Chapter 23 General Science

The Earth’s Atmosphere

*23-1 Air All Around Us*

**atmosphere**- the air that surrounds the Earth or another body in space

**troposphere**- the layer nearest the Earth in the atmosphere, where we live and where most weather takes place

**stratosphere**- the second layer in the atmosphere

**ozone**- a thin layer of gas found in the stratosphere that filters out much of the harmful radiation from the sun

**mesosphere**- the third layer in the atmosphere

**ionosphere**- the fourth layer in the atmosphere, where there are many electrically charged particles

**thermosphere**- the outermost layer in the atmosphere

\* When you breathe, you fill your lungs with air. Take a deep breath. Describe.

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\* The pull of gravity holds the **atmosphere** to the Earth. The atmosphere travels with the Earth as it moves through space.

\* Does air exist? What is it made of? Describe. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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\* Air is matter. It has mass, even though you cannot see it.

\* Air is made up mostly of gases, including the gas water vapor.

\* There is always a certain amount of dust floating in the air.

\* Each piece of precipitation has a piece of dust. Sometimes air is heavy, and sometimes it is light.

\* Air is affected by gravity and heat from the sun.

\* Earth’s atmosphere is 78% nitrogen. Oxygen makes up 21% What percent is made up of “other” materials? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\* There are small amounts of water vapor, argon, carbon dioxide, and other gases in the atmosphere.

\* The atmosphere also consists of neon, krypton, and about six other gases in addition to those in the chart. Unlike the other gases, the amount of water vapor varies greatly from place to place. The air over the oceans may be as much as four percent water vapor. The air over a desert may contain almost no water vapor.

\* The higher up you go in the atmosphere, the thinner the air is. Mountain climbers gasp for air on top of high mountains. Climbers need to breathe in more air to get more oxygen.

\* People who climb the highest peaks in the world carry oxygen in tanks with them.

\* The atmosphere does not end suddenly. It gets thinner and thinner as you go farther (up) from Earth. At about 600 miles, there is almost no atmosphere left.

\* The atmosphere is divided into 5 layers (by scientists). These are:

1.) Toposphere- This is the layer in which we live and most weather takes place. Planes fly in the troposphere.

2.) Stratosphere- Within this is a thin layer of the gas **ozone**. Ozone is a form of oxygen.. This layer is very important to living things. Ozone filters out much of the harmful radiation from the sun. Air pollution may be breaking down the ozone layer.

\* Without protection from ozone, more ultraviolet light can get through to the Earth’s surface. Ultraviolet light, which is visible, is the cause of sunburn and some skin cancers. Scientists say an increase in this radiation could cause an increase in skin cancer in humans.

3.) Mesosphere- This area blends in with the ionosphere.

4.) Ionosphere- This section contains many electrically charged particles.

5.) Thermosphere.- This is the highest layer. The air is very thin here.

*23-2 Properties of Air*

**air pressure**- the weight of the gases pressing down on the Earth

**barometer**- an instrument that measures air pressure

\* Gravity keeps the Earth’s atmosphere from flying off into space. Gravity is strongest near the Earth’s surface. Therefore, the atmosphere closest to the Earth is pulled the most by gravity. This causes the air molecules to pack together more tightly.

\* So, the air close to the Earth’s surface is heavier, or denser. The air farther away is less dense, or lighter.

\* **Air pressure** changes all the time.

\* **Barometers** are used to help predict the weather. A change in barometric pressure usually means a change in the weather.

\* The most common type of barometer is the aneroid barometer. Air pressure causes the thin sides of an airtight metal container to bend. This causes the connecting arrow to move along a scale.

\* Energy from the sun reaches the Earth as radiation. Once radiation strikes the ground, it changes to heat energy.

\* The ground radiates the heat back into the atmosphere. At that point, water vapor and other gases in the air absorb some of the warmth.

\* Clouds often block the sun’s energy. They also reflect sunlight back into the outer atmosphere. At night, though, clouds around Earth act as a blanket. They trap heat and keep it from escaping into space.

\* Describe what happens on a hot day when a cloud appears. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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\* About half of the sun’s energy that strikes the Earth’s atmosphere reaches the surface of the Earth. About ¼ is absorbed by the atmosphere and another ¼ is reflected by clouds.

