Nutrition Project -

Health Day 1 - Write down all the food you would typically eat throughout a regular day. Include breakfast, lunch, dinner, snacks, and drinks. Please write the amounts that you eat. Estimates are fine. (Example - Breakfast: 2 cups of Rice Krispies and 1 cup of whole milk) Be honest!

Health Day 2 - Find the amount of calories each item on your list amounts to. Add up all the calories you eat in a day. Determine which food groups you eat the most.

Health Days 3 and 4 - Plan a daily meal plan that includes breakfast, lunch, dinner, snacks, and drinks. Try to keep the calorie total to around 2,000 calories. Make sure to hit all the major food groups in their correct amounts.
My normal day of food:

Breakfast:

Total Calories: ______________

Lunch:

Total Calories: ______________

Dinner:

Total Calories: ______________

Snacks and Drinks:

Total Calories: ______________
Meal Planning Using the Food Pyramid

Create a daily meal plan using the food groups from the food pyramid. Include the foods and amounts just like you did in the previous activity. Try to keep the caloric intake to 2,000 calories. Make the menu into a poster.

Breakfast:

Calories: _____________

Lunch:

Calories: _____________

Dinner:

Calories: _____________

Snacks and drinks:

Calories: _____________
Science - Day 1

Day 1 - Characteristics of the Atmosphere

1. Read packet pages 85-89.
   a. Highlight as you go along - all key, important details
   b. Answer the questions along the side of the reading.

2. Answer questions on page 90.
   a. May use calculators when needed
   b. Must show work.
   c. Cite where you found your answer.

3. Do the Vocabulary and Section Summary

4. Complete the Section Review.
   a. May use calculators when needed
   b. Must show work.
   c. Cite where you found your answer.
Science - Day 2

Characteristics of the Atmosphere continued

5. Complete the Directed Reading.
   a. May use calculators when needed
   b. Must show work.
   c. Cite where you found your answer.

6. Section Quiz (open book) May also find the quiz on Google Classroom
   a. Please write your answers on the line with capital print letters or you can take the
      quiz on Google Classroom
   b. Open book
Characteristics of the Atmosphere

Before you read, you should be able to answer these questions:

- What is Earth's atmosphere made of?
- How do air pressure and temperature change as you move away from Earth's surface?
- What are the layers of the atmosphere?

What Is Earth's Atmosphere Made Of?

An atmosphere is a layer of gases that surrounds a planet or moon. On Earth, the atmosphere is often called just "the air." When you take a breath of air, you are breathing in atmosphere.

The air you breathe is made of many different things. Almost 80% of it is nitrogen gas. The rest is mostly oxygen, the gas we need to live. There is also water in the atmosphere. Some of it is invisible, in the form of a gas called water vapor.

Water is also found in the atmosphere as water droplets and ice crystals, like those that make up clouds. The atmosphere also contains tiny particles, or solid pieces. These particles are things like dust and dirt from continents, salt from oceans, and ash from volcanoes.

Gases in Earth's Atmosphere

Math Focus

2. Analyze data. About what fraction of the Earth's atmosphere is NOT made of nitrogen? Give your answer as a reduced fraction.
Where Do the Gases in the Atmosphere Come From?

The gases in Earth's atmosphere come from many different sources. The table below shows some of those sources.

<table>
<thead>
<tr>
<th>Gas</th>
<th>Where the gas comes from</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oxygen</td>
<td>Plants give off oxygen as they grow.</td>
</tr>
<tr>
<td>Nitrogen</td>
<td>Nitrogen is given off when dead plants and animals decay.</td>
</tr>
<tr>
<td>Water vapor</td>
<td>Liquid water evaporates and becomes water vapor. Plants give off water vapor as they grow.</td>
</tr>
<tr>
<td></td>
<td>Water vapor comes out of the Earth during volcanic eruptions.</td>
</tr>
<tr>
<td>Carbon dioxide</td>
<td>Carbon dioxide comes out of the Earth during volcanic eruptions.</td>
</tr>
<tr>
<td></td>
<td>When animals breathe, they give off carbon dioxide.</td>
</tr>
<tr>
<td></td>
<td>Carbon dioxide is given off when we burn things that were once plant or animal material.</td>
</tr>
</tbody>
</table>

Why Does Air Pressure Change with Height?

Air pressure is how much the air above you weighs. It is a measure of how hard air molecules push on a surface. We don't normally notice air pressure, because our bodies are used to it.

As you move up from the ground and out toward space, there are fewer gas molecules pressing down from above. Therefore, the air pressure drops. The higher you go, the lower the air pressure gets.
**Why Does Air Temperature Change with Height?**

Like air pressure, air temperature changes as you move higher in the atmosphere. Air pressure always gets lower as you move higher, but air temperature can get higher or lower. The air can get hotter or colder.

There are different layers of the atmosphere. Each layer is made of a different combination of gases. Air temperature depends on the gases in the atmosphere. Some gases absorb energy from the sun better than others. When a gas absorbs energy from the sun, the air temperature goes up.

**What Are the Layers of the Atmosphere?**

There are four main layers of the atmosphere: troposphere, stratosphere, mesosphere, and thermosphere. You cannot actually see these different layers. The divisions between the layers are based on how each layer's temperature changes with height.

6. **READING CHECK**

   Compare: How are the changes in air temperature with height different from changes in air pressure with height?

---

**Say It**

Make Up a Memory Trick

In groups of two or three, make up a sentence to help you remember the order of the layers of the atmosphere. The words in the sentence should start with T, S, M, and T. For example, "Tacos Sound Mighty Tasty." A sentence like this is called a mnemonic.

7. **TAKE A LOOK**

   Identify At what altitude does the mesosphere end and the thermosphere begin?
Critical Thinking

8. Explain Why is the troposphere important to people?

---

THE TROPOSPHERE

The troposphere is the layer of the atmosphere that we live in. It is where most of the water vapor, carbon dioxide, pollution, and living things on Earth exist. Weather conditions such as wind and rain all take place in the troposphere.

The troposphere is also the densest layer of the atmosphere. This is because the troposphere is at the bottom with all the other layers pushing down from above. Almost 90% of the gases in the atmosphere are in the troposphere. As you move higher into the troposphere (say, to the top of a mountain), both air temperature and air pressure decrease.

TAKE A LOOK

9. Analyze What does the map tell you about the air temperature in the troposphere?

---

THE STRATOSPHERE

As you go up from the ground, the temperature decreases. At an altitude of about 15 km, however, it starts to increase. This marks the beginning of the stratosphere. Strato means "layer." The gases in the stratosphere are layered. They do not mix as they do in the troposphere.

The main reason the temperature increases in the stratosphere is because of a gas called ozone. Ozone absorbs energy from the sun, making the temperature of the atmosphere increase. The ozone layer is important for life on Earth because it absorbs harmful ultraviolet energy.

THE MESOSPHERE

Above the ozone layer, at an altitude of about 50 km, the temperature begins to drop again. This marks the bottom of the mesosphere. The temperature keeps decreasing all the way up to 80 km. The temperatures in the mesosphere can be as low as \(-93^\circ C\).
THE THERMOSPHERE

The thermosphere is the uppermost layer of the atmosphere. In the thermosphere, temperatures begin to rise again. The thermosphere gets its name from its extremely high temperatures, which can be above 4,000°C. Therm means “heat.” The temperatures in the thermosphere are so high because it contains a lot of oxygen and nitrogen, which absorb energy from the sun.

THE IONOSPHERE—ANOTHER LAYER

The troposphere, stratosphere, mesosphere, and thermosphere are the four main layers of the atmosphere. However, scientists also sometimes study a region called the ionosphere. The ionosphere contains the uppermost part of the mesosphere and the lower part of the thermosphere. It is made of nitrogen and oxygen ions, or electrically charged particles.

The ionosphere is where auroras occur. Auroras are curtains and ribbons of shimmering colored lights. They form when charged particles from the sun collide with the ions in the ionosphere. The ionosphere is important to us because it can reflect radio waves. An AM radio wave can travel all the way around the Earth by bouncing off the ionosphere.

<table>
<thead>
<tr>
<th>Layer</th>
<th>How temperature and pressure change as you move higher</th>
<th>Important features</th>
</tr>
</thead>
<tbody>
<tr>
<td>Troposphere</td>
<td>temperature decreases pressure decreases</td>
<td></td>
</tr>
<tr>
<td>Stratosphere</td>
<td>gases are arranged in layers contains the ozone layer</td>
<td>has the lowest temperatures</td>
</tr>
<tr>
<td>Thermosphere</td>
<td>temperature increases pressure decreases</td>
<td></td>
</tr>
</tbody>
</table>
Section 1 Review

SECTION VOCABULARY

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air Pressure</td>
<td>The measure of the force with which air molecules push on a surface</td>
</tr>
<tr>
<td>Atmosphere</td>
<td>A mixture of gases that surrounds a planet or moon</td>
</tr>
<tr>
<td>Mesosphere</td>
<td>The layer of the atmosphere between the stratosphere and the thermosphere</td>
</tr>
<tr>
<td>Stratosphere</td>
<td>The layer of the atmosphere that is above the troposphere and in which temperature increases as altitude increases</td>
</tr>
<tr>
<td>Thermosphere</td>
<td>The uppermost layer of the atmosphere, in which temperature increases as altitude increases</td>
</tr>
<tr>
<td>Troposphere</td>
<td>The lowest layer of the atmosphere, in which temperature decreases at a constant rate as altitude increases</td>
</tr>
</tbody>
</table>

1. Define Write your own definition for atmosphere.

2. Explain Why does air temperature change as you move up from the Earth's surface?

3. Make a Graph The graph below shows how the temperature changes as you move up through the atmosphere. On the graph, draw a curve showing how the pressure changes.

![Graph showing temperature changes with altitude]

4. Identify Relationships How does the sun affect air temperatures?
Characteristics of the Atmosphere

VOCABULARY

In your own words, write a definition of the following terms in the space provided.

1. atmosphere

2. air pressure

3. troposphere

4. stratosphere

5. mesosphere

6. thermosphere
SECTION SUMMARY

Read the following section summary.

- Nitrogen and oxygen make up most of Earth's atmosphere.
- Air pressure decreases as altitude increases.
- The composition of atmospheric layers affects their temperature.
- The troposphere is the lowest atmospheric layer. It is the layer in which we live.
- The stratosphere contains the ozone layer, which protects us from harmful UV radiation.
- The mesosphere is the coldest atmospheric layer.
- The thermosphere is the uppermost layer of the atmosphere.
Characteristics of the Atmosphere

USING KEY TERMS

1. Use each of the following terms in a separate sentence: air pressure, atmosphere, troposphere, stratosphere, mesosphere, and thermosphere.

UNDERSTANDING KEY IDEAS

2. Why does the temperature of different layers of the atmosphere vary?
   a. because air temperature increases as altitude increases
   b. because the amount of energy radiated from the sun varies
   c. because of interference by humans
   d. because of the composition of gases in each layer

3. Why does air pressure decrease as altitude increases?

4. How can the thermosphere have high temperatures but not feel hot?

5. What determines the temperature of atmospheric layers?

6. What two gases make up most of the atmosphere?
MATH SKILLS

7. If an average cloud has a density of 0.5 g/m³ and has a volume of 1,000,000,000 m³, what is the weight of an average cloud? Show your work below.

CRITICAL THINKING

8. Applying Concepts  Apply what you know about about the relationship between altitude and air pressure to explain why rescue helicopters have a difficult time flying at altitudes over 6,000 m.

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9. Making Inferences  If the upper atmosphere is very thin, why do space vehicles heat up as they enter the atmosphere?

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10. Making Inferences  Explain why gases such as helium can escape Earth's atmosphere.

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Science - Day 2

Characteristics of the Atmosphere continued

5. Complete the Directed Reading.
   a. May use calculators when needed
   b. Must show work.
   c. Cite where you found your answer.

