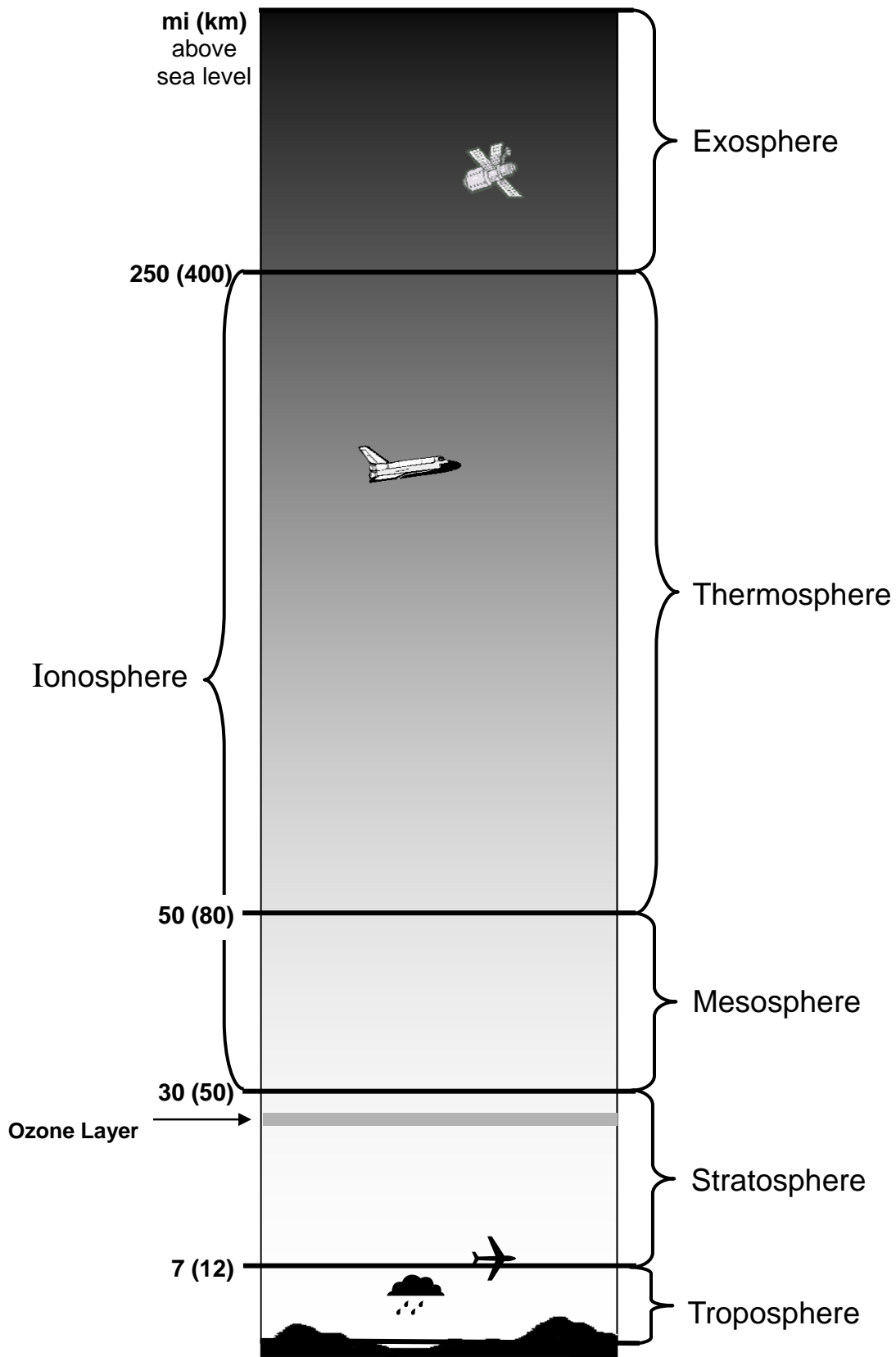


Atmospheric Layers



Atmospheric Layers

Earth's **atmosphere** is held in place by gravity. The atmosphere protects life on the planet by absorbing ultraviolet radiation and by regulating temperature.

There is no exact place where Earth's atmosphere ends. Instead, it just gets gradually thinner and thinner (less dense) until it merges with outer space where it consists mostly of interplanetary gases such as hydrogen and helium.

