learned how the human eye works as a light sensor. When you see an object in a room, the light is bouncing off of that object and going straight into your eye. How does your eye help you see? The eye has several important parts. The opening in the center is called the pupil. In the picture, the pupil is labeled. It looks black, but it is really just like a clear window that lets light into the eye.



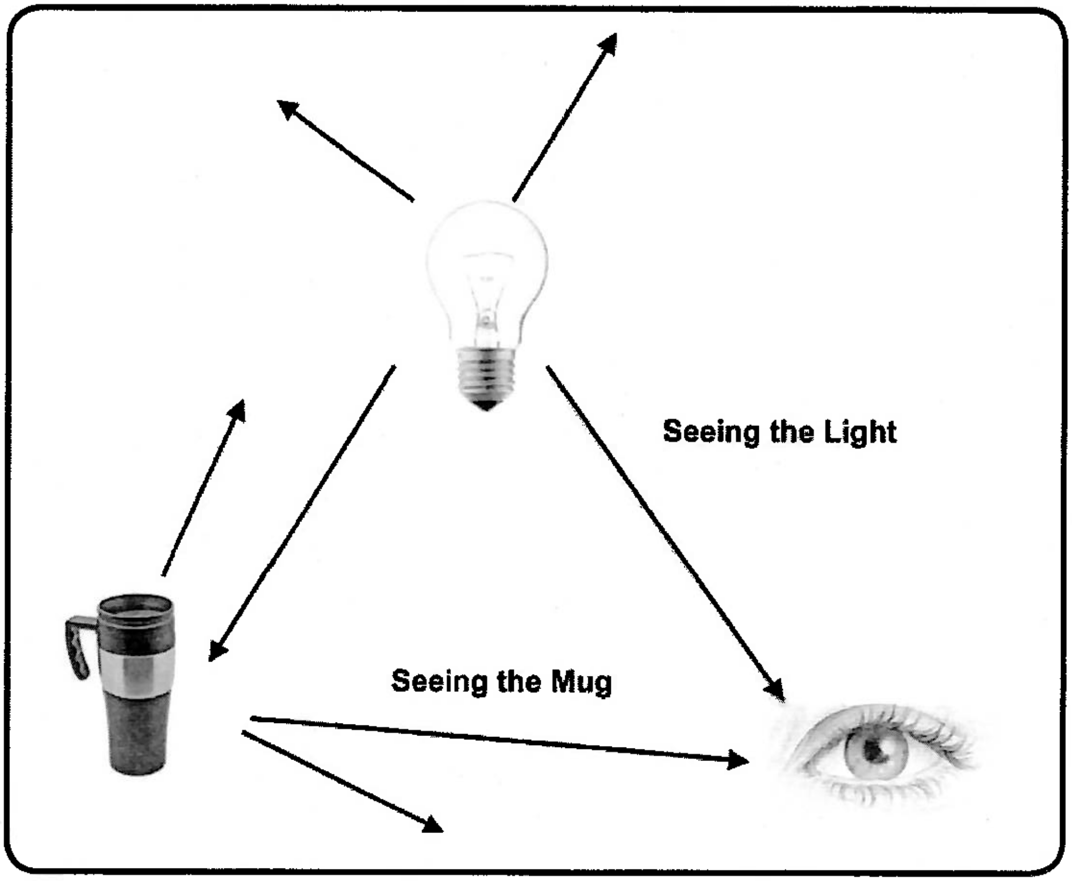
The cornea is a protective covering over the whole eye. It keeps the eye from getting scratched. The lens in the eye is like the lens in eyeglasses or in a camera. The lens focuses the light coming into the eye.

The lens focuses light onto the back of the eyeball on an area called the retina. Sensors in the retina detect the light that reaches them. Those sensors send a signal to the brain through the optic nerve.

How Do the Parts of the Eye Work Together?

When you see a light bulb, several things happen. First, some of the light coming from the bulb enters your eye and reaches your retina. Second, your retina sends a signal to your brain. Third, your brain recognizes that the signal is a light from a light bulb.

Look at the diagram. If a coffee mug were in the room so that you could see it, then some of the light from the light bulb would be bouncing off of the mug. Some of the light bouncing off of the mug would enter your eye and reach the retina. A signal would go to your brain, and recognize it as the image of a mug. A lot has to happen for you to see something; but it happens very quickly.



Using Equipment as a Light Sensor

Your eye is a sensor. Special equipment also can act as a sensor. The light sensors that you used in this lesson are one example. When you pointed the sensor at an object, it detected the light coming from that object. Just like with your eyes or with cameras, light had to enter the sensor in order to be detected. Instead of sending a signal that your brain recognizes as an image, the light sensor sends a signal to a small computer. This computer receives the signal and displays a number that tells how much light is entering the sensor. When you saw an object in the room that looked bright to your eyes, the light sensor showed a very high number on its display. You may have gotten a high number when you pointed the sensor at the lights or at a window. When you saw an object that looked dim to your eyes, the sensor showed a low number on its display. You may have gotten low numbers when you pointed the sensor under tables or desks. When light enters a sensor, a computer gives information. When light enters your eye, your brain gives you information.

Do Animal Eyes Work like Human Eyes?

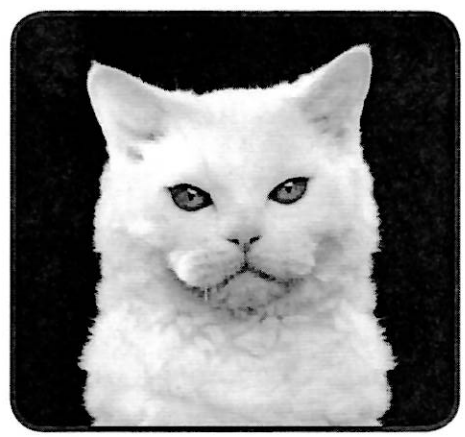
Just like human eyes, animals' eyes work by detecting light. However, there are some differences between human eyes and some animals' eyes. In this reading, you will learn about three animals that have eyes with special characteristics.

Polar Bears

Have you ever played outside in the snow on a sunny day or played on a white sand beach on a sunny day? If you have, you know how bright it is when the sun's light bounces off of the white snow or the white sand. You also may have noticed that it is difficult to see in bright light without squinting. Why do people squint?

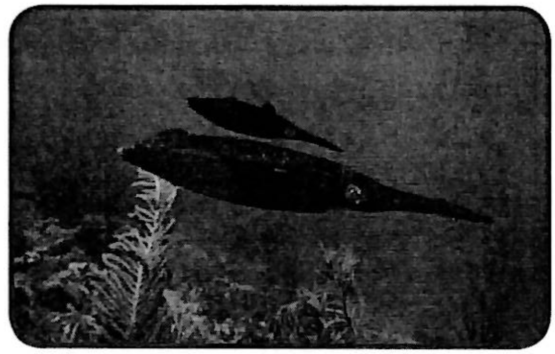
People squint so that their eyelids squeeze together and cover part of the iris. When the iris is partially covered, the path of some of the light going into the eyes gets blocked. Polar bears live outside in the snow. Because polar bears have to hunt for food in intense sunlight, their eyes have to allow them to see in very bright light. Polar bear eyes have a protective, clear cover over their eyeballs. The bears can see through this covering to hunt. The covering protects their eyes from bright sunlight and the light that bounces off the snow. It is kind of like having built-in sunglasses. This protective cover also helps protect a bear's eyes when it swims under water.

Cats



Cats also have eyes adapted to their environment. As natural hunters, cats need to have keen senses in order to stalk their prey. Cats can see almost as well as humans during the daytime, but their nighttime vision is much better. Although cats cannot see in complete darkness, they can see much better than humans in environments that appear dark to us. In fact, cats can see six times better than humans in places with low light. There are several reasons for this. Cat retinas are more sensitive than human retinas. During the day, a cat's pupil looks like a slit. This slit decreases the amount of light entering the eyes and prevents the cat from having to squint. A round pupil, like in a human eye, would let in too much light. At night, or when cats are in dark places, their pupils can open three times wider than those of humans. The wider opening lets in much more light. Like polar bears, they have a transparent protective cover over their eyes that allow them to see well in bright daylight. You may have seen a cat's eyes appear to glow in the dark when light is shined on them, as in the photo. The transparent cover causes cats' eyes to appear to glow at night. You may have also noticed this on dogs.

