

# THE LAYERS OF EARTH'S ATMOSPHERE

## OBJECTIVES:

TLW identify the four main layers of the atmosphere.  
TLW describe the characteristics of each layer of the atmosphere.  
TLW state how the atmosphere is important for supporting life on Earth.

## RELEVANT GLCEs:

E.FE.07.12 Compare and contrast the composition of the atmosphere at different elevations.

S.IP.07.16 Identify patterns in data

S.IA.17.13 Communicate and defend findings of observations and investigations.

S.RS.07.15 Demonstrate scientific concepts through various illustrations, performances, models, exhibits, and activities.

Partially Met: E.ES.M.4 Human Consequences- Human activities have changed the land, oceans, and atmosphere of the Earth resulting in the reduction of the number and variety of wild plants and animals, sometimes causing extinction of species.

Partially Met: E.ES.07.42 Describe the origins of pollution in the atmosphere, geosphere, and hydrosphere, (car exhaust, industrial emissions, acid rain, and natural sources), and how pollution impacts habitats, climatic change, threatens or endangers species.

## MATERIALS:

- Large poster paper
- Markers/ crayons/ pencils
- Tape
- Laptops or iPads
- Internet Connection
- Overhead Projector

## **E**NGAGE:

~ 10 MINUTES

Have students make observations of two pictures: one picture shows an aurora and another picture shows an airplane flying above the clouds. They should notice that there is a divide between the 'colors' and 'Earth.' They should also notice that the layer of clouds only goes up so high. Ask students if the two pictures have anything in common. What can we conclude? The students should come to the conclusion that the atmosphere is divided into layers.

Then show a graph of elevation and temperature throughout the layers. Ask the students how the layers are divided, or classified. They should come to the conclusion that the layers are classified by having different temperature trends with increasing altitude. For example, as altitude increases in the troposphere, the temperature decreases; however, as altitude increases in the stratosphere, the temperature increases.

## **E**XPLORE:

~40 MINUTES

Tell the students that they will be exploring these different layers. Divide the class into 5 heterogeneous groups. Each group will be assigned a layer of the atmosphere. Give each group member one of the notecards that corresponds to their layer. The notecards provide direction and information that the group must find about their layer. The groups will use the webpage [atmosphericlayers.weebly.com](http://atmosphericlayers.weebly.com) to find information about their layer. Each group will illustrate/ write/ graph their findings on a large piece of paper. Posters will be displayed on the front board. Each group will take turns presenting their findings to the class.

## **E**VALUATE:

~10 MINUTES

Students will complete the 7<sup>th</sup> Grade Science Bellringer handout for a formative assessment of the learning goals across the lesson plans (The Gases of the Atmosphere, Properties of Gases, and Layers of the Atmosphere). This bellringer is not graded, but is used as a formative assessment to analyze student progress across the entire unit so far.

## **E**XPLAIN:

~25 MINUTES

Use the “Layers of the Atmosphere” PowerPoint for students to take notes on. This PowerPoint includes information on the layers of each layer (thickness, important roles, temperature/pressure trends, gases), chloroflourocarbons and ozone, and how these layers were studied in the past and present. Students will be given ‘skeleton’ notes on the atmosphere to fill in. The PowerPoint offers periodic stopping points to check for student understanding.

## **E**LABORATE:

~20 MINUTES

After students have learned about the characteristics of each layer of the atmosphere, the students are going to watch the following video of ‘the guy who jumped from space.’ This video can be accessed at the following webpage: (<http://www.youtube.com/watch?v=7f-K-XnHi9I>). The video depicts the fall that Felix Baumgartner took from the stratosphere in 2012. Pause the video right before he jumps. Give students the “Free Fall from Space’ handout, having them respond before continuing watching the video. The response should include the layers Felix will fall through, a prediction of how fast and how long he will fall, and a description of potential variables that will stop Felix from reaching the ground safely. Note that Felix actually jumps from the stratosphere, but the “Free Fall from Space” response has the students imagine that he jumps from the thermosphere.

After the video is over, tell the students that he jumped from sk which layer Felix really jumped from about 39km above the ground. Ask students what layer he actually jumped from (stratosphere).