The **troposphere** is the atmospheric layer closest to the earth. It is often referred to as the "lower atmosphere." This layer holds the most dense composition of gases and molecules. Almost all of our weather is created within the troposphere.

The **stratosphere** is just above the troposphere, starting at an average altitude of about 7 miles above sea level. The air here is more dry and less dense. Only the highest clouds can be found in this layer. Aircraft often fly in the lower stratosphere to escape the turbulence present in the troposphere. Near the top of the stratosphere lies the **ozone layer**.

The **mesosphere** lies just above the stratosphere, ranging from about 30 to 50 miles above sea level. This layer contains chemicals which absorb energy from the sun. Together, the stratosphere and the mesosphere are often called the "middle atmosphere."

The **thermosphere** lies above the mesosphere, starting at about 50 miles above sea level. This layer is often called the "upper atmosphere." Any person traveling at an altitude of more than 50 miles above sea level is considered an astronaut. Space shuttles and some satellites orbit the Earth within this layer. The thermosphere also is the layer in which auroras take place.

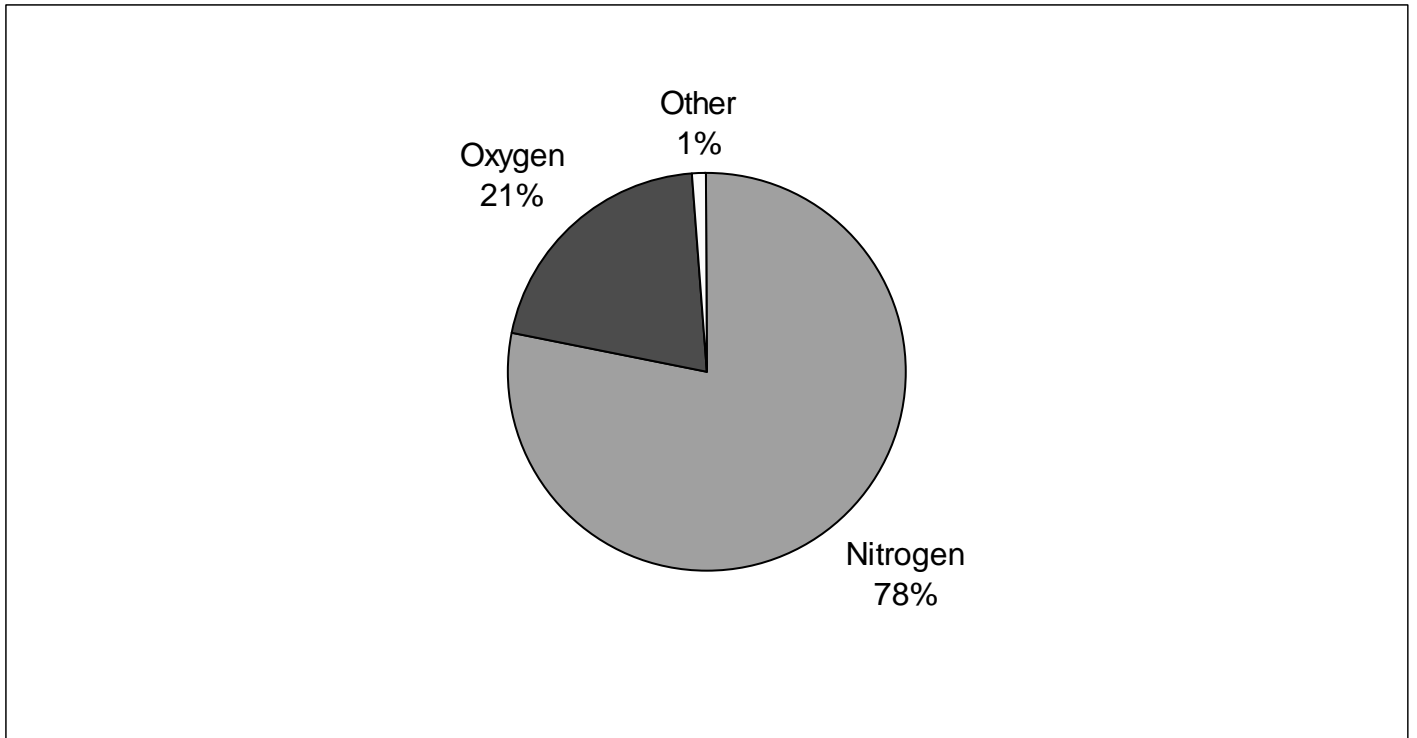
The **ionosphere** is a name often given to the combination of the mesosphere and the thermosphere. In both these layers, free ionic particles can be found. The ionosphere is important because it reflects radio waves, enabling much of our long-distance communication.