Giant Sea Squid



This is a photo of a squid. Giant sea squids are known to have the largest eyes of any animal in the animal kingdom. Even though many animals are larger than the sea squid, none have such big eyes. Some giant sea squids have eyes about the size of your head. Their huge eyes have very large pupils that let in as much light as possible. So deep in the sea, where it is very dark, their eyes can let in the little bit of light that reaches them. Even squids and cats, which can see in very dark places, need some light to see. Even with large pupils, if no light enters the eye, then the animal will not be able to see.

Summarizing

An important skill in any subject is summarizing. When you summarize something you have read, you tell the main ideas. That means thinking about what seems to be the most important ideas in what you read. In the following space, summarize what you have learned about animal eyes in today's reading. (Think about where they live and what their eyes eyes need to be able to do for the animal to survive in its environment.) The beginning of a summary is written for you to get you started.

Different animals' eyes work in different ways. How their eyes work depends on the following factors:

Wrapping Up

Show your understanding by filling in the blanks in the following sentences. In bright lights, the pupils of a human's eyes ______________________. In darkness, the pupils of a human's eyes _____________________.

Explain why the following sentence is not correct: Because cats have such good eyes, they can see when it is completely dark.

Name____**Date**____________________

After reading the text, "Eyes in the Animal Kingdom "(pgs 29-33), answer the following response questions using text evidence.

1. How do your eyes sense light?

2. How do the parts of the eye work together?

3. <u>**Draw a model**</u> of how someone would be able to see a water bottle using the **four conditions needed to see:**
   - **Light**
   - **Objects**
   - **Eyes**
   - **Unblocked path**

4. Do animal eyes work like human eyes? **Compare** how human eyes work to the way eyes of a cat work.

Name____Date______________________

After reading the article, "What is the Visible Light Spectrum?", respond to the following questions using text evidence.

1. **Define electromagnetic radiation.**

2. **Explain what happens when white light travels through a prism.**

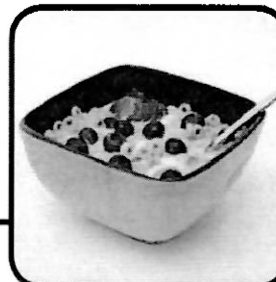
3. **How are color and temperature related? Explain with examples how color from a fire can reflect temperature.**

4. **Isaac Newton's experiment in 1665 is evidence that proves what scientific principle? (*use the diagram in the text for support)**

Reading 3.1 – Three Forms of Matter—Solid, Liquid, and Gas

Getting Ready

Think about eating a bowl of cold cereal for breakfast. What types of matter would be part of your breakfast? Are there any solids? Are there any liquids? Are there any gases? List the type of matter and the state of matter it is in.



In class, you observed materials in three forms—solid, liquid, and gas. Scientists call each form a state of matter. A *state* is the physical form in which a material can exist. As you read, think about how you can tell which state of matter a material is in and underline ideas that can help you decide.

What Determines the State of Matter a Material Is In?

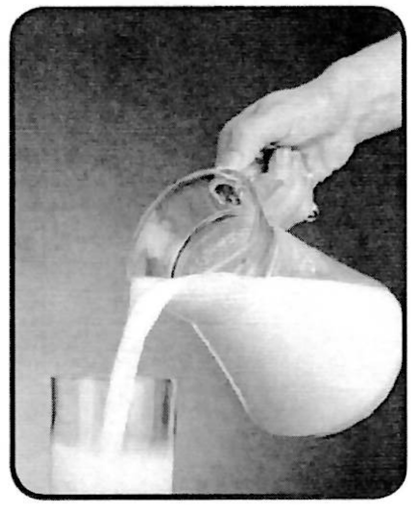
You live in a world of solids, liquids, and gases. You breathe in a gas, and you breathe out a gas. You eat solid matter. You drink liquid matter. As you have been thinking about matter, you have been considering the state in which you usually find each material. You usually find materials at room temperature. Room temperature is not when you cook something on the stove. It is not when you leave something in the refrigerator overnight. It is probably helpful for you to just think about room temperature as the temperature around you as you sit in your classroom.

Characteristics of a Solid: Can You Grab It, Hold It, or Poke It with Your Fingers?

You can determine what state a material is in based on its characteristics. A fork is a solid. An apple is a solid. A rock is a solid. You can hold each of these solids in your hand. A large rock may be too big for you to hold. If you had a sample of rock, you could hold it in your hand. You can grab a piece of each of these things. You cannot grab and hold a piece of the air. You cannot grab and hold a piece of milk. You can grab and hold a piece of wood. Apples, rocks, and wood are matter in a solid form.

Here is another test. If you had a big glass bowl and you put a solid into the bowl, the solid would stay in its original shape. A rock would sit in the bowl and look like the same rock. Solids have a fixed shape. Fixed shape means that they stay the same until you do something like break or crush them. Another way to think about solids is that you cannot poke your finger into them. Push your finger against your desk or tabletop. It is a solid. Your finger will not go through it. Floors and walls are solids. A glass bottle, a plastic bottle, and a soda pop can are solids. Sidewalks, driveways, and roads are solids. Poking your finger into something is not a perfect test, but it can help you with the idea of many solids. You will be learning more in this unit about why you cannot poke your finger into most solids but can poke your finger into liquids and gases.

Characteristics of a Liquid: Does It Change Shape When You Pour It?

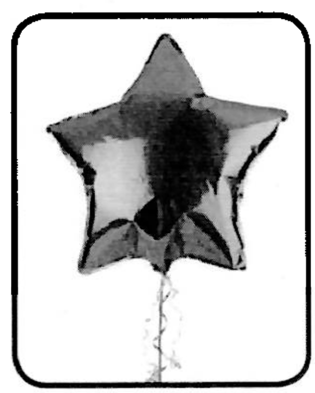


Liquids do not have a fixed shape. That means they do not hold the shape they are in. In the picture, you can see that the milk is in one shape as it pours out of the jug and a different shape in the glass. You could do this at home. Measure one cup of liquid water (or milk) and pour it into a tall glass. Then measure another one cup, and pour it into a short glass. You will notice that the liquid in the two glasses is in the shape of the glass. Someone might be fooled and think that there is more liquid in the tall glass. However, what really is happening is that the liquid water takes the shape of the glass and fits into it. It spreads out more in the wide, short glass, so it might seem like less liquid. Liquids take the shape of the container they are in. They do not hold the same shape when you pour them.

Characteristics of Gases

Gases can be difficult to study because you cannot see most of them. However, gases are all around you. Gases do some of the same things that liquids do. You have already learned that air has volume; it takes up space. When air takes up space, it also takes the shape of its container. A room is like a big container. The air in the room you are in right now is taking the shape of the room. It is filling every corner. If you are reading outdoors or in a car, air is filling that space too. Everywhere you look there is air, even though you cannot see it.

All types of gases take up the space of their containers. When gases fill the space of a container, gases also take the shape of the container. If you had a balloon in the shape of a star and you filled it with air, the air would spread into the star shape and fill it to each point. When a material is in the gas phase, it has characteristics that are similar to air. The same thing would happen if you filled the balloon with a different gas, such as helium gas. You have probably seen helium-filled balloons in many shapes. Gases fill the volume of their container.



Compare the States of Matter

In the box, compare the three states of matter. Be sure to tell what is alike and what is different about them. You can make a chart, a web, a drawing, or you can write sentences.

Name____ Date__________________

States of Matter

After reading the text, "Three Forms of Matter-Solid, Liquid, Gas"(pgs 22-23), answer the following response questions using text evidence.

1. Draw a **particle model** of each of the 3 states of matter below in the table.

2. How can you determine what state of matter a material is in?

3. List **3 characteristics** of a solid.

4. List **3 characteristics** of a liquid.

5. List **3 characteristics** of a gas.

Name____Date____________________

After reading the article, "Phase Changes between States of Matter" read and answer the following questions using evidence from the text to support your response.