## **E**VALUATE:

Ungraded assessments:

- Large posters/ presentations to the class

Graded assignments:

- Free Fall from Space Response.
- All bellringers of the week are collected and graded based on effort.
- Layers of the atmosphere project (see attached)

## EXPLORE NOTECARDS: LAYERS OF EARTH'S ATMOSPHERE

Today you will be exploring the **thermosphere/ exosphere**. You may use a handout or the Internet. Draw or write what you find on a large paper. Your group will present the information to the class.

You must find:

- Where the layer is relative to the other layers
- How much gas is found here?
- Does the exosphere end?
- Temperature trends
- Why is it important to human life?
- Any other important information

Today you will be exploring the **troposphere**. You may use a handout or the Internet. Draw or write what you find on a large paper. Your group will present the information to the class.

You must find:

- Where the layer is relative to the other layers
- How much gas is found here?
- Thickness in km
- How temperature changes within the layer
- Important gases
- Why is it important to human life?
- Any other important information

Today you will be exploring the **stratosphere**. You may use a handout or the Internet. Draw or write what you find on a large paper. Your group will present the information to the class.

You must find:

- Where the layer is relative to the other layers
- How much gas is found here?
- Thickness in km
- How temperature changes within the layer
- Important gases
- Why is it important to human life?
- Any other important information

Today you will be exploring the **mesosphere**. You may use a handout or the Internet. Draw or write what you find on a large paper. Your group will present the information to the class.

You must find:

- Where the layer is relative to the other layers
- How much gas is found here?
- Thickness in km
- How temperature changes within the layer
- Why is it important to human life?
- Any other important information

Today you will be exploring the **thermosphere/ ionosphere**. You may use a handout or the Internet. Draw or write what you find on a large paper. Your group will present the information to the class.

You must find:

- Where the layer is relative to the other layers
- How much gas is found here?
- Thickness in km
- How temperature changes within the layer
- Why is it important to human life?
- Any other important information

Name: \_\_\_\_\_ Date: \_\_\_\_\_

### 7<sup>th</sup> Grade Science Checking for Understanding

This handout is not graded based on whether you get the answers right or not, but it will be used to assess how well you have learned the important information in the atmosphere unit so far. Please do your best!

1. Name the gas that makes up the percent composition of the atmosphere below.

a) 78% \_\_\_\_\_

b) 21% \_\_\_\_\_

c) 0.9% \_\_\_\_\_

d) 0.03% \_\_\_\_\_

2. Fill in the blank:

As altitude or height increases, air pressure \_\_\_\_\_.

3. Circle the bolded words that best fit the sentence below.

Dense air **rises or sinks** and less dense air **rises or sinks**.

4. Circle the four main layers of the atmosphere below.

hemisphere      stratosphere      thermosphere      heliosphere

troposphere      hydrosphere      lithosphere      mesosphere

5. Name one thing that the atmosphere does/has that supports life on Earth.



Name: \_\_\_\_\_ Date: \_\_\_\_\_

### 7<sup>th</sup> Grade Science Checking for Understanding

This handout is not graded based on whether you get the answers right or not, but it will be used to assess how well you have learned the important information in the atmosphere unit so far. Please do your best!

6. Name the gas that makes up the percent composition of the atmosphere below.

a) 78% \_\_\_\_\_

b) 21% \_\_\_\_\_

c) 0.9% \_\_\_\_\_

d) 0.03% \_\_\_\_\_

7. Fill in the blank:

As altitude or height increases, air pressure \_\_\_\_\_.

8. Circle the bolded words that best fit the sentence below.

Dense air **rises or sinks** and less dense air **rises or sinks**.

9. Circle the four main layers of the atmosphere below.

hemisphere      stratosphere      thermosphere      heliosphere

troposphere      hydrosphere      lithosphere      mesosphere

10. Name one thing that the atmosphere does/has that supports life on Earth.



## Layers of the Atmosphere Project

In class, we talked about the different layers of the atmosphere and how each one is important in maintaining life on Earth. Your job is to show me that you know this information by choosing ONE of the following projects:

- Create a model of the atmosphere. Include all of its layers and information on each one. Be creative!
- Design a flipbook for the layers of the atmosphere and their composition. See me for examples.
- Compose a song or rap about the layers of the atmosphere. You will turn in the lyrics to the song and a recording or video.
- You are the new image consultant for the superhero "Mr. Atmosphere." He has this name because his superpowers are similar to characteristics of each layer in the atmosphere. Write a story or create a video about his latest adventure.