The **exosphere** is the outermost atmospheric layer. It has no definite outer limit, as it merges with space. Many satellites orbit the Earth within the exosphere, usually at altitudes of from 300 to 600 miles above sea level.



Air Composition

Ninety-nine percent of the air surrounding the Earth is found in the **troposphere** and the **stratosphere**. This air is made up of close to four-fifths nitrogen gas, and the rest is mostly oxygen gas. Small amounts of other gases and molecules are found in the air we breathe. Some of these are listed below.

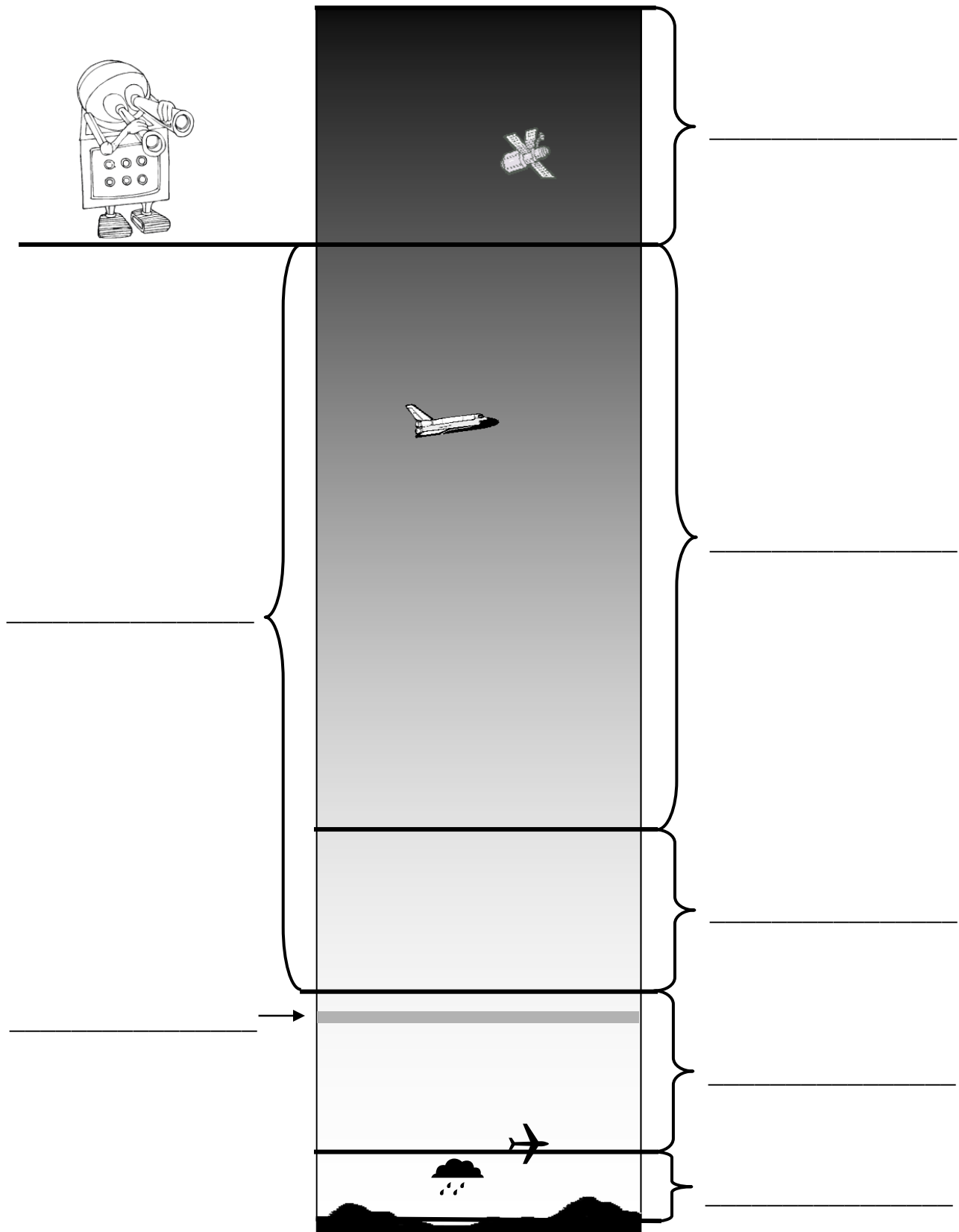


Other major components of the air:
(by descending percentage)