1. Why do phase changes occur?

2. As a result from your previous classroom investigation, What made the indicator paper inside the flask change color from yellow to blue? Provide evidence from your classroom observations and the text to support your written response below.

Reading 6.1 – In What Ways Do People Use Detectors?

Getting Ready

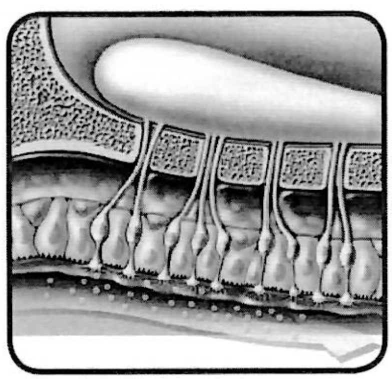
Today you used a special kind of paper to test two liquids. When the paper changed color, it meant that something had happened. The paper could be called a *detector* because it detected a change. List some other types of detectors that you have heard of or that you know about.

Detector	How Does It Work?

How Does Your Nose Work as a Detector?

Imagine breathing in and smelling brownies in the oven. How did you detect the odor? Now that your model represents air and odors as particles, you can use your model to help you explain how people smell odors.

As you breathe in through your nose, you force particles in the air to move through your nostrils. They go past the nasal cavity. You can see the nasal cavity in the diagram. It is the shaded part beneath the brain and behind the nose. The nasal cavity is where humans detect odors.



In the nasal cavity, odor particles match with receptors. Receptors are like the part of a lock into which a key fits. Specific odor particles fit into a specific receptor like a key fits into only a certain lock. When an odor particle matches with a receptor, a signal goes to the brain and tells it that a certain odor is in the air.

Why Do I Only Sometimes Smell Odors?

One reason why your nose may not detect every odor is because there may not be enough of the specific particles in the air. Another reason is that human noses can only detect certain types of particles. The particles of some materials match with receptors in your nose, but particles of other materials do not match any receptors. You may have guessed that odors that do not match with receptors in your nose are called *odorless*.

In Lesson 1, you learned that natural gas, by itself, is odorless. It is made of particles that your nose cannot detect. A material with particles your nose can detect is added to help you recognize when natural gas is in the air. The particles that make up the rotten egg odor fit with receptors in your nasal cavity. Those receptors send a signal to your brain that you smell rotten eggs in the air.

Are There Other Odorless Materials?

Another type of odorless gas is carbon monoxide. When cars are turned on, the burning gasoline produces carbon monoxide. Furnaces in your house also make carbon monoxide. Carbon monoxide does not explode like natural gas can, but it is very dangerous in another way.

You already know that people need oxygen to live and that you get oxygen by breathing in air. Usually when you breathe in air, the blood in your body carries the oxygen particles to all areas in your body. When carbon monoxide is in the air, your blood takes the carbon monoxide particles instead of the oxygen particles. Some parts of your body will not get the oxygen they need to keep working. At first, the lack of oxygen might make you feel faint. After awhile, it can kill you. Cars come with books that tell about the dangers of carbon monoxide. The warning you see here is from one of them.

Danger in Real Life

Sometimes people forget to turn cars off in their garages, and the carbon monoxide can build up in the air and move (like odors) into the house. Other times people's furnaces do not work properly, and carbon monoxide can move through the house. Next you will read information that tells about people who were exposed to carbon monoxide because their furnaces were not working properly. As you read, think about these questions.

1. How do carbon monoxide particles travel in the air?

2. Why can't your nose detect carbon monoxide in your house?

One newspaper reported the story of a family that could have died because of carbon monoxide poisoning. The three children had flu symptoms for two days. When they continued to vomit and feel nauseated, the family went to the hospital. Doctors diagnosed the problem as carbon monoxide poisoning. Everyone in the family had to take in fresh oxygen for several hours. As you have learned, their blood was missing the oxygen that all cells of their body needed.

Some amount of carbon monoxide in the air is safe. The safe level is 39 parts per million. When investigators went to the family's home, they found a furnace that needed repair. The carbon monoxide level in the home was 180 parts per million. After the furnace had been repaired, their home was safe again. People use appliances that emit carbon monoxide all the time. As long as ventilation is good and appliances are working properly, this is not a danger. In the winter, when doors and windows are kept closed, the danger can increase.

Symptoms of carbon monoxide poisoning include headaches, shortness of breath, lightheadedness, nausea, and vomiting. As you might know, some of these are also symptoms of flu or food poisoning. There is a way to be alerted when the problem is not just bacteria or virus.

Many stores sell carbon monoxide detectors. They work like smoke alarms. The alarms let out a loud noise when they detect levels of carbon monoxide in the air that are dangerous. They are made to detect a colorless, odorless gas that people cannot detect with their eyes or their nose.

How Important Are Detectors?

It is very important for people to be able to tell when carbon monoxide is present. When a dangerous gas is odorless, then people cannot rely on their nose to warn them. People need other ways to detect odorless gases. For example, carbon monoxide can be present as coal miners dig deep underground. In the past, miners would use small birds called canaries to help them. Canaries are colorful, and they are easy to see in dark areas like mines. Canaries chirp and sing a lot. They are small and have tiny lungs, so canaries are affected by carbon monoxide much sooner than people are. The miners used the canaries as detectors. When the canaries stopped chirping, the miners knew that there was too much carbon monoxide in the air. The miners then left the mine.

Think of another way that people can detect carbon monoxide is in the air. Write your idea in the space below.

The question at the beginning of today's reading is, "In what ways do people use detectors?" Why is it important to understand particles in order to invent detectors?

Name____Date____________

Detectors

After reading the text, "In What Ways Do People Use Detectors?" read and answer the following questions using the text.

1. How does your nose work as a detector?

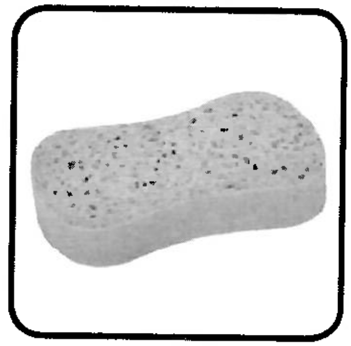
2. Give an example of one type of dangerous "odorless gas". What happens when this odorless gas is in the air?

3. Why is it important to understand particles in order to invent detectors?

Reading 5.1 – How Can I Model the Things Gases Do?

Getting Ready

Think about a sponge used for cleaning. If you have a sponge at home, you can use it to do this activity. Hold a wet sponge in one hand and squish it. Squeezing the sponge makes it smaller. You might be able to squeeze a large sponge to fit in one hand. Because you can push (or press) the sponge, you can say that the sponge can be compressed.



Think about what happens when you compress a sponge with your hand. Then think about opening your hand. The sponge will expand and open back up into its original shape. Sponges are not the only things that can compress and expand. In this reading, you will learn how air can compress and expand, a little like a sponge.

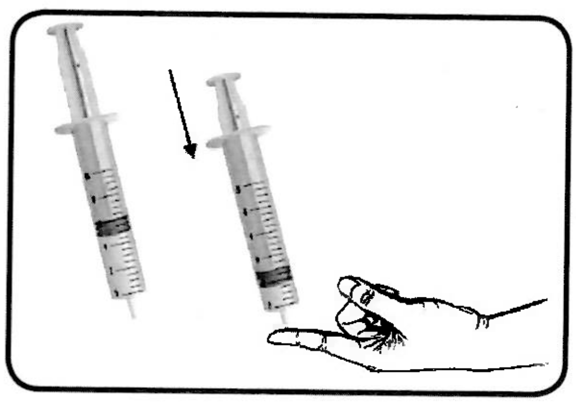
What Happens to Air When I Push a Syringe of Air?

In Lesson 2 you learned that air takes up space. When you compress air, you squeeze the air into a smaller space. Imagine you took all of the air that normally fills your closet and squeezed it into a container that can sit on your desk. To make air fit into a smaller volume, you compress the air. Scuba tanks have compressed air in them. In fact, the air in a closet could be compressed so that it fits into a small tank for scuba divers to carry on their backs.