Circle the project that you are going to do. Look at the grading rubric on the back. If you include everything that is on the rubric, you can easily get 100%. Turn this sheet in with your project. Be creative!

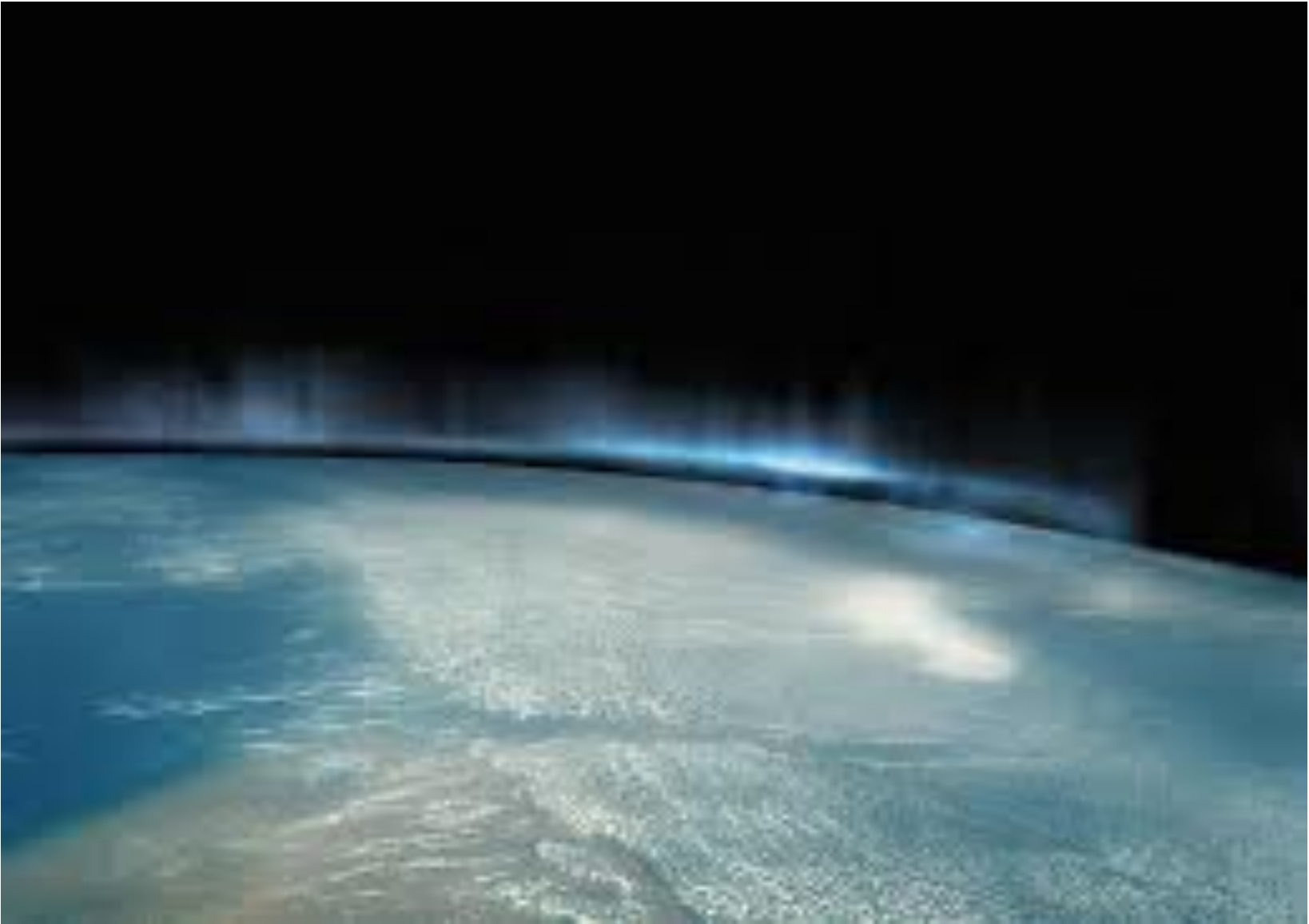
Name \_\_\_\_\_ Date \_\_\_\_\_

### Grading Rubric

This project needs to include:	Total Points Possible	Score
Where is the Troposphere?	1	
Troposphere - 2 facts	2	
Where is the Stratosphere?	1	
Stratosphere - 2 Facts	2	
What is the Ozone Layer?	1	
How does the Ozone Layer protect life?	2	
Where is the Mesosphere?	1	
Mesosphere – 2 facts	2	
Where is the Thermosphere?	1	
Thermosphere – 2 facts	2	
Creativity	5	
Total	20	