- Argon
- Carbon dioxide
- Neon
- Helium
- Methane
- Krypton
- Hydrogen
- Water vapor (variable percentage)



Label the Atmospheric Layers



Atmosphere Basics



Name at least 4 things our atmosphere does for us:

- 1.
- 2.
- 3.
- 4.
- 5.

What would happen if our atmosphere consisted of pure oxygen?

What is special about nitrogen, and what is its main function in the atmosphere?

Name at least 4 other gases in the atmosphere besides oxygen and nitrogen:

- 1.
- 2.
- 3.
- 4.
- 5.

If the atmosphere is like a greenhouse, what parts of it function as the "glass"?

- 1.
- 2.



Atmosphere Basics KEY

Name at least 4 things our atmosphere does for us:

1. supplies oxygen
2. provides pressure appropriate for bodily functions
3. protects us from meteors
4. protects us from cosmic rays
5. maintains temperature range necessary for life

What would happen if our atmosphere consisted of pure oxygen?

fires would burn out of control...

What is special about nitrogen, and what is its main function in the atmosphere?

inactive gas (uncombined); dilutes oxygen

Name at least 4 other gases in the atmosphere besides oxygen and nitrogen:

1. radon
2. argon
3. hydrogen
4. helium
5. carbon dioxide (also: neon, methane, krypton...)

If the atmosphere is like a greenhouse, what parts of it function as the "glass"?

1. carbon dioxide
2. water vapor





Layers & Gases of the Atmosphere



Match each layer with its description.

- | | |
|--------------------|---|
| _____ exosphere | A. closest to Earth, where almost all weather is created |
| _____ ionosphere | B. mesosphere plus thermosphere; reflects radio waves |
| _____ mesosphere | C. furthest from Earth; hosts the most satellites |
| _____ stratosphere | D. too high for aircraft, but too low for satellites |
| _____ thermosphere | E. hosts a few clouds and the ozone layer |
| _____ troposphere | F. hosts the space shuttle and some satellites |

Find the atmospheric gases in the box to the right inside the puzzle. Then use the leftover letters, in order from left to right and top to bottom, to find the hidden message.

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| K | R | Y | P | T | O | N | C | T |
| H | A | E | M | E | X | S | A | O |
| H | S | R | P | H | Y | E | R | R |
| E | E | H | G | A | G | S | B | A |
| L | N | W | I | O | E | H | O | C |
| I | K | A | N | A | N | Y | N | M |
| U | M | T | N | E | T | D | D | H |
| M | E | E | I | I | G | R | I | N |
| O | R | R | T | O | S | O | O | P |
| H | E | V | R | H | R | G | X | E |
| I | T | A | O | I | A | E | I | S |
| T | H | P | G | E | M | N | D | O |
| S | T | O | E | U | N | K | E | N |
| O | W | R | N | E | O | N | N | X |

| | |
|----------------|-------------|
| ARGON | METHANE |
| CARBON DIOXIDE | NEON |
| HELIUM | NITROGEN |
| HYDROGEN | OXYGEN |
| KRYPTON | WATER VAPOR |

MESSAGE:

_____ -

 _____ : _____
 _____.

 _____.



Layers & Gases of the Atmosphere **KEY**

Match each layer with its description.

- | | | |
|----------|--------------|--|
| C | exosphere | A. closest to Earth, where almost all weather is created |
| B | ionosphere | B. mesosphere plus thermosphere; reflects radio waves |
| D | mesosphere | C. furthest from Earth; hosts the most satellites |
| E | stratosphere | D. too high for aircraft, but too low for satellites |
| F | thermosphere | E. hosts a few clouds and the ozone layer |
| A | troposphere | F. hosts the space shuttle and some satellites |

Find the atmospheric gases in the box to the right inside the puzzle. Then use the leftover letters, in order from left to right and top to bottom, to find the hidden message.