Squeezing or compressing air may sound strange. It is hard to grab a handful of air like you grab a sponge or a handful of sponges. In class you saw that you can compress air. First you pulled the handle of a syringe to fill the syringe with air. Then, you placed one finger on the opening of the syringe so that the air could not come out. Finally, you pushed the handle of the syringe.

It was impossible to push the syringe in all the way. When you pushed the handle of the syringe, you were pressing all of the air into a tiny space. You were compressing the air. Air compressed when it could not go anywhere else. You might have noticed that it was difficult to keep your finger on the opening of the syringe when you pushed on the handle. Keeping a finger on the opening was very important. You were not allowing any air to escape. Even though no air left the syringe, you were able to still push the handle.

When you push the syringe handle, you are pressing the air in the syringe, making the air compress (squeeze into a smaller volume).



When you push the syringe handle, you are pressing the air in the syringe, making the air compress (squeeze into a smaller volume).

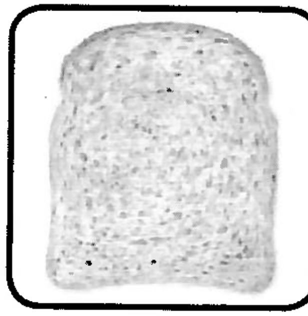
Is Compression Related to What I Know about Pressure?

Look at all of the forms of the word *compress* in this section. Words like *compress, compression,* and *compressing* all contain the word *press*. That may help you remember what compression is. Compression is related to the way you already might use the word *press* outside of science. You probably also have some ideas about pressure. As you pressed the syringe handle down, you felt pressure in two places. You felt a push on the finger that was blocking the hole. You also felt a push on the finger that was pushing the plunger down. This push is called *pressure*. Pressure is caused by millions and millions of particles hitting against a surface. When you pushed the plunger down, many more particles were hitting against the surfaces because they had been pushed into a smaller space. The increased number of particles caused the increased pressure.

Another way to increase pressure is to add more particles to a container. This makes sense because more particles hit against the sides. When you pumped more air into the ball in class, you increased the pressure inside the ball. You might already know that you can measure the pressure inside a ball or a bike tire with something called a *pressure gauge*. It measures the pressure caused by the number of particles hitting in a certain spot.

What Could Air Be Made of if I Can Compress It?

Think of some other things that you can compress. You can compress foam balls, sponges, and bread so they have less volume. You can compress these objects because there are small spaces in them. You can see small holes in bread. When you squeeze it, the material that makes up the bread comes together and there are fewer spaces between the bread. Squeezing bread can be a model of compression. Bread can be compressed because of the small spaces inside and through it.



Squeezing a sponge can also be a model of compression. Tiny spaces allow sponges to be compressed. You have seen that you can compress things that have spaces in the material, like bread and sponges. Do you think there are spaces in the material that makes up air? Explain your ideas.

What Happens to Air When I Pull on a Syringe?

You used a syringe to show something else that air does. First you pushed the handle and observed that air can be compressed. Then you tried to pull the handle of the syringe when your finger blocked the opening. You realized that you could only pull the handle out part of the way. As you pulled the syringe handle, you observed that air can also expand. Expanding is the opposite of compressing. When something expands, its volume increases. You have learned that volume is the space a material occupies. When you pulled the syringe handle, you made a larger space for the air to occupy. The air then expanded to fill that extra space.

When the space inside your lungs increases as you breathe in, more air can move into your lungs. When you pulled the handle of the syringe, you made more space. Your finger was on the opening and did not allow more air to go in. Instead, the air already in the syringe expanded and spread out into a larger volume.

When you pull the syringe handle, you are increasing the volume of the syringe. The air then expands (spreads out into a larger volume).

What Happens to Air When You Push More Air into a Container?

You might already know that compressing air (making the volume of air smaller) is not the only way to squeeze air. You can also squeeze air when you add more air into a container that is already full of air. Have you ever played with a water blaster or seen one advertised on television? Water blasters are plastic guns that shoot water. For fun, people can soak each other with water on a hot day. A stream of water comes out only if you pump in air. When you first begin pumping air into the gun, it is easy, and you can pump the air pretty fast. After a short time, it becomes harder and harder to pump more air into it. Why is that?

As you pump, you compress the air that is already in the container, and you add more air. The more air you pump into the container, the more that the air inside the container gets compressed. When you pump more and more air into a small container, you are demonstrating that air can be added.

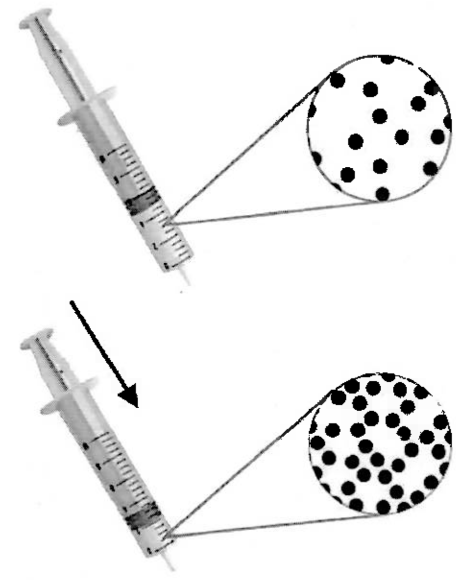
Is a Sponge a Good Model of Air?

It is helpful to use a sponge as a model of compression and expansion. You know that the sponge can compress because of all the small spaces in it. You might guess that air also compresses because of small spaces within air. However, one single sponge does not show everything that air does. For example, you read what happens to air when you add or subtract it from a container.

You also saw in class how air can be added to or taken away from a container. These are characteristics of air that a sponge cannot model. So even though a sponge is a good model of compression and expansion, a sponge is not a good model of air.

How Does the Pieces Model Help You Explain Expansion and Compression?

Look at the diagram of pushing a syringe, featured earlier in the lesson. If you looked at air using a special instrument, the big circle shows what you might see. If air is made of tiny pieces, then there can be spaces between the pieces. These tiny pieces of air are particles. When you pushed the syringe, the air compressed. The second drawing shows that when the air compressed, the particles moved closer together. Because the same number of particles squeezed into a smaller space, the pressure on your finger increased. You felt this as a push back against your finger.



When you compress air, the space between the particles gets smaller.

The opposite happened to the particles when you pulled on the syringe handle. As you pulled the syringe handle back, you created more space for the air to move into. The air particles spread out to take up the extra space. Because the same number of particles spread out in a larger space, the pressure decreased. This model of air as pieces or particles is called the *particle model*.

Can the Particle Model Represent Odors in Air?

You already know that when you smell something, it is because an odor is in the air. You have learned that odors have to be in the gaseous phase for humans to smell them. So you could use the particle model to explain odors in air. For example, when you smell an orange, you are smelling particles that started in the orange but then changed into a gas and moved into the air.

You might have other questions about air and odors being made of small pieces called particles. For example, you might wonder what the difference is between air particles and odor particles. You might wonder whether materials in other states of matter are made of particles. What questions do you have now?

Name____Date____________________

After reading the text, "How can I Model the Things Gases Do"(pgs 40-41), answer the following questions using the text.

1. Define the vocabulary term compression.

2. Define the vocabulary term expansion.

For numbers 3-4, <u>use the table to draw your models.</u>

3. Draw a **particle model** of what happens when you push a syringe of air.	4. Draw a **particle model** of what happens when you pull a syringe of air.

Reading 8.1 – Why Is the Periodic Table of the Elements Important?