6. Section Quiz (open book) May also find the quiz on Google Classroom
   a. Please write your answers on the line with capital print letters or you can take the
      quiz on Google Classroom
   b. Open book
Science - Day 1

Day 1 - Characteristics of the Atmosphere

1. Read packet pages 85-89.
   a. Highlight as you go along - all key, important details
   b. Answer the questions along the side of the reading.

2. Answer questions on page 90.
   a. May use calculators when needed
   b. Must show work.
   c. Cite where you found your answer.

3. Do the Vocabulary and Section Summary

4. Complete the Section Review.
   a. May use calculators when needed
   b. Must show work.
   c. Cite where you found your answer.
Section: Characteristics of the Atmosphere

1. A mixture of gases surrounding a planet is the
   a. oxygen.
   b. atmosphere.
   c. breathable air.
   d. hemisphere.

THE COMPOSITION OF THE ATMOSPHERE

2. The most common atmospheric gas is
   a. oxygen.
   b. argon.
   c. nitrogen.
   d. carbon dioxide.

3. Phytoplankton and plants produce the atmosphere’s
   a. oxygen.
   b. argon.
   c. nitrogen.
   d. carbon dioxide.

4. Most water in the atmosphere is in
   a. rain.
   b. ice.
   c. water vapor.
   d. carbon dioxide.

ATMOSPHERIC PRESSURE AND TEMPERATURE

5. At sea level, a square inch of surface area is under almost how many pounds of pressure?
   a. 150
   b. 15
   c. 30
   d. 1500

6. Gas molecules in the atmosphere are pulled toward the Earth by
   a. air pressure.
   b. the moon.
   c. gravity.
   d. surface area.
7. The measure of the force with which air molecules push on a surface is called

8. Explain what happens to air pressure as you move away from the Earth's surface.

9. Explain why parts of the atmosphere are warmer than others.

LAYERS OF THE ATMOSPHERE

Match the correct definition with the correct term. Write the letter in the space provided.

____ 10. coldest layer of the atmosphere
____ 11. atmosphere layer including the ozone layer
____ 12. layer of atmosphere closest to Earth
____ 13. uppermost layer of the atmosphere

a. troposphere
b. mesosphere
c. stratosphere
d. thermosphere

14. How are the layers of the atmosphere defined?

15. In the stratosphere, what happens to the temperature as altitude increases?

16. Electrically charged particles are called ____________________.

17. In polar regions, ions radiate energy as shimmering lights called ____________________.
Section: Characteristics of the Atmosphere

Write the letter of the correct answer in the space provided.

_____ 1. Which answer best describes Earth's atmosphere?
   a. mostly oxygen with about 21% nitrogen
   b. mostly nitrogen with about 21% oxygen
   c. mostly carbon dioxide with about 21% oxygen
   d. mostly nitrogen with about 21% carbon dioxide

_____ 2. What causes differences in air temperatures at different altitudes?
   a. mainly the way air radiates solar energy
   b. mainly the way gases radiate light
   c. mainly the way gases absorb solar energy
   d. mainly the way moisture moves through the atmosphere

_____ 3. What are the two highest layers of the atmosphere?
   a. troposphere, mesosphere
   b. thermosphere, mesosphere
   c. stratosphere, thermosphere
   d. troposphere, stratosphere

_____ 4. Auroras are caused by electrically charged particles in the
   a. mesosphere.
   b. troposphere.
   c. hemisphere.
   d. ionosphere.

Match the correct definition with the correct term. Write the letter in the space provided.

_____ 5. layered gases, thin air, little moisture
   a. troposphere
   b. thermosphere
   c. stratosphere
   d. mesosphere

_____ 6. coldest layer, temperature decreases as altitude increases
   a. troposphere
   b. thermosphere
   c. stratosphere
   d. mesosphere

_____ 7. lack of particle density, little thermal energy transfer
   a. troposphere
   b. thermosphere
   c. stratosphere
   d. mesosphere

_____ 8. densest layer, contains almost 90% of the atmosphere's mass
   a. troposphere
   b. thermosphere
   c. stratosphere
   d. mesosphere
Science - Day 3

Atmospheric Heating
1. Read packet pages 91-93.
   a. Highlight as you go along
   b. Answer the questions along the side of the reading.
2. Answer questions on page 94.
   a. May use calculators when needed
   b. Must show work.
   c. Cite where you found your answer.
3. Complete the Vocabulary and Section Review
4. Complete the Section Review.
   a. May use calculators when needed
   b. Must show work.
   c. Cite where you found your answer.
Science - Day 4

Atmospheric Heating Continued

5. Complete the Directed Reading.
   a. May use calculators when needed
   b. Must show work.
   c. Cite where you found your answer.

6. Section Quiz (open book) May also find the quiz on Google Classroom
   a. Please write your answers on the line with capital print letters or you can take the quiz on Google Classroom
   b. Open book
How Does Energy Travel from the Sun to Earth?

Most of the heat energy on Earth's surface comes from the sun. Energy travels from the sun to Earth by radiation, which means that it travels through space as waves. As solar energy (energy from the sun) is absorbed by air, water, and land, it turns into heat energy. This energy causes winds, the water cycle, ocean currents, and changes in the weather.

What Happens to Radiation from the Sun?

Not all of the radiation from the sun reaches Earth's surface. Much of it gets absorbed by the atmosphere. Some of it is scattered and reflected by clouds and gases.
How Is Heat Transferred by Contact?
Once sunlight is absorbed by Earth's surface, it is converted, or changed, into heat energy. Then, the heat can be transferred to other objects and moved to other places. When a warm object touches a cold object, heat moves from the warm object to the cold one. This movement of heat is called thermal conduction.

When you touch the sidewalk on a hot, sunny day, heat energy is conducted from the sidewalk to you. The same thing happens to air molecules in the atmosphere. When they touch the warm ground, the air molecules heat up.

How Is Heat Energy Transferred by Motion?
If you have ever watched a pot of water boil, you have seen convection. During convection, warm material, such as air or water, carries heat from one place to another.

When you turn on the stove under a pot of water, the water closest to the pot heats up. As the water heats up, its density decreases. The warm water near the pot is not as dense as the cool water near the air. Therefore, the cool water sinks while the warm water rises.

As it rises, the warm water begins to cool. When it cools, its density increases. It becomes denser than the layer below, so it sinks back to the bottom of the pot. This forms a circular movement called a convection current.

Convection currents also move heat through the atmosphere. In fact, most heat energy in the atmosphere is transferred by convection. Air close to the ground is heated by conduction from the ground. It becomes less dense than the cooler air above it. The warmer air rises while the cooler air sinks. The ground warms up the cooler air by conduction, and the warm air rises again.

**Convection Current**

![Diagram of convection current]

**TAKE A LOOK**
5. Describe what happens to warm air as it moves through the atmosphere?
How Does the Earth Stay Warm?

A gardener who needs to keep plants warm uses a glass building called a greenhouse. Light travels through the glass into the building, and the air and plants inside absorb the energy. The energy is converted to heat, which cannot travel back through the glass as easily as light came in. Much of the heat energy stays trapped within the greenhouse, keeping the air inside warmer than the air outside.

Earth's atmosphere acts like the glass walls of a greenhouse. Sunlight travels through the atmosphere easily, but heat does not. Gases in the atmosphere, such as water vapor and carbon dioxide, absorb heat energy coming from Earth. Then, they radiate it back to Earth's surface. This is known as the **greenhouse effect**.

The Greenhouse Effect

1. Light energy from the sun passes through the atmosphere and is absorbed by clouds and by Earth's surface.
2. Clouds and Earth's surface radiate the energy back out as heat energy.
3. Heat energy warms Earth's atmosphere.

What Is Global Warming?

Many scientists are worried that Earth has been getting warmer over the past hundred years. This increase in temperatures all over the world is called **global warming**.

Scientists think that human activities may be causing global warming. When we burn fossil fuels, we release greenhouse gases, such as carbon dioxide, into the atmosphere. Because greenhouse gases trap heat in the atmosphere, adding more of them can make Earth even warmer. Global warming can have a strong effect on weather and climate.

**Reading Check**


**Take a Look**

7. Identify On the drawing, label the light coming from the sun with an L. Label the heat energy that is trapped by Earth's atmosphere with an H.

**Say It**

**Predict** How might global warming affect your community? What can you do to slow global warming? In groups of two or three, discuss how global warming might affect your lives.
Section 2 Review

SECTION VOCABULARY

| Convection: the transfer of thermal energy by the circulation or movement of a liquid or gas. |
| Global warming: a gradual increase in average global temperature. |
| Greenhouse effect: the warming of the surface and lower atmosphere of Earth that occurs when water vapor, carbon dioxide, and other gases absorb and reradiate thermal energy. |
| Radiation: the transfer of energy as electromagnetic waves. |
| Thermal conduction: the transfer of energy as heat through a medium. |

1. Apply Concepts A person is camping outside. The person toasts a marshmallow by holding it above the flames of the fire. Does the marshmallow cook because of convection, conduction, or radiation? Explain your answer.

2. Compare Fill in the table below to name and describe the three ways energy is transferred in Earth's atmosphere.

<table>
<thead>
<tr>
<th>Type of energy transfer</th>
<th>How energy is transferred</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Energy travels as electromagnetic waves.</td>
</tr>
<tr>
<td>Conduction</td>
<td></td>
</tr>
</tbody>
</table>

3. Explain How does most of the heat in Earth's atmosphere move from place to place?

4. Identify Relationships Explain how global warming and the greenhouse effect are related.
Vocabulary and Section Summary

Atmospheric Heating

VOCABULARY

In your own words, write a definition of the following terms in the space provided.

1. radiation

2. thermal conduction

3. convection

4. greenhouse effect

5. global warming

SECTION SUMMARY

Read the following section summary.

- Energy from the sun is transferred through the atmosphere by radiation, thermal conduction, and convection.

- Radiation is energy transfer by electromagnetic waves. Thermal conduction is energy transfer by direct contact. Convection is energy transfer by circulation.

- The greenhouse effect is Earth's natural heating process. Increasing levels of greenhouse gases could cause global warming.
Global Winds and Local Winds
USING KEY TERMS

1. In your own words, write a definition for each of the following terms: wind, Coriolis effect, jet stream, polar easterlies, westerlies, and trade winds.

   ___________________________________________________________
   ___________________________________________________________
   ___________________________________________________________
   ___________________________________________________________
   ___________________________________________________________
   ___________________________________________________________

UNDERSTANDING KEY IDEAS

2. Why does warm air rise and cold air sink?
   a. because warm air is less dense than cold air
   b. because warm air is denser than cold air
   c. because cold air is less dense than warm air
   d. because warm air has less pressure than cold air does

3. What are pressure belts?

   ___________________________________________________________

4. What causes winds?

   ___________________________________________________________

5. How does the Coriolis effect affect wind movement?

   ___________________________________________________________

6. How are sea and land breezes similar to mountain and valley breezes?

   ___________________________________________________________
7. Would there be winds if the Earth’s surface were the same temperature everywhere? Explain your answer.

---

**MATH SKILLS**

8. Flying an airplane at 500 km/h, an airplane pilot plans to reach her destination in 5 h. But she finds a jet stream moving 250 km/h in the direction she is traveling. If she gets a boost from the jet stream for 2 h, how long will the flight last? Show your work below.

---

**CRITICAL THINKING**

9. **Making Inferences** In the Northern Hemisphere, why do westerlies flow from the west but trade winds flow from the east?

---

10. **Applying Concepts** Imagine you are near an ocean in the daytime. You want to go to the ocean, but you don’t know how to get there. How might a local wind help you find the ocean?
Science - Day 4
Atmospheric Heating Continued

5. Complete the Directed Reading.
   a. May use calculators when needed
   b. Must show work.
   c. Cite where you found your answer.

6. Section Quiz (open book) May also find the quiz on Google Classroom
   a. Please write your answers on the line with capital print letters or you can take the quiz on Google Classroom
   b. Open book
Science - Day 3

Atmospheric Heating

1. Read packet pages 91-93.
   a. Highlight as you go along
   b. Answer the questions along the side of the reading.

2. Answer questions on page 94.
   a. May use calculators when needed
   b. Must show work.
   c. Cite where you found your answer.