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| K | R | Y | P | T | O | N | C |
| H | A | R | | | X | | A |
| E | | | G | | Y | | R |
| L | | W | | O | G | | B |
| I | | A | | | E | H | O |
| U | M | T | N | | N | Y | N |
| M | | E | I | | D | D | |
| | | R | T | | O | O | |
| | | V | R | H | | G | X |
| | | A | O | | A | E | I |
| | | P | G | | | N | D |
| | | O | E | | | | E |
| | | R | N | E | O | N | |

| | |
|----------------|-------------|
| ARGON | METHANE |
| CARBON DIOXIDE | NEON |
| HELIUM | NITROGEN |
| HYDROGEN | OXYGEN |
| KRYPTON | WATER VAPOR |

MESSAGE:

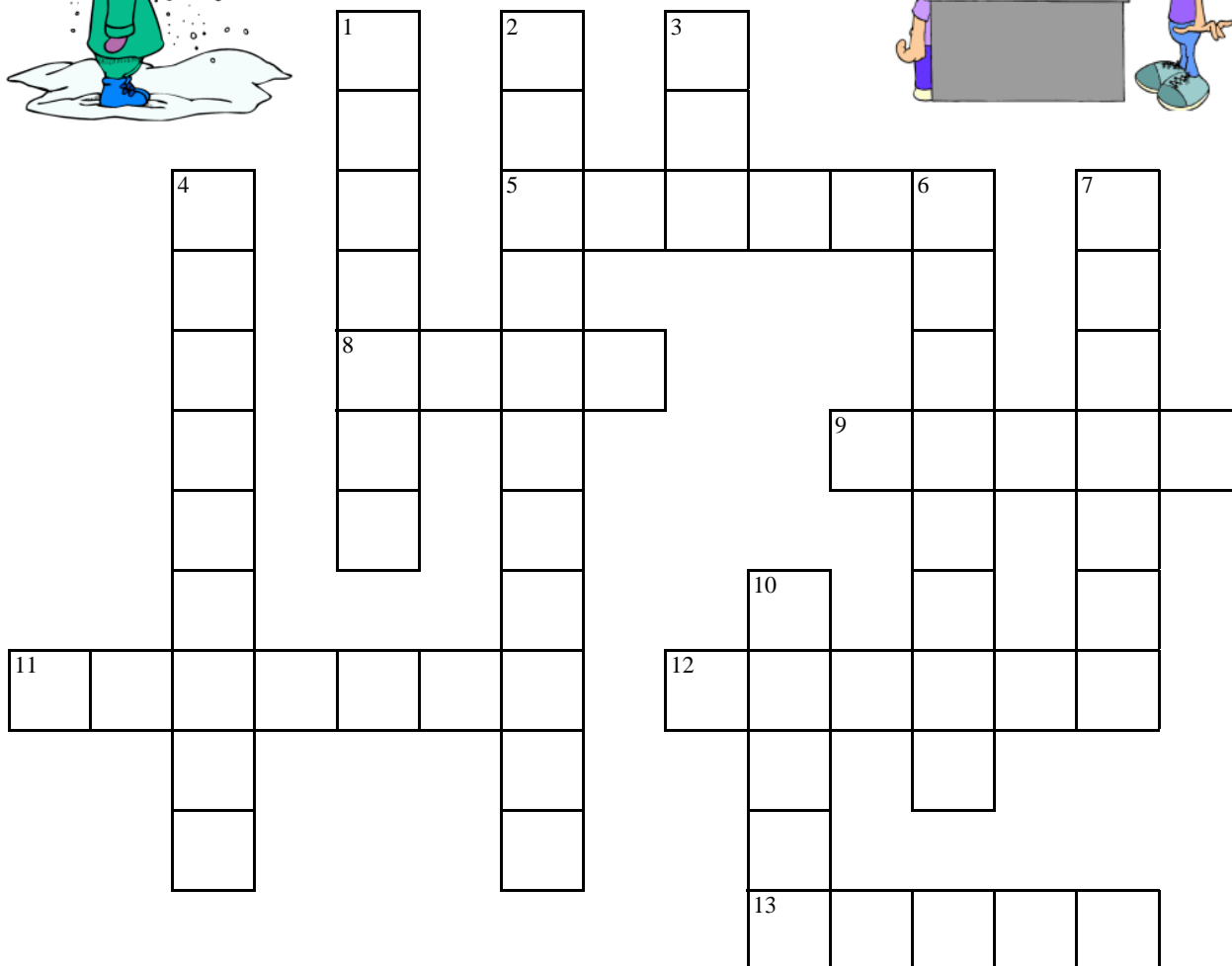
The mesosphere has
a nickname: the
ignorosphere.
It is the most
unknown.