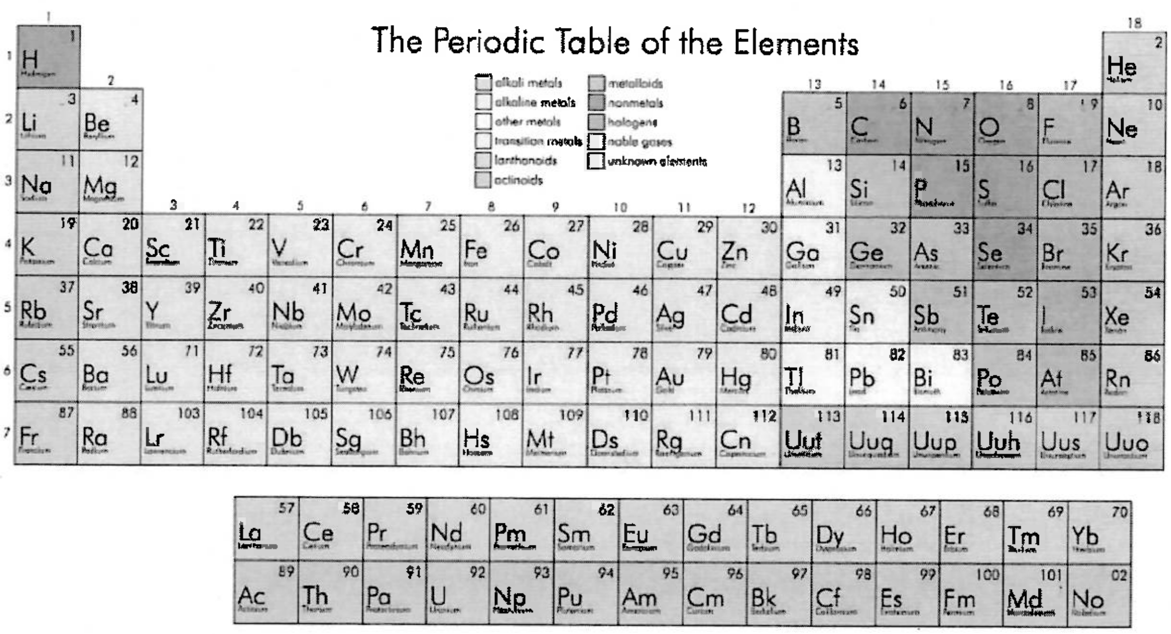
Getting Ready

Imagine that you need to go shopping for bread, milk, and ice cream. Would you find all of these items in the same aisle of the grocery store? You already know that items in a store are organized based on certain characteristics. Different kinds of bread are all in the same aisle. However, ice cream, milk, and bread are in different aisles for important reasons. Ice cream needs to stay frozen. Milk needs to stay cold but not frozen. Bread needs to stay at room temperature. Food in a grocery store is arranged in a way that works for the characteristics of the items. When you go to the store, you can find what you need because you understand how things are arranged.

Scientists also organize things in ways that are useful to them. Today, you will read about one way that chemists organize elements like the ones you have been studying.

What Is the Periodic Table of the Elements?

In 1869 Dmitri Mendeleev, a chemist, created the first periodic table as a way to organize all 61 elements known at that time. The periodic table of the elements is a way that scientists organize elements according to important characteristics. The modern periodic table has more than 100 elements. In fact, new elements are still being discovered.



Exploring the Periodic Table of the Elements

Read the names of the elements in the periodic table. Draw a circle around elements you have heard of. What do you notice about the elements you have heard of? Do you see any patterns?

What Is Important about Elements?

In class you have been examining elements. You have learned that each element is made up of only one type of atom. Gold is made of only gold atoms. Hydrogen is made of only hydrogen atoms. Also, you have tested a few elements to learn about properties such as hardness and malleability. In the periodic table, each element is listed by its name and its chemical symbol. Look closely at the top row. On the left, you can see hydrogen and its chemical symbol (H). Hydrogen is a nonmetal. You also know that it is a gas at room temperature and that it is colorless. Depending on why you are studying an element or what you want to use it for, different properties and characteristics are more important than others.

What Elements Do I Know?

You have already studied the element oxygen and used a capital O when you wrote about it in class. O makes sense for oxygen, but not all chemical symbols are so obvious. Below is a list of a few elements that can be used to make jewelry. Find each one in the periodic table and write its chemical symbol.

Element	Symbol
Gold	
Nickel	
Silver	
Platinum	

As you can see, the symbol does not always match the name of the element. This is because when the period table of the elements was created, Latin was the language scientists used. The Latin name for iron is *ferrum*. Iron's chemical symbol is Fe. Elements that were named long ago still keep their Latin symbols.

What Characteristics Are Used to Arrange the Elements?

Elements with the same properties are listed in columns, called *groups* or *families*. Argon (Ar) and xenon (Xe) are in the same family with neon (Ne) and helium (He). These elements are all gases at room temperature, which you know from looking at the emission spectra photographs.

You will learn more about the arrangement of elements in high school. For now, it is important to realize that the elements are arranged according to properties related to the mass of their atoms. They repeat according to a periodic trend, which is how the table got its name. Chemists still use this table for classifying, comparing, and organizing elements. As a science student, you might use it mostly to help you learn elements and their chemical symbols, or to begin to look for patterns across the elements you are studying in class. The Periodic Table of the Elements is an important tool for chemists who use and study different materials.

Name____Date______________

The Periodic Table of Elements

After reading the text, "Why is the periodic table of the Elements Important?," (pgs 65-66) read and answer the questions using the text.

1. What is the periodic table of elements and who discovered it?

2. Define the vocabulary term ***element***.

3. Write the names of the elements and molecules below using the periodic table:

   a. C______________________

   b. B______________________

   c. N______________________

   d. H______________________

   e. Au ______________________

   f. CO2 ____________________

   g. H2O ____________________

4. What characteristics are used to arrange the elements?

Reading 9.1 – What Kinds of Particles Do I Breathe, and What Are They Made Of?

Getting Ready

When you breathe in air, what is going into your lungs? You probably know that your body takes in oxygen by breathing in air. What else do you breathe in? What do you breathe out? Make two lists in the chart below.

When I breathe in air, I am breathing in . . .	When I breathe out, I am breathing out . . .

As you read, you will learn more about what particles are part of the air you breathe in and out. You will also learn what types of atoms make up these particles.

What Kinds of Particles Are in the Air You Breathe In?

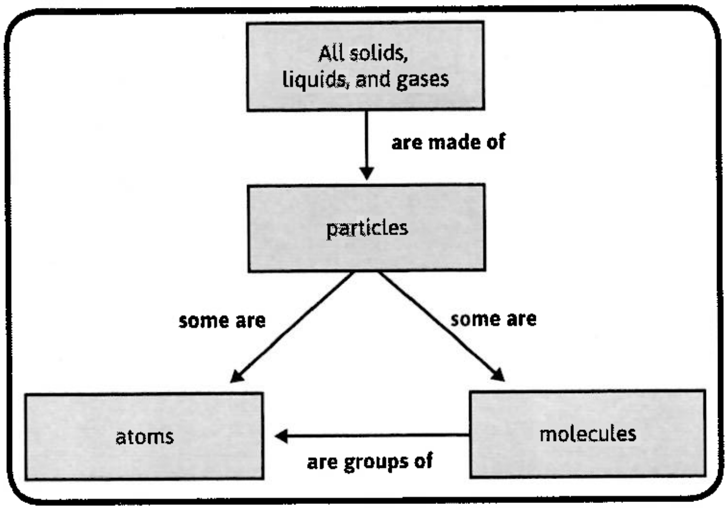
You have been thinking a lot about odors and air. If odors are part of the air, then you must breathe them in when you take a breath. Odors could be on your "breathe in" list. You could also put odors on your "breathe out" list. For example, think about bad breath. Bad breath is what you smell when someone breathes out odor particles.

In Lesson 3 you observed water going into the air as it changed from a liquid to a gaseous state. Water particles from lakes and puddles also go into the air. When you breathe in air, you must also breathe in water particles, but air is only made of a small amount of water. Most of the air is made up of nitrogen. When you breathe out onto a cold window or on a mirror, you see the window fog up. It fogs up because what you breathe out has water in it. All animals breathe out carbon dioxide, so carbon dioxide is part of the air. You may have listed other particles that are part of the air, too.

What Are the Particles in Air Made Of?