3. Complete the Vocabulary and Section Review

4. Complete the Section Review.
   a. May use calculators when needed
   b. Must show work.
   c. Cite where you found your answer.
Section: Atmospheric Heating

Write the letter of the correct answer in the space provided.

1. How much energy radiated by the sun reaches Earth?
   a. about 80%  
   b. about 50%  
   c. about two-billionths  
   d. about one one-hundredth

2. Energy transferred as electromagnetic waves is called
   a. thermal conduction.  
   b. radiation.  
   c. convection.  
   d. convection current.

3. Energy transferred as heat through a material is called
   a. thermal conduction.  
   b. radiation.  
   c. convection.  
   d. convection current.

4. Thermal energy transferred by circulation of a liquid or gas is called
   a. thermal conduction.  
   b. radiation.  
   c. convection.  
   d. convection current.

5. The process by which gases in the atmosphere absorb thermal energy and radiate it back to earth is called
   a. the thermal effect.  
   b. the greenhouse effect.  
   c. global warming.  
   d. radiation balance.

6. When the amount of energy received from the sun and the amount of energy returned to space are about equal, it is called
   a. seasonal equality.  
   b. radiation balance.  
   c. solar reradiation.  
   d. global warming.

7. One reason for global warming may be
   a. decreasing global gases.  
   b. increasing global gases.  
   c. increasing greenhouse gases.  
   d. decreasing greenhouse gases.
Section: Atmospheric Heating

1. How long does it take the sun’s energy to reach the Earth?
   a. about 8 hours  
   b. about 80 hours  
   c. about 8 minutes  
   d. about 8 days

ENERGY IN THE ATMOSPHERE

2. What percentage of the energy radiated by the sun reaches the Earth’s surface?
   a. two-fiftieths  
   b. two-thousandths  
   c. two-millionths  
   d. two-bilionths

3. What percentage of the sun’s energy that reaches the Earth is absorbed by Earth’s surface?
   a. 25%  
   b. 50%  
   c. 20%  
   d. 5%

4. What percentage of the sun’s energy that reaches the Earth is absorbed by ozone, clouds, and atmospheric gases?
   a. 25%  
   b. 50%  
   c. 20%  
   d. 5%

Match the correct description with the correct term. Write the letter in the space provided.

5. transfer of energy as heat through a material  
   a. thermal conduction
   b. radiation
   c. convection current
   d. convection

6. transfer of energy by circulation or movement of a gas

7. circular movement of warm air rising and cool air sinking

8. transfer of energy as electromagnetic waves
9. Explain what process produces the greenhouse effect.

10. The balance between incoming solar energy and outgoing energy radiated into space is called ____________________.

11. A gradual increase in average global temperature is called ____________________.

12. What are greenhouse gases?

13. What human activities may increase the level of greenhouse gases in the atmosphere?
Science - Day 5

Global Winds and Local Winds
   a. Highlight as you go along
   b. Answer the questions along the side of the reading.
2. Answer questions on page 100.
   a. May use calculators when needed
   b. Must show work.
   c. Cite where you found your answer.
3. Complete the Vocabulary and Section Summary.
4. Complete the Section Review.
   a. May use calculators when needed
   b. Must show work.
   c. Cite where you found your answer.
Science - Day 6

Global Winds and Local Winds continued

5. Complete the Directed Reading.
   a. May use calculators when needed
   b. Must show work.
   c. Cite where you found your answer.

6. Section Quiz (open book) May also find the quiz on Google Classroom.
   a. Please write your answers on the line with capital print letters or you can take the quiz on Google Classroom
   b. Open book
What Causes Wind?

Winds are moving air caused by differences in air pressure. Air moves from areas of high pressure to areas of low pressure. The greater the pressure difference, the faster the air moves, and the stronger the wind blows.

You can see how air moves if you blow up a balloon and then let it go. The air inside the balloon is at a higher pressure than the air around the balloon. If you open the end of the balloon, air will rush out.

What Causes Differences in Air Pressure?

Most differences in air pressure are caused by differences in air temperature. Temperature differences happen because some parts of Earth get more energy from the sun than others. For example, the sun shines more directly on the equator than on the poles. As a result, the air is warmer near the equator.

The warm air near the equator is not as dense as the cool air near the poles. Because it is less dense, the air at the equator rises, forming areas of low pressure. The cold air near the poles sinks, forming areas of high pressure. The air moves in large circular patterns called convection cells. The drawing on the next page shows these convection cells.
**SECTION 3  Global Winds and Local Winds continued**

**Convection Cells**

![Diagram of convection cells with high and low pressure areas at 0°, 90°S, 90°N, and Equator]

**What Are the Major Global Wind Systems?**

*Global winds* are large-scale wind systems. There are three pairs of major global wind systems, or wind belts: trade winds, westerlies, and polar easterlies.

**Trade winds** are wind belts that blow from 30° latitude almost to the equator. They curve to the west as they blow toward the equator. **Westerlies** are wind belts that are found between 30° and 60° latitude. The westerlies blow toward the poles from west to east. Most of the United States is located in the belt of westerly winds. These winds can carry moist air over the United States, producing rain and snow.

**Polar easterlies** are wind belts that extend from the poles to 60° latitude. They form as cold, sinking air moves away from the poles. In the Northern Hemisphere, polar easterlies can carry cold arctic air over the United States. This can produce snow and freezing weather.

<table>
<thead>
<tr>
<th>Wind belt</th>
<th>Location (latitude)</th>
<th>Toward the equator or toward the poles?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trade winds</td>
<td>0° to 30°</td>
<td>toward the equator</td>
</tr>
<tr>
<td>Westerlies</td>
<td>30° to 60°</td>
<td></td>
</tr>
<tr>
<td>Polar easterlies</td>
<td>60° to 90°</td>
<td></td>
</tr>
</tbody>
</table>

The figure on the next page shows the locations of these different wind belts. Notice that the winds do not move in straight lines. The paths of the wind belts are controlled by convection cells and by the Earth’s rotation.
Why Do Global Winds Curve?

Remember that pressure differences can cause air to move and form winds. If Earth did not rotate, these winds would blow in straight lines. However, because Earth does rotate, the winds follow curved paths. This deflection, or curving, of moving objects from a straight path because of Earth's rotation is called the Coriolis effect.

As Earth rotates, places near the equator travel faster than places closer to the poles. This difference in speed causes the Coriolis effect. Wind moving from the poles to the equator is deflected to the west. Wind moving from the equator to the poles is deflected east.

The Coriolis effect causes wind and water to move along curved paths.
What Are Jet Streams?

The polar easterlies, prevailing westerlies, and trade winds are all winds that we feel on the ground. However, wind systems can also form at high altitude. Jet streams are narrow belts of very high-speed winds in the upper troposphere and lower stratosphere. They blow from west to east all the way around the Earth.

Jet streams can reach speeds of 400 km/h. Pilots flying east over the United States or the Atlantic Ocean try to catch a jet stream. This wind pushes airplanes along, helping them fly faster and use less fuel. Pilots flying west try to avoid the jet streams.

The global wind systems are always found in about the same place every day. Unlike these global wind systems, jet streams can be in different places on different days. Because jet streams can affect the movements of storms, meteorologists try to track the jet streams. They can sometimes predict the path of a storm if they know where the jet streams are.

TAKE A LOOK

11. Infer Why would a pilot flying across North America take a different route on Tuesday than on Monday?

Jet streams form between hot and cold air masses. Unlike the other wind systems, jet streams are found in slightly different places every day.
What Are Local Winds?

Most of the United States is in the belt of prevailing westerly winds, which move from west to east. However, you've probably noticed that the wind in your neighborhood does not always blow from the west to the east. This is because global winds are not the only winds that blow. Local winds are also important. Local winds are winds that generally move over short distances and can blow from any direction.

Like the other wind systems, local winds are caused by differences in temperature. Many of these temperature differences are caused by geographic features, such as mountains and bodies of water. The figure below shows how water and mountains can affect local winds.

Critical Thinking

12. Compare Describe one difference between global winds and local winds.

Say It

Share Experiences Have you ever been in a very strong wind? In groups of two or three, discuss the strongest or worst wind you've ever been in.

TAKE A LOOK

13. Identify In the figures, label the high-pressure areas with an H and the low-pressure areas with an L.

Mountain Breezes and Valley Breezes

Mountain and valley breezes are other examples of local winds caused by geography. During the day, the sun warms the air on mountain slopes. The warm air rises up the mountain slopes, producing a warm valley breeze. At night, the air on the slopes cools. The cool air moves down the slopes, producing a cool mountain breeze.
SECTION VOCABULARY

<table>
<thead>
<tr>
<th>Coriolis effect</th>
<th>trade winds</th>
</tr>
</thead>
<tbody>
<tr>
<td>the curving of the path of a moving object from an otherwise straight path due to the Earth's rotation</td>
<td>prevailing winds that blow from east to west in both hemispheres</td>
</tr>
<tr>
<td>jet stream</td>
<td>west-to-east prevailing winds that blow from west to east between 30° and 60° latitude in both hemispheres</td>
</tr>
<tr>
<td>polar easterlies</td>
<td>wind that is the movement of air caused by differences in air pressure</td>
</tr>
</tbody>
</table>

1. **Identify** The drawing below shows a convection cell. Put arrows on the cell to show which way the air is moving. Label high pressure areas with an H and low pressure areas with an L. Label cold air with a C and warm air with a W.

![Convection Cell Diagram]

2. **Identify** Which global wind system blows toward the poles between 30° and 60° latitude?

3. **Explain** Why does wind tend to blow down from mountains at night?

4. **Apply Concepts** Would there be winds if Earth's surface were the same temperature everywhere? Explain your answer.
Global Winds and Local Winds

VOCABULARY

In your own words, write a definition of the following terms in the space provided.

1. wind

2. Coriolis effect

3. polar easterlies

4. westerlies

5. trade winds

6. jet stream

SECTION SUMMARY

Read the following section summary.

- Winds blow from areas of high pressure to areas of low pressure.
- Pressure belts are found approximately every 30° of latitude.
- The Coriolis effect causes wind to appear to curve as it moves across the Earth's surface.
- Global winds include the polar easterlies, the westerlies, and the trade winds.
- Local winds include sea and land breezes and mountain and valley breezes.
Global Winds and Local Winds

USING KEY TERMS

1. In your own words, write a definition for each of the following terms: wind, Coriolis effect, jet stream, polar easterlies, westerlies, and trade winds.

2. Why does warm air rise and cold air sink?
   a. because warm air is less dense than cold air
   b. because warm air is denser than cold air
   c. because cold air is less dense than warm air
   d. because warm air has less pressure than cold air does

3. What are pressure belts?

4. What causes winds?

5. How does the Coriolis effect affect wind movement?

6. How are sea and land breezes similar to mountain and valley breezes?
7. Would there be winds if the Earth’s surface were the same temperature everywhere? Explain your answer.

---

**MATH SKILLS**

8. Flying an airplane at 500 km/h, an airplane pilot plans to reach her destination in 5 h. But she finds a jet stream moving 250 km/h in the direction she is traveling. If she gets a boost from the jet stream for 2 h, how long will the flight last? Show your work below.

---

**CRITICAL THINKING**

9. **Making Inferences** In the Northern Hemisphere, why do westerlies flow from the west but trade winds flow from the east?

---

10. **Applying Concepts** Imagine you are near an ocean in the daytime. You want to go to the ocean, but you don’t know how to get there. How might a local wind help you find the ocean?

---
Science - Day 6
Global Winds and Local Winds continued
5. Complete the Directed Reading.
   a. May use calculators when needed
   b. Must show work.
   c. Cite where you found your answer.
6. Section Quiz (open book) May also find the quiz on Google Classroom.
   a. Please write your answers on the line with capital print letters or you can take the quiz on Google Classroom
   b. Open book
Science - Day 5

Global Winds and Local Winds

   a. Highlight as you go along
   b. Answer the questions along the side of the reading.