The Puzzling Atmosphere

How well do you know your atmosphere?
Use the clues below to help fill in the puzzle.



ACROSS

5. This gas makes up close to one-fourth of the air surrounding Earth.
8. There is a high concentration of this and other metals in the mesosphere.
9. This is the third most abundant gas in the atmosphere.
11. The churning air in the troposphere helps determine the ____ of a place.
12. The atmosphere is composed of five ____.
13. The ____ layer is near the top of the stratosphere.

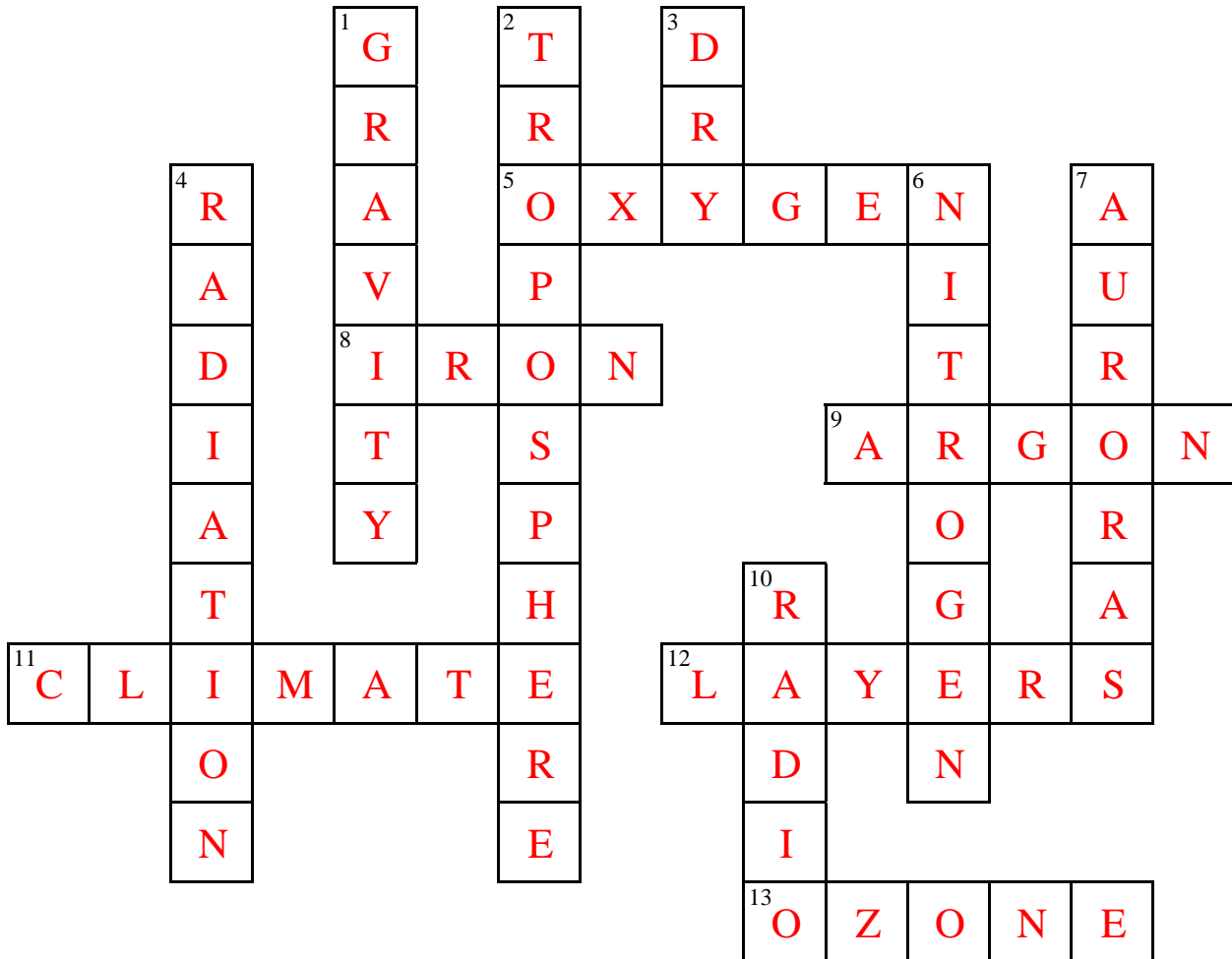
DOWN

1. This force holds Earth's atmosphere in its place.
2. This layer holds almost all of the water vapor in the atmosphere, as well as almost 3/4 of its mass.
3. The air in the stratosphere is less dense and more ____ than in the troposphere.
4. One way in which the atmosphere helps us is by absorbing solar ____.
6. This is the most abundant gas in air.
7. These are seen in the thermosphere.
10. This type of wave is reflected by particles in the ionosphere.



The Puzzling Atmosphere **KEY**

How well do you know your atmosphere?
Use the clues below to help fill in the puzzle.



ACROSS

- This gas makes up close to one-fourth of the air surrounding Earth.
- There is a high concentration of this and other metals in the mesosphere.
- This is the third most abundant gas in the atmosphere.
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DOWN

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- One way in which the atmosphere helps us is by absorbing solar ____.