# Anticipatory Set

- In your notebook, make observations of the 2 pictures I will show you. Write down what you see/notice about both pictures.
- Make a conclusion about the atmosphere based off of your two observations.



What do you notice in this picture?

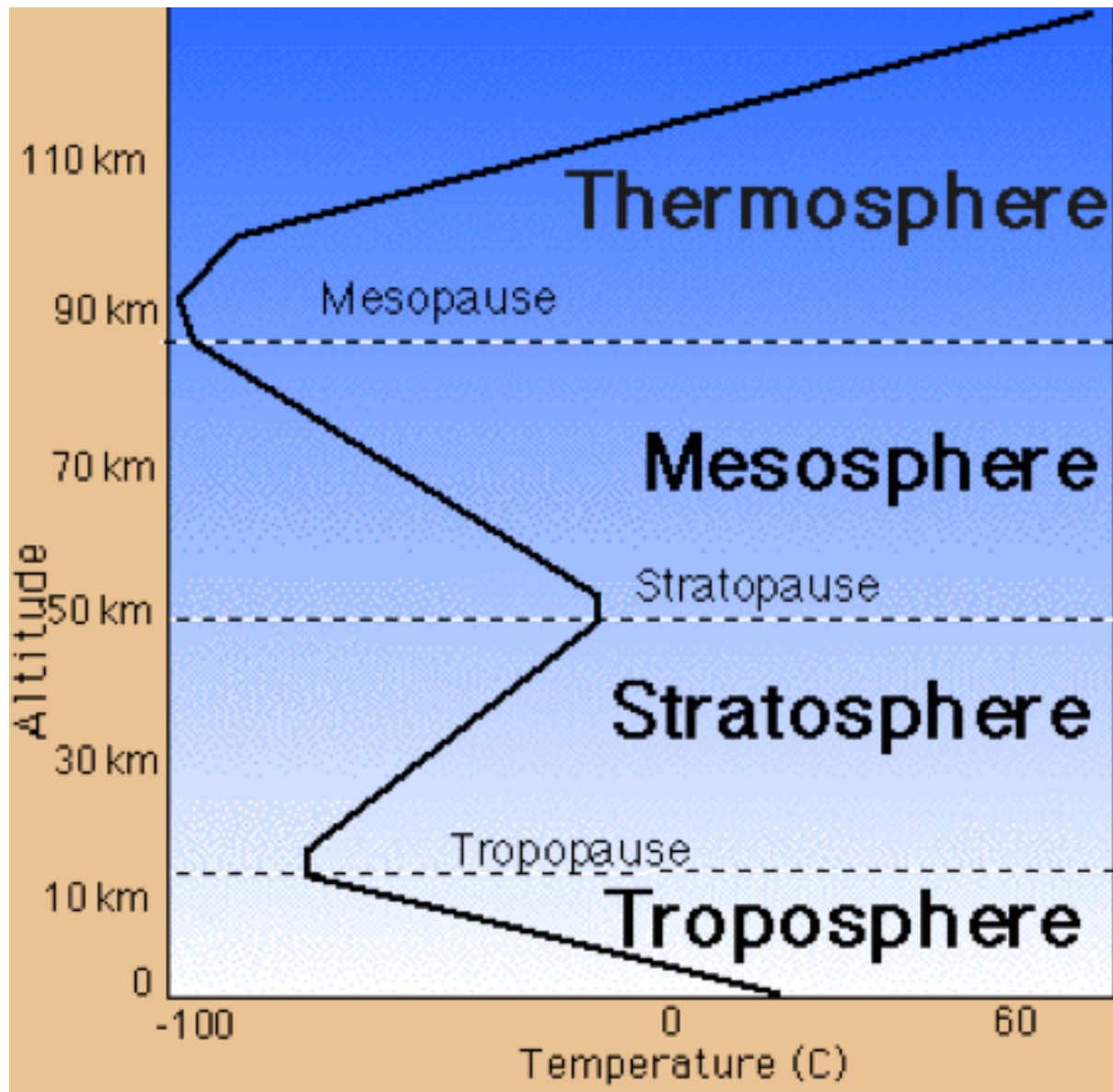
What do you notice about this picture?