2. Answer questions on page 100.
   a. May use calculators when needed
   b. Must show work.
   c. Cite where you found your answer.

3. Complete the Vocabulary and Section Summary.

4. Complete the Section Review.
   a. May use calculators when needed
   b. Must show work.
   c. Cite where you found your answer.
Section: Global Winds and Local Winds

WHY AIR MOVES

1. What causes differences in air pressure?
   a. even heating of the Earth
   b. even cooling of the Earth
   c. unequal heating of the Earth
   d. increased heating of the Earth

2. The movement of air caused by differences in air pressure is called
   a. dense air.
   b. wind.
   c. polar air.
   d. vents.

3. Air is warmer and less dense than surrounding air at the equator
   because the equator receives more
   a. wind.
   b. air pressure.
   c. solar energy.
   d. radiation.

4. Because air at the poles is colder and denser than surrounding air, it
   a. rises.
   b. sinks.
   c. circulates.
   d. stagnates.

5. High pressure areas are created around the poles as cold air
   a. rises.
   b. blows.
   c. stagnates.
   d. sinks.

6. After high pressure areas are created around the poles, cold polar air
   flows toward
   a. the equator.
   b. the North Pole.
   c. the South Pole.
   d. the atmosphere.
7. Large, circular patterns of air movement are called _________________.

8. Bands of high pressure and low pressure found every 30° of latitude are called _________________.

9. When the paths of winds and ocean currents seem to curve because of the Earth's rotation, it's called the _________________.

GLOBAL WINDS

Match the correct description with the correct term. Write the letter in the space provided.

10. winds that blow from 30° latitude in both hemispheres almost to the equator
    a. polar easterlies
    b. westerlies
    c. trade winds
    d. doldrums
    e. horse latitudes

11. the area around the equator where trade winds meet

12. wind formed as cold, sinking air moves from the poles to 60° north and 60° south latitude

13. wind belts that extend between 30° and 60° latitude in both hemispheres

14. area in which sinking air creates high pressure and weak winds at about 30° north and 30° south latitude

15. Narrow belts of high speed winds in the upper troposphere and lower stratosphere are called _________________.

LOCAL WINDS

16. Which of the following are local winds?
    a. mountain breezes
    b. convection cells
    c. polar winds
    d. westerlies

17. Explain how geographic features can cause local winds.

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________
Section Quiz

Section: Global Winds and Local Winds

Write the letter of the correct answer in the space provided.

1. What causes wind?
   a. differences in air pressure  
   b. differences in gravity  
   c. differences in oxygen  
   d. differences in the thermosphere

2. What causes differences in air pressure around the Earth?
   a. Warm air rises at the equator, and cold air sinks at the poles.
   b. Warm air sinks at the equator, and cold air rises at the poles.
   c. Warm air rises at the equator, and cold air rises at the poles.
   d. Cold air rises at the equator, and warm air sinks at the poles.

3. Air moves in large, circular patterns called
   a. pressure belts.
   b. convection currents.
   c. convection cells.
   d. trade winds.

4. In the Northern Hemisphere, winds traveling north appear to curve to
   the east because of the
   a. trade winds.
   b. convection currents.
   c. Coriolis effect.
   d. polar easterlies.

5. Global winds that blow from west to east are called
   a. polar easterlies.
   b. westerlies.
   c. mountain breezes.
   d. trade winds.

6. Global winds that blow northeast from 30° north latitude and
   southeast from 30° south latitude are called
   a. northerlies.
   b. trade winds.
   c. polar easterlies.
   d. global easterlies.

7. Narrow belts of winds that can reach 400 km/h are called
   a. jet currents.
   b. jet streams.
   c. convection currents.
   d. convection streams.

8. Local winds are produced by
   a. global winds.
   b. global geographic features.
   c. local farms and ranches.
   d. local geographic features.

9. Mountain and valley breezes are caused by
   a. differences in temperature and elevation.
   b. similarities in temperature and elevation.
   c. the same temperature at all elevations.
   d. high temperatures at all elevations.
Science - Day 7

Chapter Review

1. Do the Chapter Review
   a. May use calculators when needed
   b. Must show work.
   c. Cite where you found your answer.

2. Do the Reinforcement page
Science - Day 8
Chapter Test - You may find it on Google Classroom.

1. Take the Chapter test
   a. Please write your answers on the line with capital print letters or you can take the test on Google Classroom
   b. Open book
USING KEY TERMS
For each pair of terms, explain how the meanings of the terms differ.

1. *air pressure* and *wind*

2. *troposphere* and *thermosphere*

3. *greenhouse effect* and *global warming*

4. *convection* and *thermal conduction*

5. *global wind* and *local wind*

6. *stratosphere* and *mesosphere*

UNDERSTANDING KEY IDEAS
Multiple Choice

7. What is the most abundant gas in the atmosphere?
   a. oxygen
   b. hydrogen
   c. nitrogen
   d. carbon dioxide

8. A major source of oxygen for the Earth's atmosphere is
   a. sea water.
   b. the sun.
   c. plants.
   d. animals.

9. The bottom layer of the atmosphere, where almost all weather occurs, is the
   a. stratosphere.
   b. troposphere.
   c. thermosphere.
   d. mesosphere.

10. What percentage of the solar energy that reaches the outer atmosphere is absorbed at the Earth's surface?
    a. 20%
    b. 30%
    c. 50%
    d. 70%
Chapter Review continued

11. The ozone layer is located in the
   a. stratosphere.
   b. troposphere.
   c. thermosphere.
   d. mesosphere.

12. By which method does most thermal energy in the atmosphere circulate?
   a. conduction
   b. convection
   c. advection
   d. radiation

13. The balance between incoming and outgoing energy is called
   a. the convection balance.
   b. the convection balance.
   c. the greenhouse effect.
   d. the radiation balance.

14. In which wind belt is most of the United States located?
   a. westerlies
   b. northeast trade winds
   c. southeast trade winds
   d. doldrums

15. Which of the following pollutants is NOT a primary pollutant?
   a. car exhaust
   b. acid precipitation
   c. smoke from a factory
   d. fumes from burning plastic

16. The Clean Air Act
   a. controls the amount of air pollutants that can be released from many sources.
   b. requires cars to run on fuels other than gasoline.
   c. requires many industries to use scrubbers.
   d. Both (a) and (c)

Short Answer

17. Why does the atmosphere become less dense as altitude increases?

18. Explain why air rises when it is heated.

19. What is the main cause of temperature changes in the atmosphere?
22. **Identifying Relationships** What is the relationship between the greenhouse effect and global warming?

---

23. **Applying Concepts** How do you think the Coriolis effect would change if the Earth rotated twice as fast as it does? Explain.

---

24. **Making Inferences** The atmosphere of Venus has a very high level of carbon dioxide. How might this fact influence the greenhouse effect on Venus?
20. What are secondary pollutants, and how do they form? Give an example of a secondary pollutant.

21. Concept Mapping Use the following terms to create a concept map:
mesosphere, stratosphere, layers, temperature, troposphere, atmosphere.
INTERPRETING GRAPHICS

Use the diagram below to answer the questions that follow. When answering the questions that follow, assume that ocean currents do not affect the path of the boats.

25. If Boat A traveled to 50°N, from which direction would the prevailing wind blow?

26. If Boat B sailed with the prevailing westerlies in the Northern Hemisphere, in which direction would the boat be traveling?
Earth’s Amazing Atmosphere

Complete this worksheet after you finish reading the section “Characteristics of the Atmosphere.”

The Earth’s atmosphere is divided into four layers. Choose the layer in Column B that best matches the description in Column A, and write your answer in the space provided. Then, use the directions below to label the diagram of the Earth’s atmosphere on the next page.

**Column A**

1. the layer of the Earth’s atmosphere you live in
2. the coldest layer of the Earth’s atmosphere; lies directly below the uppermost layer
3. the uppermost layer of the atmosphere
4. the layer that contains most of the atmosphere’s ozone; above the layer that you live in

**Column B**

a. troposphere
b. stratosphere
c. mesosphere
d. thermosphere

5. Label the four layers of the atmosphere on the diagram on the next page.
6. There is no clear boundary between the uppermost layer of the atmosphere and space. The atmosphere becomes thinner and thinner and blends into space. At the very top of the diagram, write the word **space** with an arrow pointing up.

7. The ozone layer is the upper part of the atmospheric layer that contains most of the atmosphere’s ozone. Use the symbol for ozone to draw in the ozone layer on the diagram.

8. The ozone layer is important because it absorbs ultraviolet radiation. Draw a wavy line coming from space to represent the UV radiation that is absorbed by the ozone layer.

9. Ions are electrically charged particles. When nitrogen and oxygen atoms absorb solar energy in the lower thermosphere, they become ions. This part of the thermosphere is called the ionosphere. Draw the ions in the ionosphere. Remember that the thermosphere is very thin. There are almost no ions near the top of the thermosphere.

10. The troposphere is the densest layer of the atmosphere. It is much denser than the other layers. Shade this layer heavily to indicate how dense it is.

11. The stratosphere is very thin. Shade this lightly.

12. The mesosphere is even less dense than the stratosphere. Shade this layer very lightly.
Reinforcement continued

Key
- Density
- Ozone
- Ions
- UV radiation

Altitude
- 0 km
- 16 km
- 50 km
- 80 km

Earth
Science - Day 8

Chapter Test - You may find it on Google Classroom.

1. Take the Chapter test
   a. Please write your answers on the line with capital print letters or you can take the test on Google Classroom
   b. Open book
Science - Day 7

Chapter Review

1. Do the Chapter Review
   a. May use calculators when needed
   b. Must show work.
   c. Cite where you found your answer.

2. Do the Reinforcement page
The Atmosphere

MULTIPLE CHOICE

Write the letter of the correct answer in the space provided.

1. What is the atmosphere?
   a. oxygen
   b. carbon dioxide
   c. a mixture of gases
   d. water vapor

2. The air we breathe is mostly
   a. oxygen.
   b. carbon dioxide.
   c. ozone.
   d. nitrogen.

3. About how much of Earth's atmosphere is oxygen?
   a. 21%
   b. 78%
   c. 35%
   d. 50%

4. Why is air pressure greatest at the Earth's surface?
   a. because of the pressure of oxygen
   b. because gravity pulls gas molecules toward the surface
   c. because of the weight of ice crystals
   d. because of pollution

5. Air temperature changes as altitude increases because of
   a. gases that absorb solar energy.
   b. gravity's pull on oxygen.
   c. air pollution.
   d. air pressure.

6. The protective ozone layer is found in the
   a. thermosphere.
   b. mesosphere.
   c. troposphere.
   d. stratosphere.
7. Most solar energy that reaches Earth's atmosphere is
   a. absorbed by Earth's surface.
   b. reflected by Earth's surface.
   c. scattered by clouds.
   d. absorbed by clouds, ozone and gases.

8. Radiation is the transfer of energy
   a. as electromagnetic waves.
   b. by circulation of gases.
   c. from atmospheric gases.
   d. as heat through a material.

9. Thermal conduction is the transfer of energy
   a. by the circulation of gases or liquids.
   b. as electromagnetic waves.
   c. as heat through a material.
   d. to the atmosphere.

10. Convection is the transfer of energy
    a. by the circulation of gases or liquids.
    b. as electromagnetic waves.
    c. as heat through a material.
    d. to the atmosphere.

11. Global warming may be caused by
    a. a decrease in greenhouse gases.
    b. an increase in greenhouse gases.
    c. the escape of thermal energy.
    d. the escape of radiation.

12. Wind occurs because of differences in
    a. latitude.
    b. air pressure.
    c. nitrogen levels.
    d. humidity.

13. The winds that blow from 30° latitude in both hemispheres toward the equator are called
    a. westerlies.
    b. polar easterlies.
    c. trade winds.
    d. the doldrums.
14. The winds that blow from 30° to 60° latitude in both hemispheres are called
   a. westerlies.
   b. polar easterlies.
   c. trade winds.
   d. the doldrums.