You also could have written on your list that you breathe atoms and molecules. Some of the particles in air are single atoms. Atoms of argon make up a small fraction of air. Other particles that are part of the air are groups of atoms joined together. These particles are called molecules. Molecules are made of two (or more) atoms joined together. The atoms in a molecule stay together when the material changes states. Molecules do not come apart during phase changes. The following diagram is another way to show how matter, particles, atoms, and molecules are related. If you follow one of the arrows, from one box to the next, you will come up with the following ideas:

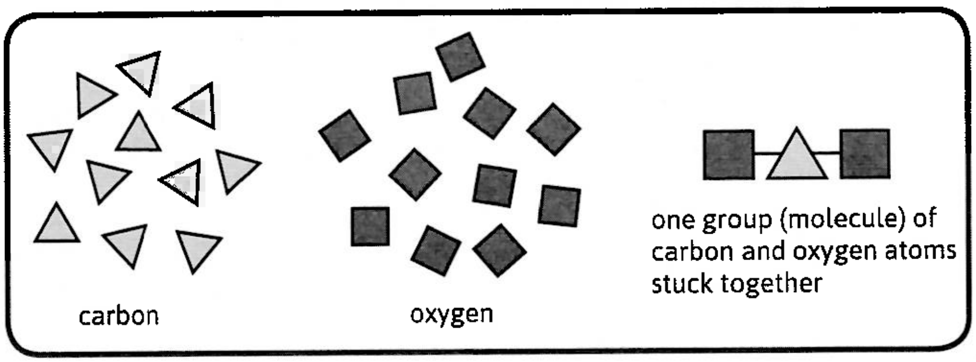
- All solids, liquids, and gases are made of particles.



- Some particles are single atoms.
- Other particles are molecules.
- Molecules are groups of atoms.

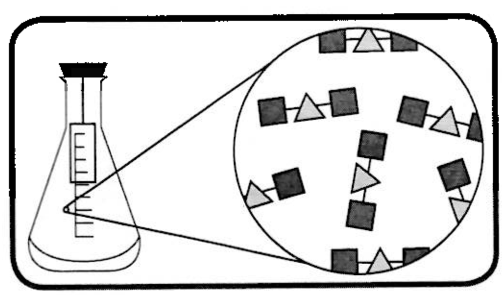
What Do the Particles I Breathe In and Out Look Like?

You breathe molecules in, and you breathe them out. In the last lesson, you learned that oxygen is an element. That means it is made up of only of oxygen atoms. The other materials that make up air are not elements. They are made of different types of atoms. Carbon dioxide is one material that is made of two different types of atoms—carbon atoms and oxygen atoms.



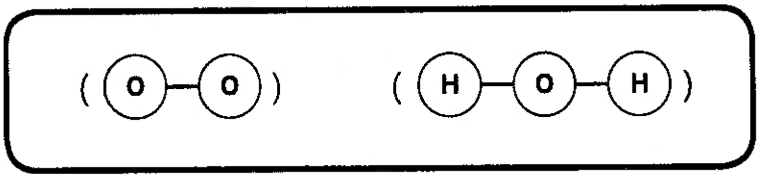
You cannot see molecules of any kind. Models can help you think about how atoms of different types are grouped together. Look at the model of the two types of atoms that make up a carbon dioxide molecule. Triangles represent carbon atoms. Squares represent oxygen atoms. In the image, you see a single carbon dioxide molecule. It is made up of two atoms of oxygen and one atom of carbon.

You have learned that billions of particles make up all matter. The substance called *carbon dioxide* is not just one molecule. Even a very tiny sample of carbon dioxide is made of billions of molecules. This next image represents only a few molecules, but it is important to understand that billions of molecules make up only a tiny dot of carbon dioxide.



If you could look at a tiny sample of carbon dioxide gas with a special microscope, you would see billions of carbon-oxygen molecules.

In class you used gumdrops and toothpicks to create models of some of the molecules that make up air. You might have noticed that some molecules can be made of the same type of atoms, and some are made of different types of atoms. One molecule of oxygen is made of two oxygen atoms. One carbon dioxide molecule is made of two different types of atoms—one carbon and two oxygen.



What Is the Best Way to Model Atoms and Molecules?

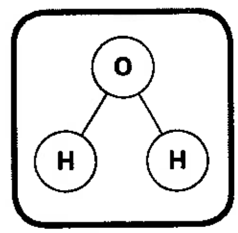
A model is a way to represent something. For your gumdrop models, it did not matter what color gumdrops you used. If you used a blue gumdrop to represent oxygen that does not mean oxygen atoms are really blue. Atoms can be represented by different shapes and colors. Squares, dots, and gumdrop shapes are three ways to represent atoms. You can probably think of others. You can represent molecules joining together in different ways, too. In class you used toothpicks. In the previous models, there are lines connecting the atoms. All of these ways to model atoms and molecules in a substance help you understand something your eye cannot see.

Who Cares about Atoms and Molecules Outside of Science Class?

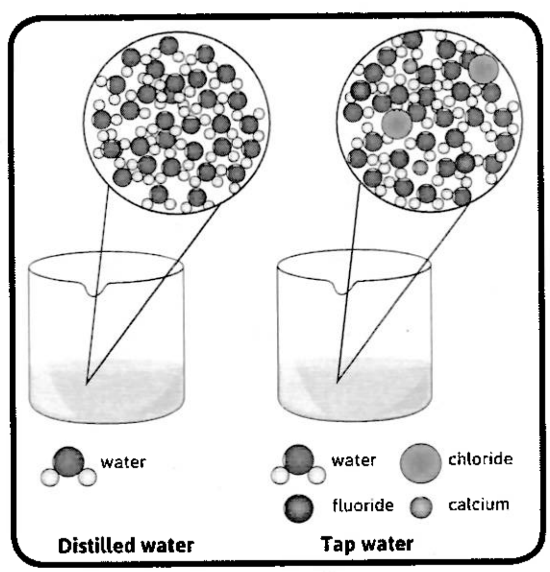
Think about all the materials you use at home. You use materials to clean yourself, such as soap, shampoo, a towel, and a toothbrush. You use paper materials to blow your nose, to write on, and to read from. All of these are made of different types of molecules. By knowing about atoms and molecules, scientists can create new materials. In Lesson 1, you read about scientists adding molecules of mercaptan (rotten egg odor) to natural gas to keep people safe. Another way that atoms and molecules are important in the real world is when choosing water to drink. Some water is safe to swim in and to drink, but some water is not safe. Knowing about atoms and molecules is important in knowing about safe water.

What Is in the Water I Drink?

Pure water, which is also called *distilled water*, is made of only water molecules. You can buy distilled water at the grocery store. Scientists represent one molecule of water as H_2O. That representation shows that a water molecule is made of two hydrogen atoms and one oxygen atom. In class, you created a gumdrop model of water that looked like the one here.



Pure water is made of only water molecules. When something is made of only one type of particle, it is called a *pure substance*. It is pure because no other type of particle is mixed with it. You can see in the model here that distilled water is a pure substance. There is only one type of particle in pure water—water molecules.



Water molecules are made of two types of atoms—hydrogen atoms and oxygen atoms. The atoms join together to form water molecules. Pure water is a substance because it is made of the same kind of molecule all the way through. The diagram shows pure, distilled water on the left. You can buy pure water in stores, but you do not get pure, distilled water when you turn on a faucet. Water from the faucet (which some people call *tap water*) has other substances in it. The water you drink from a faucet is a mixture. A mixture is a material that has more than one type of particle in it. In the drawing of tap water, you can see that some of those particles are molecules and some are single atoms. The model shows that tap water is a mixture. Notice in the diagram that besides water molecules, tap water can have other substances in it, like fluoride. Sometimes cities add sodium fluoride to water. Scientists and dentists have found that fluoride helps prevent tooth decay or cavities. Some homes do not have fluoride in their water, but many homes in cities do. People who live in rural areas probably get their water from a well that does not have extra fluoride. If you drink bottled water, look closely at the label. Are you drinking a substance or drinking a mixture?

What can I conclude about substances and mixtures?

Some things are mixtures. Some things are substances: What is air? What are odors?