# Conclusion

Based off of my observations, the atmosphere is....

**MADE UP OF LAYERS!**

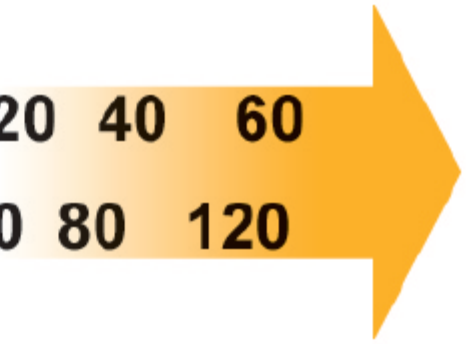


Based on this graph, how is the atmosphere divided into layers?

# Layers of the Atmosphere

- The atmosphere is divided into layers **based on temperature changes**.

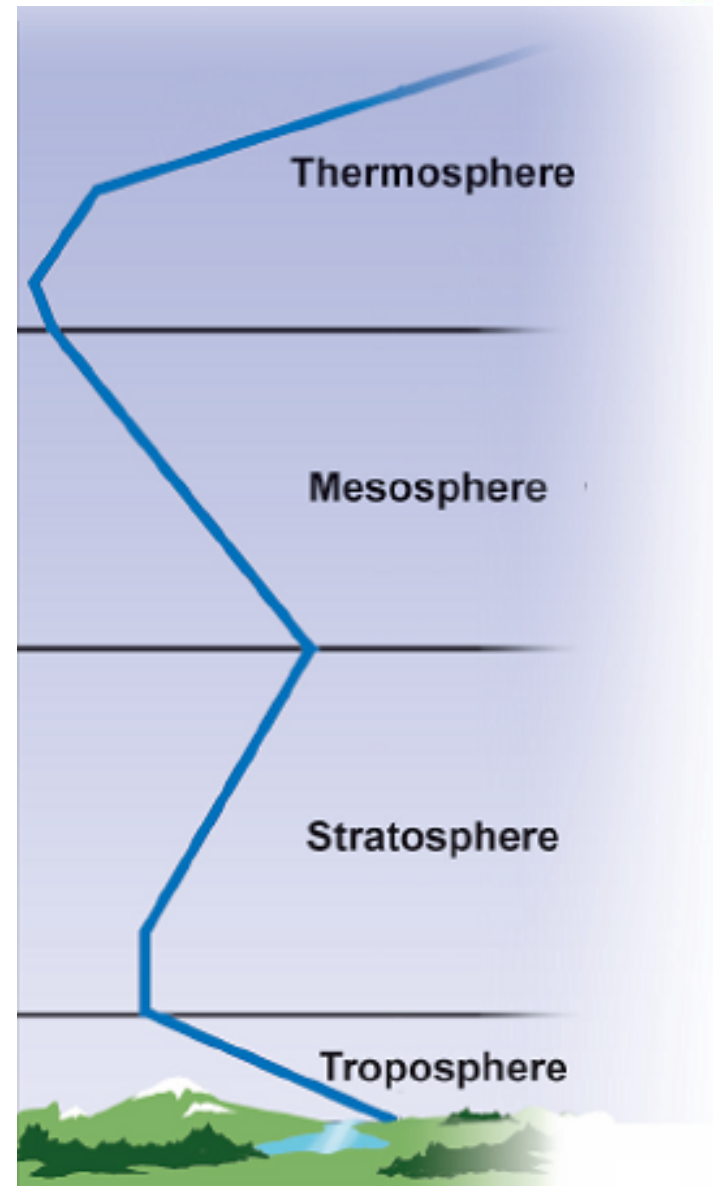
°C	-100	-80	-60	-40	-20	0	20	40	60
°F	-120	-80	-40	0	40	80	120		