15. The winds that blow from the poles to 60° latitude in both hemispheres are called
   a. westerlies.
   b. polar easterlies.
   c. trade winds.
   d. the doldrums.

16. What causes local winds?
   a. global winds
   b. trade winds
   c. easterlies
   d. temperature differences

17. Which is an example of a primary pollutant?
   a. ozone
   b. sea salt
   c. acid rain
   d. smog

18. What is the largest source of human-caused air pollution in the United States?
   a. chemical waste
   b. smoke from power plants
   c. vehicle exhaust
   d. ozone

19. What is the greatest problem created by the ozone hole?
   a. It allows more UV rays to reach Earth’s atmosphere.
   b. It allows more UV rays to reach the Earth’s surface.
   c. It allows more UV rays to escape Earth’s atmosphere.
   d. It does not allow enough UV rays to reach Earth’s surface.

20. A vehicle that runs on both electricity and gasoline is called a
    a. catalytic converter
    b. hybrid car.
    c. hydrogen car.
    d. low-emission car.
MATCHING

Match the correct description with the correct term. Write the letter in the space provided.

21. middle layer of the atmosphere, the coldest layer
   a. stratosphere
   b. thermosphere
   c. mesosphere
   d. troposphere

22. layer of the atmosphere where gases do not mix

23. the highest layer of the atmosphere, temperatures can reach 1,000°C

24. layer of the atmosphere closest to Earth's surface
Science - Day 1

Day 1 - Characteristics of the Atmosphere

1. Read packet pages 85-89.
   a. Highlight as you go along - all key, important details
   b. Answer the questions along the side of the reading.

2. Answer questions on page 90.
   a. May use calculators when needed
   b. Must show work.
   c. Cite where you found your answer.

3. Do the Vocabulary and Section Summary

4. Complete the Section Review.
   a. May use calculators when needed
   b. Must show work.
   c. Cite where you found your answer.
Science - Day 2

Characteristics of the Atmosphere continued

5. Complete the Directed Reading.
   a. May use calculators when needed
   b. Must show work.
   c. Cite where you found your answer.

6. Section Quiz (open book) May also find the quiz on Google Classroom
   a. Please write your answers on the line with capital print letters or you can take the quiz on Google Classroom
   b. Open book
What Is Earth’s Atmosphere Made Of?

An atmosphere is a layer of gases that surrounds a planet or moon. On Earth, the atmosphere is often called just “the air.” When you take a breath of air, you are breathing in atmosphere.

The air you breathe is made of many different things. Almost 80% of it is nitrogen gas. The rest is mostly oxygen, the gas we need to live. There is also water in the atmosphere. Some of it is invisible, in the form of a gas called water vapor.

Water is also found in the atmosphere as water droplets and ice crystals, like those that make up clouds. The atmosphere also contains tiny particles, or solid pieces. These particles are things like dust and dirt from continents, salt from oceans, and ash from volcanoes.

Gases in Earth’s Atmosphere

Math Focus
2. Analyze Data About what fraction of the Earth’s atmosphere is NOT made of nitrogen? Give your answer as a reduced fraction.
Where Do the Gases in the Atmosphere Come From?
The gases in Earth's atmosphere come from many different sources. The table below shows some of those sources.

<table>
<thead>
<tr>
<th>Gas</th>
<th>Where the gas comes from</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oxygen</td>
<td>Plants give off oxygen as they grow.</td>
</tr>
<tr>
<td>Nitrogen</td>
<td>Nitrogen is given off when dead plants and animals decay.</td>
</tr>
<tr>
<td>Water vapor</td>
<td>Liquid water evaporates and becomes water vapor. Plants give off water vapor as they grow. Water vapor comes out of the Earth during volcanic eruptions.</td>
</tr>
<tr>
<td>Carbon dioxide</td>
<td>Carbon dioxide comes out of the Earth during volcanic eruptions. When animals breathe, they give off carbon dioxide. Carbon dioxide is given off when we burn things that were once plant or animal material.</td>
</tr>
</tbody>
</table>

Why Does Air Pressure Change with Height?
Air pressure is how much the air above you weighs. It is a measure of how hard air molecules push on a surface. We don't normally notice air pressure, because our bodies are used to it.

As you move up from the ground and out toward space, there are fewer gas molecules pressing down from above. Therefore, the air pressure drops. The higher you go, the lower the air pressure gets.
Why Does Air Temperature Change with Height?
Like air pressure, air temperature changes as you move higher in the atmosphere. Air pressure always gets lower as you move higher, but air temperature can get higher or lower. The air can get hotter or colder.

There are different layers of the atmosphere. Each layer is made of a different combination of gases. Air temperature depends on the gases in the atmosphere. Some gases absorb energy from the sun better than others. When a gas absorbs energy from the sun, the air temperature goes up.

What Are the Layers of the Atmosphere?
There are four main layers of the atmosphere: troposphere, stratosphere, mesosphere, and thermosphere. You cannot actually see these different layers. The divisions between the layers are based on how each layer's temperature changes with height.

6. Compare: How are the changes in air temperature with height different from changes in air pressure with height?

Say It
Make Up a Memory Trick
In groups of two or three, make up a sentence to help you remember the order of the layers of the atmosphere. The words in the sentence should start with T, S, M, and T. For example, "Tacos Sound Mighty Tasty." A sentence like this is called a mnemonic.

7. Identify: At what altitude does the mesosphere end and the thermosphere begin?
THE TROPOSPHERE

The troposphere is the layer of the atmosphere that we live in. It is where most of the water vapor, carbon dioxide, pollution, and living things on Earth exist. Weather conditions such as wind and rain all take place in the troposphere.

The troposphere is also the densest layer of the atmosphere. This is because the troposphere is at the bottom with all the other layers pushing down from above. Almost 90% of the gases in the atmosphere are in the troposphere. As you move higher into the troposphere (say, to the top of a mountain), both air temperature and air pressure decrease.

TAKE A LOOK

9. Analyze What does the map tell you about the air temperature in the troposphere?

Weather happens in the troposphere. A weather map shows what the troposphere is like in different places.

THE STRATOSPHERE

As you go up from the ground, the temperature decreases. At an altitude of about 15 km, however, it starts to increase. This marks the beginning of the stratosphere. Strato means "layer." The gases in the stratosphere are layered. They do not mix as they do in the troposphere.

The main reason the temperature increases in the stratosphere is because of a gas called ozone. Ozone absorbs energy from the sun, making the temperature of the atmosphere increase. The ozone layer is important for life on Earth because it absorbs harmful ultraviolet energy.

THE MESOSPHERE

Above the ozone layer, at an altitude of about 50 km, the temperature begins to drop again. This marks the bottom of the mesosphere. The temperature keeps decreasing all the way up to 80 km. The temperatures in the mesosphere can be as low as −93°C.
THE THERMOSPHERE

The thermosphere is the uppermost layer of the atmosphere. In the thermosphere, temperatures begin to rise again. The thermosphere gets its name from its extremely high temperatures, which can be above 1,000°C. Therm means “heat.” The temperatures in the thermosphere are so high because it contains a lot of oxygen and nitrogen, which absorb energy from the sun.

THE IONOSPHERE—ANOTHER LAYER

The troposphere, stratosphere, mesosphere, and thermosphere are the four main layers of the atmosphere. However, scientists also sometimes study a region called the ionosphere. The ionosphere contains the uppermost part of the mesosphere and the lower part of the thermosphere. It is made of nitrogen and oxygen ions, or electrically charged particles.

The ionosphere is where auroras occur. Auroras are curtains and ribbons of shimmering colored lights. They form when charged particles from the sun collide with the ions in the ionosphere. The ionosphere is important to us because it can reflect radio waves. An AM radio wave can travel all the way around the Earth by bouncing off the ionosphere.

<table>
<thead>
<tr>
<th>Layer</th>
<th>How temperature and pressure change as you move higher</th>
<th>Important features</th>
</tr>
</thead>
<tbody>
<tr>
<td>Troposphere</td>
<td>temperature decreases pressure decreases</td>
<td></td>
</tr>
<tr>
<td>Stratosphere</td>
<td>gases are arranged in layers contains the ozone layer</td>
<td></td>
</tr>
<tr>
<td></td>
<td>has the lowest temperatures</td>
<td></td>
</tr>
<tr>
<td>Thermosphere</td>
<td>temperature increases pressure decreases</td>
<td></td>
</tr>
</tbody>
</table>

TAKE A LOOK

11. Explain Why is the thermosphere called the thermosphere?

12. Identify Use the information from the text to fill in the table.
Section 1 Review

SECTION VOCABULARY

| **air pressure** | the measure of the force with which air molecules push on a surface |
| **atmosphere** | a mixture of gases that surrounds a planet or moon |
| **mesosphere** | the layer of the atmosphere between the stratosphere and the thermosphere and in which temperature decreases as altitude increases |
| **stratosphere** | the layer of the atmosphere that is above the troposphere and in which temperature increases as altitude increases |
| **thermosphere** | the uppermost layer of the atmosphere, in which temperature increases as altitude increases |
| **troposphere** | the lowest layer of the atmosphere, in which temperature decreases at a constant rate as altitude increases |

1. Define Write your own definition for atmosphere.

2. Explain Why does air temperature change as you move up from the Earth's surface?

3. Make a Graph The graph below shows how the temperature changes as you move up through the atmosphere. On the graph, draw a curve showing how the pressure changes.

4. Identify Relationships How does the sun affect air temperatures?
Characteristics of the Atmosphere

VOCABULARY

In your own words, write a definition of the following terms in the space provided.

1. atmosphere

2. air pressure

3. troposphere

4. stratosphere

5. mesosphere

6. thermosphere
SECTION SUMMARY

Read the following section summary.

- Nitrogen and oxygen make up most of Earth's atmosphere.
- Air pressure decreases as altitude increases.
- The composition of atmospheric layers affects their temperature.
- The troposphere is the lowest atmospheric layer. It is the layer in which we live.
- The stratosphere contains the ozone layer, which protects us from harmful UV radiation.
- The mesosphere is the coldest atmospheric layer.
- The thermosphere is the uppermost layer of the atmosphere.
Characteristics of the Atmosphere
USING KEY TERMS

1. Use each of the following terms in a separate sentence: air pressure, atmosphere, troposphere, stratosphere, mesosphere, and thermosphere.

UNDERSTANDING KEY IDEAS

2. Why does the temperature of different layers of the atmosphere vary?
   a. because air temperature increases as altitude increases
   b. because the amount of energy radiated from the sun varies
   c. because of interference by humans
   d. because of the composition of gases in each layer

3. Why does air pressure decrease as altitude increases?

4. How can the thermosphere have high temperatures but not feel hot?

5. What determines the temperature of atmospheric layers?

6. What two gases make up most of the atmosphere?
MATH SKILLS
7. If an average cloud has a density of 0.5 g/m³ and has a volume of 1,000,000,000 m³, what is the weight of an average cloud? Show your work below.

CRITICAL THINKING
8. Applying Concepts Apply what you know about about the relationship between altitude and air pressure to explain why rescue helicopters have a difficult time flying at altitudes over 6,000 m.

9. Making Inferences If the upper atmosphere is very thin, why do space vehicles heat up as they enter the atmosphere?

10. Making Inferences Explain why gases such as helium can escape Earth's atmosphere.
Science - Day 2

Characteristics of the Atmosphere continued

5. Complete the Directed Reading.
   a. May use calculators when needed
   b. Must show work.
   c. Cite where you found your answer.

6. Section Quiz (open book) May also find the quiz on Google Classroom
   a. Please write your answers on the line with capital print letters or you can take the quiz on Google Classroom
   b. Open book
Science - Day 1

Day 1 - Characteristics of the Atmosphere

1. Read packet pages 85-89.
   a. Highlight as you go along - all key, important details
   b. Answer the questions along the side of the reading.

2. Answer questions on page 90.
   a. May use calculators when needed
   b. Must show work.
   c. Cite where you found your answer.