In class you modeled the molecules that make up air. You saw that air is made up of nitrogen, oxygen, carbon dioxide, water molecules, and other materials. In fact, most things that you use, see, feel, taste, and eat are mixtures. Things that you smell might also be mixtures. A specific odor, like the minty scent of menthol, is made of one type of molecule. It is a pure substance. Scents from flowers, fruit, and perfumes are usually many different substances mixed into one scent. Air is a mixture of odor molecules plus many other types of molecules.

Choose three of the sentence starters below, and finish the sentence based on today's reading.

1. I already knew

2. I was surprised to learn

3. I thought it was interesting that

4. A question I would like to ask is

Reading 11.1 – How Can I Make Particles Move Faster?

Getting Ready

Today's reading is about molecules, temperature, and energy. These are important ideas in science, but they can be difficult to understand. Before you start reading, decide whether you think each statement is true or false.

Before Reading			After Reading	
T	F	Particles in a gas are always moving.	T	F
T	F	As temperature increases, particles move faster.	T	F
T	F	As temperature increases, particles move faster and their energy increases.	T	F
T	F	Particles are always moving, but the speed of the particles can be different.	T	F

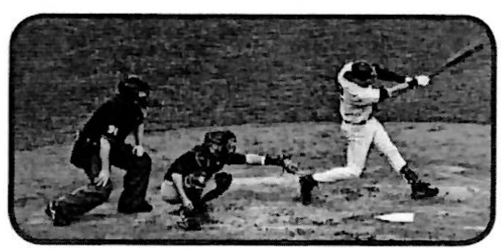
As you read, focus on temperature, energy, and how particles move.

How Do Particles in Air Move?

Imagine the billions of particles moving in one tiny bit of air. The molecules that make up the air are always moving. They move until they hit each other. Then they bounce off and go in a different direction. Air particles never stop moving. They are always bumping into each other and bouncing off.

Even though particles never stop moving, they can move quickly or they can move slowly. You might have learned in math class that the distance an object travels in a certain amount of time is called the *speed* of the object. Cars measure speed in miles per hour (MPH) or kilometers per hour (KPH). A gauge like the one in the picture shows the number of miles (the distance) that the car moves in one hour (the amount of time). Driving 40 miles per hour means that in one hour, the car will go 40 miles if it is always moving at the same speed. A car might go 25, 40, 55, or 70 miles in an hour. Particles can also move at different speeds. Particles in a gas move much faster than cars can move. The average speed of air particles is 1,100 miles per hour or 1,770 kilometers per hour. At that speed, it seems like particles would travel far, but they do not. They do not because they bump into other particles and change direction.

Another Way to Think about the Speed of Atoms and Molecules



Think about watching a bat hitting a baseball. Imagine the bat as one particle in the air. Imagine the baseball as another particle. When the pitcher throws the ball, the ball moves at a very fast speed. If the batter swings the bat at a slow speed, then the ball will bounce off the bat and move away slowly. If the batter swings the bat at a fast speed, then the ball will bounce off the bat faster. If you know about baseball, think about trying to bunt or trying to hit a home run. To make the ball go farther, the batter needs to swing the bat faster. The speed of the bat and the speed of the ball before they hit affect how fast the ball moves after it hit the bat.

Particles move a little bit like the bat and ball. The speed of the particles affects how fast they can bounce away from each other. A bat and ball are only two particles. Think of what happens when billions of particles move and bounce off of each other at once.

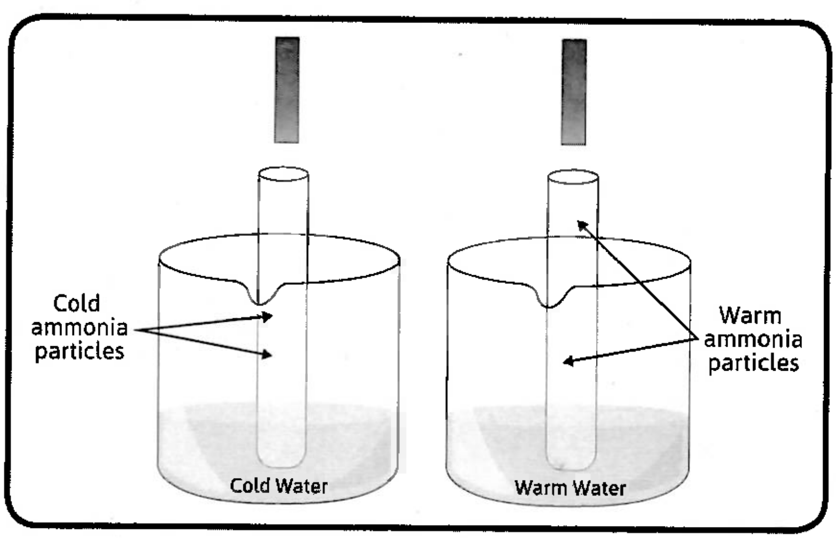
What Happens to the Speed of Particles When They Are Warm or Cold?

You investigated this question by testing how temperature is related to the speed at which particles move.

This investigation used two containers. One test tube held cool ammonia. Another test tube held warm ammonia. Indicator paper was held above the opening of each test tube. You observed that the indicator paper near the warm ammonia changed to dark blue much sooner than the indicator near the cool ammonia.

Why Did the Indicator Papers Change Color at Different Times?

In this investigation, temperature was the only variable that was different between the two containers. In both test tubes, the ammonia particles bounced around among the air particles. Indicator paper was the detector that provided data. When it changed color, the indicator paper provided evidence that ammonia particles had moved out of the test tube. You saw that the indicator paper above the warm ammonia changed color sooner. The paper also provided evidence that the speed of the ammonia and air particles in the warm test tube must have been faster than the speed of the cold ammonia and air particles.



This investigation showed that molecules move at different speeds. The speed of particles is related to temperature.

What Does the Temperature of a Substance Tell about the Speed of Its Particles?

Scientists call *temperature* the average speed of molecules in a substance. This is true for all substances. When a thermometer measures the air temperature, it measures the average speed of the molecules that make up the air around the thermometer.

Here is another way to think about molecules and temperature: When you heat a substance, the particles in that substance move faster. When their energy increases, they move faster, their energy increases. This was true about the ammonia that you saw in class, and it is true about all substances. When you heat a substance, several things happen:

1. The particles move faster.
2. Their energy increases.
3. Faster-moving particles hit into each other harder.
4. Faster-moving particles bounce off of each other harder and move further apart.
5. As most of the particles that make up the substance move faster, the temperature of the substance increases.

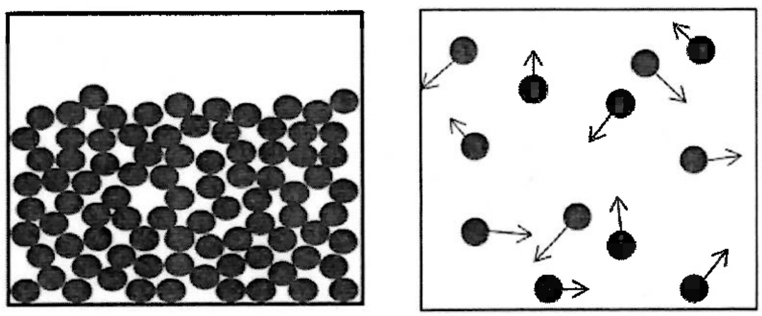
Now that you have finished reading, go back to the beginning and circle whether each statement is true or false. Did any of your ideas change? If the answer is yes, use evidence from your investigation to explain why your ideas have now changed.

Name____Date_______________

Use the model below to write a response to the following scenario.

Lina learned about molecules, temperature and energy in her science class after reading the text," How can I make particles move faster?" (pgs 91-93). Lina was asked to draw a particle model describing how she can make particles move faster.

Explain in words what Lina's model shows happening to a substance.



Reading 12.1 – How Can the Volume of a Balloon Change without Removing or Adding Air?