- This is the most abundant gas in air.
- These are seen in the thermosphere.
- This type of wave is reflected by particles in the ionosphere.





Layers of the Atmosphere Diagram



For younger students:

1. Give each student a copy of the following two pages.
2. Lay out 9" wide construction paper of various colors, plus rulers, scissors, and pencils.
3. Instruct students to measure and cut the following five 9" strips of paper, each in a different color:
 - #1 (Troposphere) = 1/2 inch wide
 - #2 (Stratosphere) = 1 inch wide
 - #3 (Mesosphere) = 1 inch wide
 - #4 (Thermosphere) = 2 1/2 inches wide
 - #5 (Exosphere) = 1 inch wide
4. Instruct students to glue the strips in the above order (Troposphere on the bottom) inside the black box under the title "Layers of the Atmosphere."
5. Have students cut out the items on the second page, gluing them inside the appropriate layers, on top of the colored strips:
 - ✓ Glue the name of the layer near the center of each strip
 - ✓ Glue either the mile markers or kilometer markers near the left edge of each pair of strips (overlapping two strips)
 - ✓ Glue the temperature arrows near the right edge of each strip, paying close attention to the colors (red=hotter, blue=colder)
 - ✓ Glue the jet, clouds, and other objects onto the correct layers:
 - satellites (Exo and/or Thermo)
 - jet (bottom of Strato)
 - helicopter, bird, clouds, and hot air balloon (Tropo)