3. Do the Vocabulary and Section Summary

4. Complete the Section Review.
   a. May use calculators when needed
   b. Must show work.
   c. Cite where you found your answer.
Section: Characteristics of the Atmosphere
Circle the letter of the best answer for each question.

1. What is the atmosphere that surrounds the Earth made of?
   a. oxygen
   b. a mixture of particles
   c. a mixture of gases
   d. water vapor

THE COMPOSITION OF THE ATMOSPHERE

2. What gas is most of the atmosphere made of?
   a. oxygen
   b. nitrogen
   c. carbon dioxide
   d. argon

3. How much of the atmosphere is oxygen?
   a. about 1%
   b. about 78%
   c. about 20%
   d. about 100%

4. Where is most of the water in the atmosphere?
   a. in rain
   b. in ice
   c. in water vapor
   d. in carbon dioxide
ATMOSPHERIC PRESSURE AND TEMPERATURE

Circle the letter of the best answer for each question.

5. At sea level, a square inch of the Earth is under how much air?
   a. 150 lbs
   b. 15 lbs
   c. 30 lbs
   d. 1500 lbs

As Altitude Increases, Air Pressure Decreases

6. What pulls the gas molecules in the atmosphere down to the Earth?
   a. air pressure
   b. gravity
   c. water
   d. solar energy

7. What measures the force that air molecules use to push on a surface?
   a. Earth’s surface
   b. altitude
   c. water vapor
   d. air pressure

8. Where is air pressure strongest?
   a. on top of a mountain
   b. on the Earth’s surface
   c. in outer space
   d. close to the sun
Atmospheric Composition Affects Air Temperature

Circle the letter of the best answer for each question.

9. Warmer parts of the atmosphere have more of these than cold parts.
   a. gases that make heat
   b. gases that absorb water
   c. gases that absorb cold
   d. gases that absorb solar energy

LAYERS OF THE ATMOSPHERE

The Troposphere: The Layer in Which We Live

Read the description. Then, draw a line from the dot next to each description to the matching word.

10. coldest layer of the atmosphere ●
    a. troposphere

11. atmosphere layer with the ozone layer ●
    b. mesosphere

12. atmosphere layer closest to Earth ●
    c. stratosphere

13. top layer of the atmosphere ●
    d. thermosphere

The Ionosphere: Home of the Auroras

Circle the letter of the best answer for the question.

14. Where is the ionosphere?
    a. in the troposphere
    b. in the thermosphere
    c. on the tops of mountains
    d. at the bottom of the ocean
Section Quiz

Section: Characteristics of the Atmosphere
Write the letter of the correct answer in the space provided.

1. Which answer best describes Earth's atmosphere?
   a. mostly oxygen with about 21% nitrogen
   b. mostly nitrogen with about 21% oxygen
   c. mostly carbon dioxide with about 21% oxygen
   d. mostly nitrogen with about 21% carbon dioxide

2. What causes differences in air temperatures at different altitudes?
   a. mainly the way air radiates solar energy
   b. mainly the way gases radiate light
   c. mainly the way gases absorb solar energy
   d. mainly the way moisture moves through the atmosphere

3. What are the two highest layers of the atmosphere?
   a. troposphere, mesosphere
   b. thermosphere, mesosphere
   c. stratosphere, thermosphere
   d. troposphere, stratosphere

4. Auroras are caused by electrically charged particles in the
   a. mesosphere.
   b. troposphere.
   c. hemisphere.
   d. ionosphere.

Match the correct definition with the correct term. Write the letter in the space provided.

5. layered gases, thin air, little moisture
   a. troposphere
   b. thermosphere
   c. stratosphere
   d. mesosphere

6. coldest layer, temperature decreases as altitude increases
   a. troposphere
   b. thermosphere
   c. stratosphere
   d. mesosphere

7. lack of particle density, little thermal energy transfer
   a. or b.

8. densest layer, contains almost 90% of the atmosphere's mass
   a. or b.
Science - Day 3

Atmospheric Heating

1. Read packet pages 91-93.
   a. Highlight as you go along
   b. Answer the questions along the side of the reading.

2. Answer questions on page 94.
   a. May use calculators when needed
   b. Must show work.
   c. Cite where you found your answer.

3. Complete the Vocabulary and Section Review

4. Complete the Section Review.
   a. May use calculators when needed
   b. Must show work.
   c. Cite where you found your answer.
Science - Day 4

Atmospheric Heating Continued

5. Complete the Directed Reading.
   a. May use calculators when needed
   b. Must show work.
   c. Cite where you found your answer.

6. Section Quiz (open book) May also find the quiz on Google Classroom
   a. Please write your answers on the line with capital print letters or you can take the quiz on Google Classroom
   b. Open book
CHES1RE 5 The Atmosphere
SECTION 2 Atmospheric Heating

BEFORE YOU READ
After you read this section, you should be able to answer these questions:
- How does energy travel from the sun to Earth?
- What are the differences between radiation, conduction, and convection?
- Why is Earth's atmosphere so warm?

How Does Energy Travel from the Sun to Earth?
Most of the heat energy on Earth's surface comes from the sun. Energy travels from the sun to Earth by radiation, which means that it travels through space as waves. As solar energy (energy from the sun) is absorbed by air, water, and land, it turns into heat energy. This energy causes winds, the water cycle, ocean currents, and changes in the weather.

What Happens to Radiation from the Sun?
Not all of the radiation from the sun reaches Earth's surface. Much of it gets absorbed by the atmosphere. Some of it is scattered and reflected by clouds and gases.

About 20% is absorbed by ozone, clouds, and atmospheric gases.
About 25% is scattered and reflected by clouds and air.
About 50% is absorbed by Earth's surface.
About 5% is reflected by Earth's surface.

STUDY TIP
Outline In your notebook, write an outline of this chapter. Use the questions in bold to make your outline. As you read, fill in information about each question.

TAKE A LOOK
1. Identify How much of the sunlight that gets to Earth is absorbed by Earth's surface?

2. Summarize What happens to the sunlight that is not absorbed by Earth's surface?
How Is Heat Transferred by Contact?

Once sunlight is absorbed by Earth's surface, it is converted, or changed, into heat energy. Then, the heat can be transferred to other objects and moved to other places. When a warm object touches a cold object, heat moves from the warm object to the cold one. This movement of heat is called **thermal conduction**.

When you touch the sidewalk on a hot, sunny day, heat energy is conducted from the sidewalk to you. The same thing happens to air molecules in the atmosphere. When they touch the warm ground, the air molecules heat up.

How Is Heat Energy Transferred by Motion?

If you have ever watched a pot of water boil, you have seen convection. During **convection**, warm material, such as air or water, carries heat from one place to another.

When you turn on the stove under a pot of water, the water closest to the pot heats up. As the water heats up, its density decreases. The warm water near the pot is not as dense as the cool water near the air. Therefore, the cool water sinks while the warm water rises.

As it rises, the warm water begins to cool. When it cools, its density increases. It becomes denser than the layer below, so it sinks back to the bottom of the pot. This forms a circular movement called a **convection current**.

Convection currents also move heat through the atmosphere. In fact, most heat energy in the atmosphere is transferred by convection. Air close to the ground is heated by conduction from the ground. It becomes less dense than the cooler air above it. The warmer air rises while the cooler air sinks. The ground warms up the cooler air by conduction, and the warm air rises again.

**Convection Current**

![Diagram of convection current]

Warm air cools down. Cool air warms up.

Cooler, denser air sinks. Warm, less dense air rises.

---

**TAKE A LOOK**

5. **Describe** What happens to warm air as it moves through the atmosphere?
How Does the Earth Stay Warm?

A gardener who needs to keep plants warm uses a glass building called a greenhouse. Light travels through the glass into the building, and the air and plants inside absorb the energy. The energy is converted to heat, which cannot travel back through the glass as easily as light came in. Much of the heat energy stays trapped within the greenhouse, keeping the air inside warmer than the air outside.

Earth's atmosphere acts like the glass walls of a greenhouse. Sunlight travels through the atmosphere easily, but heat does not. Gases in the atmosphere, such as water vapor and carbon dioxide, absorb heat energy coming from Earth. Then, they radiate it back to Earth's surface. This is known as the greenhouse effect.

The Greenhouse Effect

1. Light energy from the sun passes through the atmosphere and is absorbed by clouds and by Earth's surface.

2. Clouds and Earth's surface radiate the energy back out as heat energy.

3. Heat energy warms Earth's atmosphere.

What Is Global Warming?

Many scientists are worried that Earth has been getting warmer over the past hundred years. This increase in temperatures all over the world is called global warming.

Scientists think that human activities may be causing global warming. When we burn fossil fuels, we release greenhouse gases, such as carbon dioxide, into the atmosphere. Because greenhouse gases trap heat in the atmosphere, adding more of them can make Earth even warmer. Global warming can have a strong effect on weather and climate.
Section 2 Review

SECTION VOCABULARY

| Convection | The transfer of thermal energy by the circulation or movement of a liquid or gas |
| Global warming | A gradual increase in average global temperature |
| Greenhouse effect | The warming of the surface and lower atmosphere of Earth that occurs when water vapor, carbon dioxide, and other gases absorb and reradiate thermal energy |
| Radiation | The transfer of energy as electromagnetic waves |
| Thermal conduction | The transfer of energy as heat through a material |

1. Apply Concepts: A person is camping outside. The person toasts a marshmallow by holding it above the flames of the fire. Does the marshmallow cook because of convection, conduction, or radiation? Explain your answer.

2. Compare: Fill in the table below to name and describe the three ways energy is transferred in Earth’s atmosphere.

<table>
<thead>
<tr>
<th>Type of energy transfer</th>
<th>How energy is transferred</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Energy travels as electromagnetic waves.</td>
</tr>
<tr>
<td>Conduction</td>
<td></td>
</tr>
</tbody>
</table>

3. Explain: How does most of the heat in Earth’s atmosphere move from place to place?

4. Identify Relationships: Explain how global warming and the greenhouse effect are related.
Vocabulary and Section Summary

Atmospheric Heating

VOCABULARY

In your own words, write a definition of the following terms in the space provided.

1. radiation

2. thermal conduction

3. convection

4. greenhouse effect

5. global warming

SECTION SUMMARY

Read the following section summary.

- Energy from the sun is transferred through the atmosphere by radiation, thermal conduction, and convection.
- Radiation is energy transfer by electromagnetic waves. Thermal conduction is energy transfer by direct contact. Convection is energy transfer by circulation.
- The greenhouse effect is Earth's natural heating process. Increasing levels of greenhouse gases could cause global warming.
Atmospheric Heating

USING KEY TERMS

1. Use each of the following terms in a separate sentence: thermal conduction, radiation, convection, greenhouse effect, and global warming.

UNDERSTANDING KEY IDEAS

2. Which of the following is the best example of conduction?
   a. a light bulb warming a lampshade
   b. an egg cooking in a frying pan
   c. water boiling in a pot
   d. gases circulating in the atmosphere

3. Describe three ways that energy is transferred in the atmosphere.

4. What is the difference between the greenhouse effect and global warming?

5. What is the radiation balance?
MATH SKILLS

6. Find the average of the following temperatures: 73.2°F, 71.1°F, 54.6°F, 65.5°F, 78.2°F, 81.9°F, and 82.1°F. Show your work below.

CRITICAL THINKING

7. Identifying Relationships How does the process of convection rely on radiation?

Science - Day 4
Atmospheric Heating Continued
5. Complete the Directed Reading.
   a. May use calculators when needed
   b. Must show work.
   c. Cite where you found your answer.
6. Section Quiz (open book) May also find the quiz on Google Classroom
   a. Please write your answers on the line with capital print letters or you can take the quiz on Google Classroom
   b. Open book
Science - Day 3

Atmospheric Heating

1. Read packet pages 91-93.
   a. Highlight as you go along
   b. Answer the questions along the side of the reading.

2. Answer questions on page 94.
   a. May use calculators when needed
   b. Must show work.
   c. Cite where you found your answer.