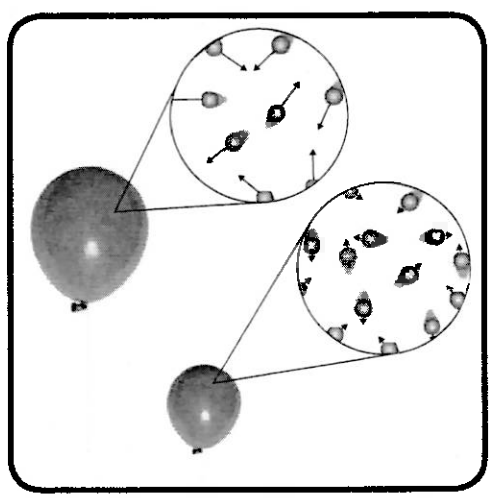
Getting Ready

Do you ever eat popcorn? Before popcorn pops, the kernels are hard. How does a hard kernel become soft, fluffy, white popcorn that is easy to chew? Popcorn pops because each kernel contains water. As you heat popcorn, the water molecules inside each kernel move faster. As they move faster, the molecules collide (hit) each other harder. The more they are heated, the faster the molecules move. They soon have so much energy that they create a lot of pressure inside the tiny kernel. The molecules hit against the material that makes up the kernel with so much speed that the kernel breaks open and pops.

What happens inside a popcorn kernel is related to the speed of particles, energy, temperature, and pressure. The reasons that a popcorn kernel pops are the same reasons that a balloon shrinks and expands as the molecules inside of it are heated and cooled. Sometimes, it is a challenge to connect experiences that seem very different. What happens inside a balloon and what happens inside a popcorn kernel can both be explained by knowing the behavior of particles. As you read, think about how your observations of a balloon in class would apply to a balloon even if it were filled with a different gas.

What Happens Inside a Balloon When It Is Cooled and Warmed?

In class you saw a balloon filled with gas. You observed what happened when you put the balloon inside a cold container. The balloon got smaller. Then you let the balloon warm up, and it got bigger. What would happen if the balloon were filled with a different gas instead of the gases that make up air?



Imagine that the balloons in the following model are filled with helium. In this model, arrows represent how fast the particles are moving. Longer arrows mean the particles are moving faster. Shorter arrows mean they are moving more slowly. Can you tell which one represents a cold balloon and which one represents a warm balloon?

The balloon on the left shows how helium atoms might move if the balloon were in a warm room. If you put the same balloon into a freezer, the atoms might move like the ones on the right. Many things happen as you warm and cool a balloon.

Notice the following four things:

1. the temperature of the balloon (warm or cold)
2. the size of the balloon (larger or smaller)
3. the speed of the atoms (faster or slower)
4. the number of atoms in the tiny spot that is magnified (more or fewer)

If you could see one tiny amount of helium gas in each balloon, you would notice many differences between their atoms. For example, in the balloon on the left, the warm helium atoms would be moving faster and bouncing farther away from each other. The atoms would also collide with the particles the balloon is made of. A balloon can stretch if something pushes against it. As the gas particles push the balloon, they make the balloon stretch, and it gets larger.

Balloons and Popcorn Kernels

You already know that gases take the shape of their container. As more gas is added to a balloon, the pressure against the sides of the balloon increases. The gas particles move further apart and push against the sides of the balloon. The balloon stretches a little more, and the gas particles move apart to fill the space of the container. If you add more gas, the balloon expands again because the particles continue to bounce off of each other and fill the space. You probably know, however, that a balloon can only stretch so far. If you put more gas into a balloon than it can stretch to hold, the balloon will break. Does this remind you of popcorn? When a container cannot hold any more gas but you try to put more in (like a balloon), or you keep heating the gas so that it keeps expanding (like water vapor in a kernel), the container can break. A balloon and a popcorn kernel both pop.

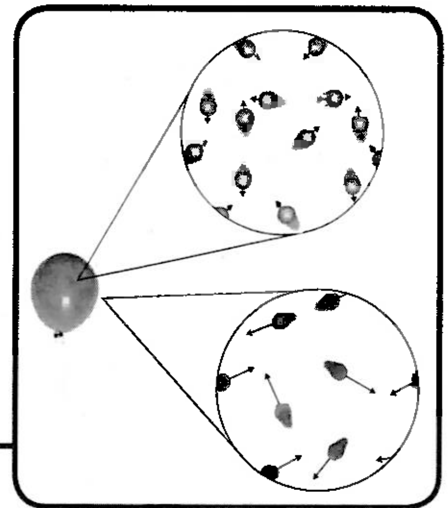
Cooling a Balloon

If you tie a balloon shut and then put it in ice, the particles slow down. They do not have as much energy. They still collide with each other and with the sides of the balloon, but they do not collide as hard. Think about the bat and baseball that you read about in the last lesson. As the helium in the balloon cools, the particles move more slowly. They do not push against the side of the balloon as hard. They still fill the space of the balloon, but because they are moving more slowly and bouncing less far apart, they put less pressure on the sides of the balloon, and the balloon gets smaller.

Why Does It Look Like the Balloons Have Different Numbers of Atoms?

One thing might be confusing. It might look like the warm balloon contains fewer atoms, but remember that the balloon you saw in class was closed. No air was added to it, and no air could escape. The number of atoms in each balloon stayed the same. The number of atoms looks different because the diagram represents a tiny spot inside each balloon. In a warm balloon, the atoms would be farther apart, so fewer of them would be in a tiny spot. Because the atoms are closer together in the cool balloon, you could see more of them in a tiny spot. The number of atoms does not change. What you would see when you focus on a tiny spot, if you had an instrument that would let you see atoms, is whether they are closer together or farther apart.

What Are the Air Molecules outside the Balloon Doing?



You have learned about the particles inside the balloon, but you know that air molecules are also moving in the room outside of the balloon. This diagram shows what the gas molecules were doing inside and outside the balloon. As particles were moving inside the balloon, particles were also moving outside the balloon.

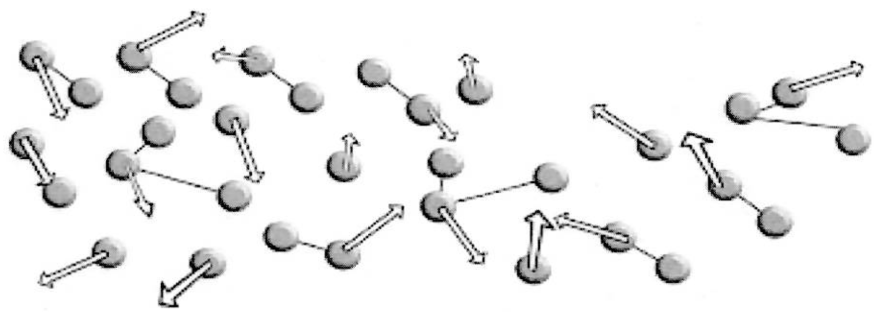
What would you expect to happen to the molecules inside the balloon if the balloon sat in a warm room all day? Explain your ideas.

Name____Date________________

Explaining a Particle Model

Use the model below to write a response to the following scenario. You may use reading 12.1- "How can the volume of a Balloon change without removing or adding air?" (pgs 97-99) to support your response.

The particle model below shows what happens when gases are heated.



Explain what would happen to the particles if the temperature dropped to 0 degrees.

Name____Date___________

After reading the article, "The water cycle" read and answer the questions using the text.

1. Explain what the water cycle describes.

2. List the eight forms that water exist.

3. _________________ is the process of a liquid's surface

   changing to a ___________. In the water cycle, __________ water (in the ocean, lakes or rivers) evaporates and becomes __________ ____________.

4. How is condensation influenced by the sun?

5. Why is fog not considered precipitation?

Name____Date__________

After reading the article, “The water cycle” read and answer the questions using the text.

1. **Define transpiration.**

2. **Explain how plants use transpiration.**

3. **The opening of _____________ is strongly influenced by _______________, and so is often associated with the sun and the process of _________________.**

4. **Explain how evapotranspiration works. What is it used to evaluate?**

5. **_________________is simply the amount of water vapor in the air.**

Name____Date__________

After reading the article, "Matter and Energy: Evaporation and condensation" read and answer the questions using the text.

1. Explain what all matter is made up of?

2. Describe and explain what happens when evaporation occurs.

3. Explain two key differences between evaporation and boiling.

4. Describe condensation and give a real world example of when condensation can be observed.