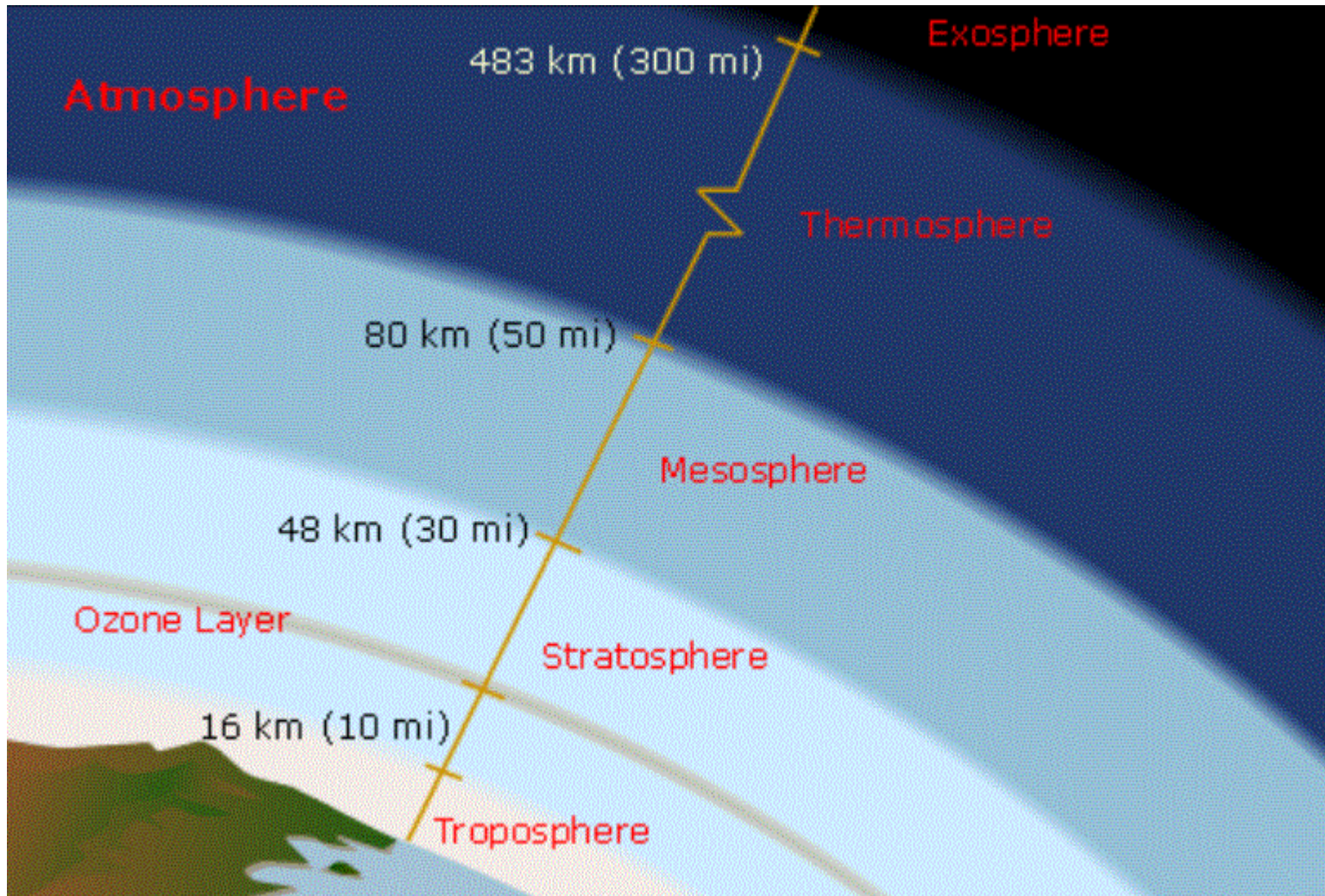


# Layers of the Atmosphere

- The atmosphere has four layers:
  - Thermosphere (containing the Ionosphere and Exosphere).
  - Mesosphere
  - Stratosphere
  - Troposphere



# The Layers of the Atmosphere



# Become an expert on a layer...

- In your groups, you will explore a layer of the atmosphere.
- Go to [atmosphericlayers.weebly.com](http://atmosphericlayers.weebly.com)
- Follow the instructions on your card for what to look for
- Include all of the information on a poster. You can use words, phrases, and/ or pictures.
- Post your poster on the whiteboard. Your group will present the information you found to the class.