3. Complete the Vocabulary and Section Review

4. Complete the Section Review.
   a. May use calculators when needed
   b. Must show work.
   c. Cite where you found your answer.
Section: Atmospheric Heating
Circle the letter of the best answer for the question.

1. How long does it take the sun’s energy to reach the Earth?
   a. about 8 hours
   b. about 80 hours
   c. about 8 minutes
   d. about 8 days

ENERGY IN THE ATMOSPHERE
Radiation: Energy Transfer by Waves
Read the description. Then, draw a line from the dot next to each description to the matching word.

2. transfer of energy through a material
   ●
   a. radiation

3. transfer of energy by movement of liquid or gas
   ●
   b. convection

4. transfer of energy as electromagnetic waves
   ●
   c. thermal conduction

The Greenhouse Effect and Life on Earth

5. when atmospheric gases absorb and reradiate thermal energy
   ●
   a. greenhouse effect
   b. global warming

6. when temperatures around the Earth rise little by little
   ●
Section: Atmospheric Heating
Circle the letter of the best answer for the question.

1. How long does it take the sun’s energy to reach the Earth?
   a. about 8 hours
   b. about 80 hours
   c. about 8 minutes
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ENERGY IN THE ATMOSPHERE
Radiation: Energy Transfer by Waves
Read the description. Then, draw a line from the dot next to each description to the matching word.

2. transfer of energy through a material
   ○ a. radiation
3. transfer of energy by movement of liquid or gas
   ○ b. convection
4. transfer of energy as electromagnetic waves
   ○ c. thermal conduction

The Greenhouse Effect and Life on Earth

5. when atmospheric gases absorb and reradiate thermal energy
   ○ a. greenhouse effect
6. when temperatures around the Earth rise little by little
   ○ b. global warming
Section: Atmospheric Heating

Write the letter of the correct answer in the space provided.

1. How much energy radiated by the sun reaches Earth?
   a. about 80%
   b. about 50%
   c. about two-billionths
   d. about one one-hundredth

2. Energy transferred as electromagnetic waves is called
   a. thermal conduction.
   b. radiation.
   c. convection.
   d. convection current.

3. Energy transferred as heat through a material is called
   a. thermal conduction.
   b. radiation.
   c. convection.
   d. convection current.

4. Thermal energy transferred by circulation of a liquid or gas is called
   a. thermal conduction.
   b. radiation.
   c. convection.
   d. convection current.

5. The process by which gases in the atmosphere absorb thermal energy and radiate it back to earth is called
   a. the thermal effect.
   b. the greenhouse effect.
   c. global warming.
   d. radiation balance.

6. When the amount of energy received from the sun and the amount of energy returned to space are about equal, it is called
   a. seasonal equality.
   b. radiation balance.
   c. solar reradiation.
   d. global warming.

7. One reason for global warming may be
   a. decreasing global gases.
   b. increasing global gases.
   c. increasing greenhouse gases.
   d. decreasing greenhouse gases.
Science - Day 5

Global Winds and Local Winds

   a. Highlight as you go along
   b. Answer the questions along the side of the reading.

2. Answer questions on page 100.
   a. May use calculators when needed
   b. Must show work.
   c. Cite where you found your answer.

3. Complete the Vocabulary and Section Summary.

4. Complete the Section Review.
   a. May use calculators when needed
   b. Must show work.
   c. Cite where you found your answer.
Science - Day 6

Global Winds and Local Winds continued

5. Complete the Directed Reading.
   a. May use calculators when needed
   b. Must show work.
   c. Cite where you found your answer.

6. Section Quiz (open book) May also find the quiz on Google Classroom.
   a. Please write your answers on the line with capital print letters or you can take the quiz on Google Classroom
   b. Open book
BEFORE YOU READ

After you read this section, you should be able to answer these questions:

• What causes wind?
• What is the Coriolis effect?
• What are the major global wind systems on Earth?

What Causes Wind?

Wind moving air caused by differences in air pressure. Air moves from areas of high pressure to areas of low pressure. The greater the pressure difference, the faster the air moves, and the stronger the wind blows.

You can see how air moves if you blow up a balloon and then let it go. The air inside the balloon is at a higher pressure than the air around the balloon. If you open the end of the balloon, air will rush out.

What Causes Differences in Air Pressure?

Most differences in air pressure are caused by differences in air temperature. Temperature differences happen because some parts of Earth get more energy from the sun than others. For example, the sun shines more directly on the equator than on the poles. As a result, the air is warmer near the equator.

The warm air near the equator is not as dense as the cool air near the poles. Because it is less dense, the air at the equator rises, forming areas of low pressure. The cold air near the poles sinks, forming areas of high pressure. The air moves in large circular patterns called convection cells. The drawing on the next page shows these convection cells.
What Are the Major Global Wind Systems?

Global winds are large-scale wind systems. There are three pairs of major global wind systems, or wind belts: trade winds, westerlies, and polar easterlies.

Trade winds are wind belts that blow from 30° latitude almost to the equator. They curve to the west as they blow toward the equator. Westerlies are wind belts that are found between 30° and 60° latitude. The westerlies blow toward the poles from west to east. Most of the United States is located in the belt of westerly winds. These winds can carry moist air over the United States, producing rain and snow.

Polar easterlies are wind belts that extend from the poles to 60° latitude. They form as cold, sinking air moves away from the poles. In the Northern Hemisphere, polar easterlies can carry cold arctic air over the United States. This can produce snow and freezing weather.

<table>
<thead>
<tr>
<th>Wind belt</th>
<th>Location (latitude)</th>
<th>Toward the equator or toward the poles?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trade winds</td>
<td>0° to 30°</td>
<td>toward the equator</td>
</tr>
<tr>
<td>Westerlies</td>
<td>30° to 60°</td>
<td></td>
</tr>
<tr>
<td></td>
<td>60° to 90°</td>
<td></td>
</tr>
</tbody>
</table>
Why Do Global Winds Curve?

Remember that pressure differences can cause air to move and form winds. If Earth did not rotate, these winds would blow in straight lines. However, because Earth does rotate, the winds follow curved paths. This deflection, or curving, of moving objects from a straight path because of Earth’s rotation is called the Coriolis effect.

As Earth rotates, places near the equator travel faster than places closer to the poles. This difference in speed causes the Coriolis effect. Wind moving from the poles to the equator is deflected to the west. Wind moving from the equator to the poles is deflected east.
What Are Jet Streams?

The polar easterlies, prevailing westerlies, and trade winds are all winds that we feel on the ground. However, wind systems can also form at high altitude. **Jet streams** are narrow belts of very high-speed winds in the upper troposphere and lower stratosphere. They blow from west to east all the way around the Earth.

Jet streams can reach speeds of 400 km/h. Pilots flying east over the United States or the Atlantic Ocean try to catch a jet stream. This wind pushes airplanes along, helping them fly faster and use less fuel. Pilots flying west try to avoid the jet streams.

The global wind systems are always found in about the same place every day. Unlike these global wind systems, jet streams can be in different places on different days. Because jet streams can affect the movements of storms, meteorologists try to track the jet streams. They can sometimes predict the path of a storm if they know where the jet streams are.

---

**TAKE A LOOK**

11. **Infer** Why would a pilot flying across North America take a different route on Tuesday than on Monday?

---

Jet streams form between hot and cold air masses. Unlike the other wind systems, jet streams are found in slightly different places every day.
What Are Local Winds?
Most of the United States is in the belt of prevailing westerly winds, which move from west to east. However, you've probably noticed that the wind in your neighborhood does not always blow from the west to the east. This is because global winds are not the only winds that blow. Local winds are also important. Local winds are winds that generally move over short distances and can blow from any direction.

Like the other wind systems, local winds are caused by differences in temperature. Many of these temperature differences are caused by geographic features, such as mountains and bodies of water. The figure below shows how water and mountains can affect local winds.

**Critical Thinking**
12. Compare Describe one difference between global winds and local winds.

---

**Say It**
Share Experiences Have you ever been in a very strong wind? In groups of two or three, discuss the strongest or worst wind you've ever been in.

---

**TAKE A LOOK**
13. Identify In the figures, label the high-pressure areas with an H and the low-pressure areas with an L.

---

**MOUNTAIN BREEZES AND VALLEY BREEZES**
Mountain and valley breezes are other examples of local winds caused by geography. During the day, the sun warms the air on mountain slopes. The warm air rises up the mountain slopes, producing a warm valley breeze. At night, the air on the slopes cools. The cool air moves down the slopes, producing a cool mountain breeze.
Section 3 Review

SECTION VOCABULARY

- Coriolis effect: the curving of the path of a moving object from an otherwise straight path due to the Earth's rotation
- Jet stream: a narrow band of strong winds that blow in the upper troposphere
- Polar easterlies: prevailing winds that blow from east to west between 60° and 90° latitude in both hemispheres
- Trade winds: prevailing winds that blow from east to west from 30° latitude to the equator in both hemispheres
- Westerlies: prevailing winds that blow from west to east between 30° and 60° latitude in both hemispheres
- Wind: the movement of air caused by differences in air pressure

1. Identify The drawing below shows a convection cell. Put arrows on the cell to show which way the air is moving. Label high pressure areas with an H and low pressure areas with an L. Label cold air with a C and warm air with a W.

   ![Convection Cell Diagram]

2. Identify Which global wind system blows toward the poles between 30° and 60° latitude?

3. Explain Why does wind tend to blow down from mountains at night?

4. Apply Concepts Would there be winds if Earth's surface were the same temperature everywhere? Explain your answer.
Global Winds and Local Winds

**VOCABULARY**

In your own words, write a definition of the following terms in the space provided.

1. wind

2. Coriolis effect

3. polar easterlies

4. westerlies

5. trade winds

6. jet stream

**SECTION SUMMARY**

Read the following section summary.

- Winds blow from areas of high pressure to areas of low pressure.
- Pressure belts are found approximately every 30° of latitude.
- The Coriolis effect causes wind to appear to curve as it moves across the Earth's surface.
- Global winds include the polar easterlies, the westerlies, and the trade winds.
- Local winds include sea and land breezes and mountain and valley breezes.
Global Winds and Local Winds

**USING KEY TERMS**

1. In your own words, write a definition for each of the following terms: wind, Coriolis effect, jet stream, polar easterlies, westerlies, and trade winds.

**UNDERSTANDING KEY IDEAS**

2. Why does warm air rise and cold air sink?
   - a. because warm air is less dense than cold air
   - b. because warm air is denser than cold air
   - c. because cold air is less dense than warm air
   - d. because warm air has less pressure than cold air does

3. What are pressure belts?

4. What causes winds?

5. How does the Coriolis effect affect wind movement?

6. How are sea and land breezes similar to mountain and valley breezes?
7. Would there be winds if the Earth’s surface were the same temperature everywhere? Explain your answer.

MATH SKILLS
8. Flying an airplane at 500 km/h, an airplane pilot plans to reach her destination in 5 h. But she finds a jet stream moving 250 km/h in the direction she is traveling. If she gets a boost from the jet stream for 2 h, how long will the flight last? Show your work below.

CRITICAL THINKING
9. Making Inferences  In the Northern Hemisphere, why do westerlies flow from the west but trade winds flow from the east?

10. Applying Concepts  Imagine you are near an ocean in the daytime. You want to go to the ocean, but you don’t know how to get there. How might a local wind help you find the ocean?
Science - Day 6

Global Winds and Local Winds continued

5. Complete the Directed Reading.
   a. May use calculators when needed
   b. Must show work.
   c. Cite where you found your answer.

6. Section Quiz (open book) May also find the quiz on Google Classroom.
   a. Please write your answers on the line with capital print letters or you can take the quiz on Google Classroom
   b. Open book
Science - Day 5

Global Winds and Local Winds
   a. Highlight as you go along
   b. Answer the questions along the side of the reading.
2. Answer questions on page 100.
   a. May use calculators when needed
   b. Must show work.
   c. Cite where you found your answer.
3. Complete the Vocabulary and Section Summary.
4. Complete the Section Review.
   a. May use calculators when needed
   b. Must show work.
   c. Cite where you found your answer.
Section: Global Winds and Local Winds
WHY AIR MOVES

Circle the letter of the best answer for each question.