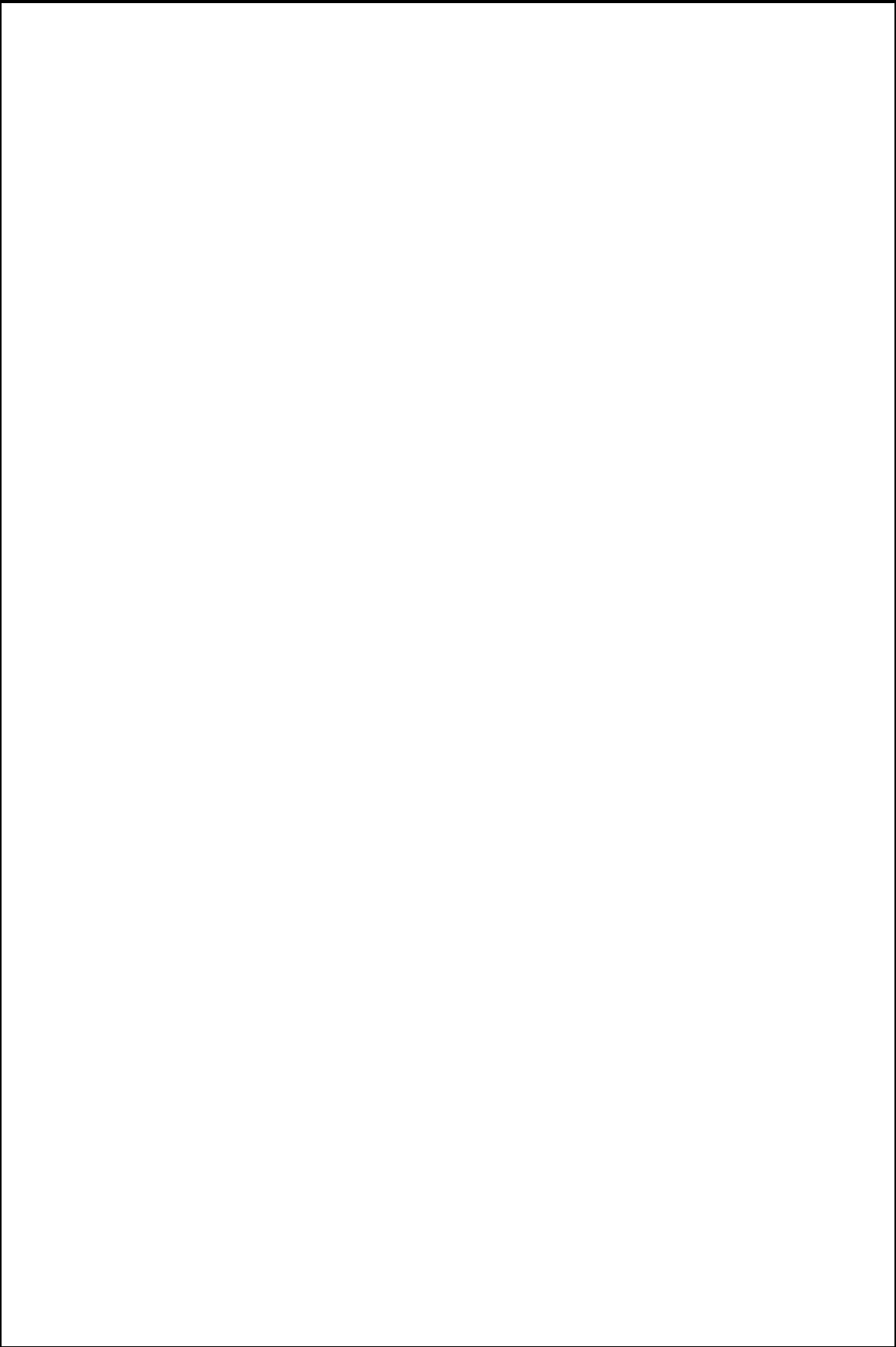
For older students:

Give each student a copy of the last page and instruct to:

- ✓ Write the name of each layer in the box near the middle of each layer
- ✓ Write the approximate height (mi. or km) in the boxes to the left
- ✓ Color the boxes to the right for temperature, using a blue and a red colored pencil and blending from hotter (red) to colder (blue) (look at colored arrows on item page for the general idea)

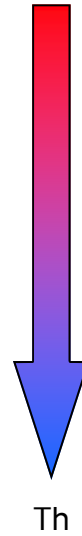
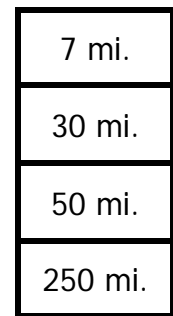
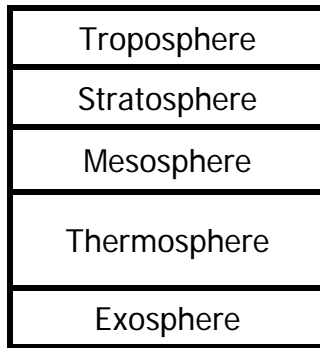


Layers of the Atmosphere

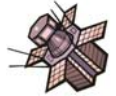









Layers of the Atmosphere Diagram

- Cut:
- one 1/2 inch strip
 - three 1 inch strips
 - one 2 1/2 inch strip



Layers of the Atmosphere

| | | |
|--|---|--|
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| |  <input data-bbox="690 808 763 1354" type="text"/> | <input data-bbox="893 1753 966 1879" type="text"/> |
| | <input data-bbox="998 808 1071 1354" type="text"/> | <input data-bbox="1088 1753 1161 1879" type="text"/> |
| |  <input data-bbox="1193 808 1266 1354" type="text"/> | <input data-bbox="1274 1753 1347 1879" type="text"/> |
| |   <input data-bbox="1339 808 1412 1354" type="text"/> | <input data-bbox="1364 1753 1437 1879" type="text"/> |
| |    | |