\* Wind is moving air. Remember that heat causes the molecules in all matter to move. The warmer the air, the fast it moves and the more molecules spread out.

\* That air becomes less dense. This is why hot air rises and cold air sweeps into the empty space left by the warmer air. This is called *convection current*.

\* Houses are heated by convection currents. Warm air moves out of vents near the floor. The heated air rises and cooler air sinks, setting up convection currents.

\* Convection currents form large wind systems. Warm air at the equator rises and moves towards the poles.

\* Cooler air flows toward the equator from the north and south to replace the rising warm air. This causes a huge convection current.

\* The rotation of the Earth breaks up this big wind into a number of smaller, circular winds.

\* The effect of the Earth’s rotation on world wind systems is known as the Coriolis effect.

\* Due to the Coriolis effect, winds in the Northern Hemisphere spin to the right, while winds in the Southern Hemisphere spin to the left.

\* Earth has many other things that impact wind. Mountains, valleys, big bodies of water (among other things) create local winds.

\* Local winds are smaller wind systems. For examples, cold mountain breezes blow down mountain slopes at night. Warm valley breezes blow up mountain slopes on sunny days.

\* Winds over land and water also change between day and night. Is a swimming pool warmer then the air around it? Explain. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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\* Land heats up (and cools) faster than oceans or large lakes.

\* So, during the day, the air over land becomes warmer than the air over large bodies of water. When the warm air over the land rises, the cold air over the ocean or lake rushes in. This kind of wind is called a *sea breeze*.

\* At night, the opposite happens. The land cools faster than the ocean. So, the air over land gets cooler than the air over the ocean. The ocean air rises and the land air rushes out. This creates a *land breeze*.

\* Local winds are always named for the direction from which they come. So a *westerly* is blowing from the west. It blows toward the east.

\* A *north wind* is blowing from the north. It blows toward the south.

\* Winds called monsoons occur in certain parts of the world. In the summer, land surfaces absorb more solar energy than water surfaces. The cool, moist ocean air moves toward land, bringing heavy rain for long periods of time.

*23-3 Water and Air*

**humidity**- the amount of water vapor in the air at any given time

**precipitation**- any form of water that falls from the air

**dew point**- the temperature at which water vapor turn into liquid water

**cirrus cloud**- a high-altitude cloud made of ice crystals

**stratus cloud**- a low-lying gray cloud that covers a wide area

**cumulus cloud-** a big, puffy low-altitude cloud that usually signals good weather

\* Remember: When water evaporates, it turns from a liquid into a gas.

\* Look at the sky. Describe everything you see. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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\* There is always water in the air. Water enters the air by evaporating off the ground, lakes, oceans, rivers, plants, and animals.

\* When **humidity** is high, water may fall from the air. In the desert, the air is often dry (it is not humid).

\* The temperature of the air changes the type of **precipitation** that falls from the sky.

\* What are the ways that precipitation falls from the sky? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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\* What are the temperatures at which precipitation changes form? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\* Liquid water falls as rain. Warming can change rain into the gas water vapor. Cooling can turn water vapor back into liquid form.

\* If air is cooled below the **dew point**, some of the water vapor in the air forms tiny droplets of water. These droplets collect to make clouds.

\* Fog is a low-lying layer of cloud. When the droplets become large enough and heavy enough, they fall as rain.

\* If the temperature in a cloud is below freezing, the water vapor may form ice crystals. These then fall as snow.

\* Sleet is rain that freezes as it falls through a layer of cold air near the ground.

\* Hail is made up of lumps of ice. These lumps form as winds toss ice crystals up and down in a rain cloud. Each time the crystals move up, water freezes around them. Heavy lumps of ice form and fall to the ground and usually occur during strong thunderstorms.

\* Clouds form whenever water droplets or ice particles collect in the atmosphere. A lot of moisture in the air and cold temperatures help clouds to form

\* There are three main types of clouds:

1.) **cirrus cloud**- thin, feathery, and bright white

2.) **stratus cloud-** float low in the sky and appear as a broken cloud cover.

3.) **cumulus cloud**- made up of water droplets.

\* A *Thunderhead* is a special kind of cumulous cloud that usually brings storms.

\* Thunderheads grow to heights as great as 60,000 feet. Also known as cumulonimbus clouds, thunderheads may produce heavy rain, lightning, thunder, hail, and tornadoes.