1. What causes wind?
   - a. differences in water
   - b. differences in gases
   - c. differences in air pressure
   - d. differences in oxygen

Air Rises at the Equator and Sinks at the Poles

2. What causes differences in air pressure?
   - a. unequal heating of the Earth
   - b. unequal oxygen on the Earth
   - c. equal heating of the Earth
   - d. equal temperature of the Earth

Pressure Belts Are Found Every 30°

3. What are the large, circular patterns air travels in called?
   - a. pressure belts
   - b. pressure cells
   - c. convection belts
   - d. convection cells

The Coriolis Effect

4. What is the Coriolis effect?
   - a. apparent curving of wind and ocean currents
   - b. force of air on Earth’s surface
   - c. transfer of thermal energy
   - d. balance of incoming and outgoing energy
GLOBAL WINDS
Polar Easterlies

Read the words in the box. Read the sentences. Fill in each blank with the word or phrase that best completes the sentence.

<table>
<thead>
<tr>
<th>horse latitudes</th>
<th>trade winds</th>
<th>doldrums</th>
</tr>
</thead>
<tbody>
<tr>
<td>polar easterlies</td>
<td>westerlies</td>
<td></td>
</tr>
</tbody>
</table>

5. Winds that blow from 30° latitude to the equator are ____________________________.

6. The area around the equator without much wind is called the ____________________________.

7. Belts of wind from the poles to 60° latitude are called ____________________________.

8. Winds that blow to the poles from west to east are ____________________________.

9. Areas of weak winds at about 30° latitude are called ____________________________.

Jet Streams: Atmospheric Conveyor Belts

Circle the letter of the best answer for the question.

10. What are the jet streams?
   a. a polar wind system
   b. a highway for jets
   c. curving paths of winds
   d. narrow belts of high-speed winds
LOCAL WINDS

Circle the letter of the best answer for each question.

11. What is most likely to cause local winds?
   a. a shoreline or mountain
   b. convection cells
   c. polar winds
   d. westerlies

Mountain Breezes and Valley Breezes

12. What are mountain breezes and valley breezes?
   a. curving winds
   b. global winds
   c. local winds
   d. jet streams
Section: Global Winds and Local Winds

Write the letter of the correct answer in the space provided.

1. What causes wind?
   a. differences in air pressure  
   b. differences in gravity  
   c. differences in oxygen  
   d. differences in the thermosphere

2. What causes differences in air pressure around the Earth?
   a. Warm air rises at the equator, and cold air sinks at the poles.  
   b. Warm air sinks at the equator, and cold air rises at the poles.  
   c. Warm air rises at the equator, and cold air rises at the poles.  
   d. Cold air rises at the equator, and warm air sinks at the poles.

3. Air moves in large, circular patterns called
   a. pressure belts.  
   b. convection currents.  
   c. convection cells.  
   d. trade winds.

4. In the Northern Hemisphere, winds traveling north appear to curve to the east because of the
   a. trade winds.  
   b. convection currents.  
   c. Coriolis effect.  
   d. polar easterlies.

5. Global winds that blow from west to east are called
   a. polar easterlies.  
   b. westerlies.  
   c. mountain breezes.  
   d. trade winds.

6. Global winds that blow northeast from 30° north latitude and southeast from 30° south latitude are called
   a. northerlies.  
   b. trade winds.  
   c. polar easterlies.  
   d. global easterlies.

7. Narrow belts of winds that can reach 400 km/h are called
   a. jet currents.  
   b. jet streams.  
   c. convection currents.  
   d. convection streams.

8. Local winds are produced by
   a. global winds.  
   b. global geographic features.  
   c. local farms and ranches.  
   d. local geographic features.

9. Mountain and valley breezes are caused by
   a. differences in temperature and elevation.  
   b. similarities in temperature and elevation.  
   c. the same temperature at all elevations.  
   d. high temperature at all elevations.
Science - Day 7

Chapter Review
1. Do the Chapter Review
   a. May use calculators when needed
   b. Must show work.
   c. Cite where you found your answer.
2. Do the Reinforcement page
Science - Day 8
Chapter Test - You may find it on Google Classroom.

1. Take the Chapter test
   a. Please write your answers on the line with capital print letters or you can take the test on Google Classroom
   b. Open book
USING KEY TERMS
For each pair of terms, explain how the meanings of the terms differ.

1. air pressure and wind

2. troposphere and thermosphere

3. greenhouse effect and global warming

4. convection and thermal conduction

5. global wind and local wind

6. stratosphere and mesosphere

UNDERSTANDING KEY IDEAS
Multiple Choice

7. What is the most abundant gas in the atmosphere?
   a. oxygen  c. nitrogen
   b. hydrogen  d. carbon dioxide

8. A major source of oxygen for the Earth’s atmosphere is
   a. sea water  c. plants.
   b. the sun  d. animals.

9. The bottom layer of the atmosphere, where almost all weather occurs, is the
   a. stratosphere.
   b. troposphere.
   c. thermosphere.
   d. mesosphere.

10. What percentage of the solar energy that reaches the outer atmosphere is absorbed at the Earth’s surface?
    a. 60%  c. 50%
    b. 50%  d. 70%
11. The ozone layer is located in the  
   a. stratosphere.  
   b. troposphere.  
   c. thermosphere  
   d. mesosphere.

12. By which method does most thermal energy in the atmosphere circulate?  
   a. conduction  
   b. convection  
   c. advection  
   d. radiation.

13. The balance between incoming and outgoing energy is called  
   a. the convection balance  
   b. the conduction balance  
   c. the greenhouse effect.  
   d. the radiation balance.

14. In which wind belt is most of the United States located?  
   a. westerlies  
   b. northeast trade winds  
   c. southeast trade winds  
   d. doldrums.

15. Which of the following pollutants is NOT a primary pollutant?  
   a. car exhaust  
   b. acid precipitation  
   c. smoke from burning coal  
   d. fumes from burning plastic.

16. The Clean Air Act  
   a. controls the amount of air pollutants that can be released from many sources.  
   b. requires cars to run on fuels other than gasoline.  
   c. requires many industries to use scrubbers.  
   d. Both (a) and (c).

17. Why does the atmosphere become less dense as altitude increases?

18. Explain why air rises when it is heated.

19. What is the main cause of temperature changes in the atmosphere?
20. What are secondary pollutants, and how do they form? Give an example of a secondary pollutant.

CRITICAL THINKING
21. Concept Mapping Use the following terms to create a concept map: mesosphere, stratosphere, layers, temperature, troposphere, atmosphere.
22. **Identifying Relationships** What is the relationship between the greenhouse effect and global warming?

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

23. **Applying Concepts** How do you think the Coriolis effect would change if the Earth rotated twice as fast as it does? Explain.

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

24. **Making Inferences** The atmosphere of Venus has a very high level of carbon dioxide. How might this fact influence the greenhouse effect on Venus?

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
INTERPRETING GRAPHICS

Use the diagram below to answer the questions that follow. When answering the questions that follow, assume that ocean currents do not affect the path of the boats.

25. If Boat A traveled to 50°N, from which direction would the prevailing wind blow?

26. If Boat B sailed with the prevailing westerlies in the Northern Hemisphere, in which direction would the boat be traveling?

Look at the Global Winds and Local Winds section
Earth’s Amazing Atmosphere

Complete this worksheet after you finish reading the section “Characteristics of the Atmosphere.”

The Earth’s atmosphere is divided into four layers. Choose the layer in Column B that best matches the description in Column A, and write your answer in the space provided. Then, use the directions below to label the diagram of the Earth’s atmosphere on the next page.

### Column A

1. the layer of the Earth’s atmosphere you live in
2. the coldest layer of the Earth’s atmosphere; lies directly below the uppermost layer
3. the uppermost layer of the atmosphere
4. the layer that contains most of the atmosphere’s ozone; above the layer that you live in

### Column B

a. troposphere
b. stratosphere
c. mesosphere
d. thermosphere

5. Label the four layers of the atmosphere on the diagram on the next page.
6. There is no clear boundary between the uppermost layer of the atmosphere and space. The atmosphere becomes thinner and thinner and blends into space. At the very top of the diagram, write the word space with an arrow pointing up.
7. The ozone layer is the upper part of the atmospheric layer that contains most of the atmosphere’s ozone. Use the symbol for ozone to draw in the ozone layer on the diagram.
8. The ozone layer is important because it absorbs ultraviolet radiation. Draw a wavy line coming from space to represent the UV radiation that is absorbed by the ozone layer.
9. Ions are electrically charged particles. When nitrogen and oxygen atoms absorb solar energy in the lower thermosphere, they become ions. This part of the thermosphere is called the ionosphere. Draw the ions in the ionosphere. Remember that the thermosphere is very thin. There are almost no ions near the top of the thermosphere.
10. The troposphere is the densest layer of the atmosphere. It is much denser than the other layers. Shade this layer heavily to indicate how dense it is.
11. The stratosphere is very thin. Shade this lightly.
12. The mesosphere is even less dense than the stratosphere. Shade this layer very lightly.
Reinforcement continued

Key

Density
Ozone
Ions
UV radiation.

Altitude

80 km
50 km
16 km
0 km

Earth
Science - Day 8

Chapter Test - You may find it on Google Classroom.

1. Take the Chapter test
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   b. Open book
Science - Day 7

Chapter Review

1. Do the Chapter Review
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   c. Cite where you found your answer.

2. Do the Reinforcement page
The Atmosphere

MULTIPLE CHOICE

Circle the letter of the best answer for each question.

1. What is the atmosphere that surrounds the Earth made of?
   a. water vapor
   b. carbon dioxide
   c. a mixture of gases
   d. oxygen

2. What is most of the air we breathe made of?
   a. oxygen
   c. ozone
   b. carbon dioxide
   d. nitrogen

3. What pulls gas molecules in the air toward the Earth?
   a. air pressure
   b. gravity
   c. water
   d. solar energy

4. What is part of the thermosphere called?
   a. the hemisphere
   b. the ionosphere
   c. the troposphere
   d. the aurora sphere
MULTIPLE CHOICE
Circle the letter of the best answer for each question.

5. Where does most of the human-caused air pollution come from?
   a. pets and other animals
   b. smoke from forest fires
   c. car exhaust
   d. carbon dioxide

6. What is rain, sleet, or snow that has lots of acids in it called?
   a. acid shock
   b. acid precipitation
   c. scattered precipitation
   d. acid wash

7. What is the main problem caused by the ozone hole?
   a. too much radiation escapes Earth
   b. too much radiation reaches Earth
   c. too little radiation reaches Earth
   d. too little radiation escapes Earth

8. What is smog made of?
   a. ozone and vehicle exhaust
   b. ozone and killer fog
   c. smoke and vehicle exhaust
   d. smoke and ozone
MATCHING

Read the description. Then, draw a line from the dot next to each description to the matching word.

9. movement of air caused by differences in air pressure
   a. Coriolis effect
   b. pressure belts
   c. convection cells
   d. wind

10. large, circular patterns air travels in

11. bands of high and low pressure about every 30° latitude

12. path of the wind seems to curve because the Earth is turning

13. flow toward the poles from west to east
   a. local winds
   b. westerlies
   c. trade winds
   d. polar easterlies

14. used by traders to sail from Europe to the Americas

15. winds that blow from the poles to 60° latitude in both hemispheres

16. can blow from any direction
FILL-IN-THE-BLANK

Read the words in the box. Read the sentences. Fill in each blank with the word or phrase that best completes the sentence.

radiation  thermal conduction

global warming  convection current

17. Energy that moves as electromagnetic waves is called ____________________________.

18. When heat moves through something it is called ____________________________.

19. When the global temperature rises bit by bit it is called ____________________________.

20. Warm air rising and cool air sinking is called a(n) ____________________________.