# Checking for Understanding

- Grab the 7<sup>th</sup> Grade Science Handout in the front basket.
- Silently answer the questions the best that you can!
- This is not graded based on if you are right or not, but I want to see how much you have learned about the atmosphere so far.

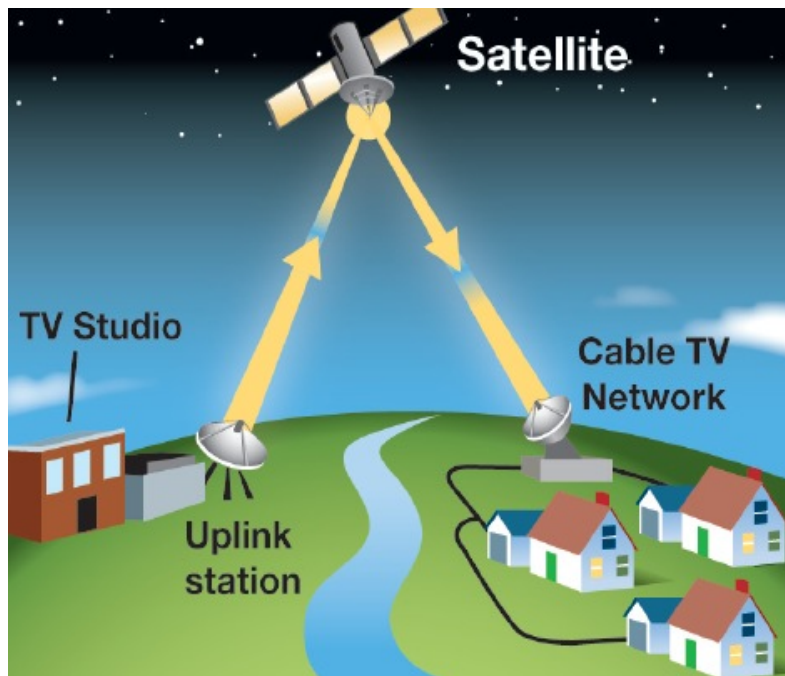
# Leon Teisserenc de Bort (1855-1913)

- Used unmanned instrumented balloons to study the atmosphere
- 1900: found that the atmosphere must have 2 layers based on temperature changes
- Since de Bort, the other layers have been identified
- The layers are currently being studied using satellites



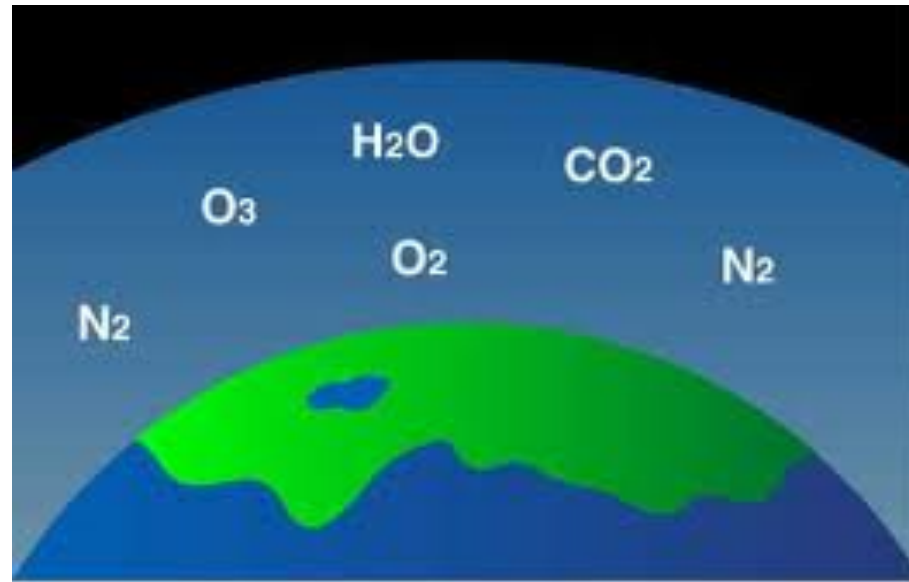


# Satellites

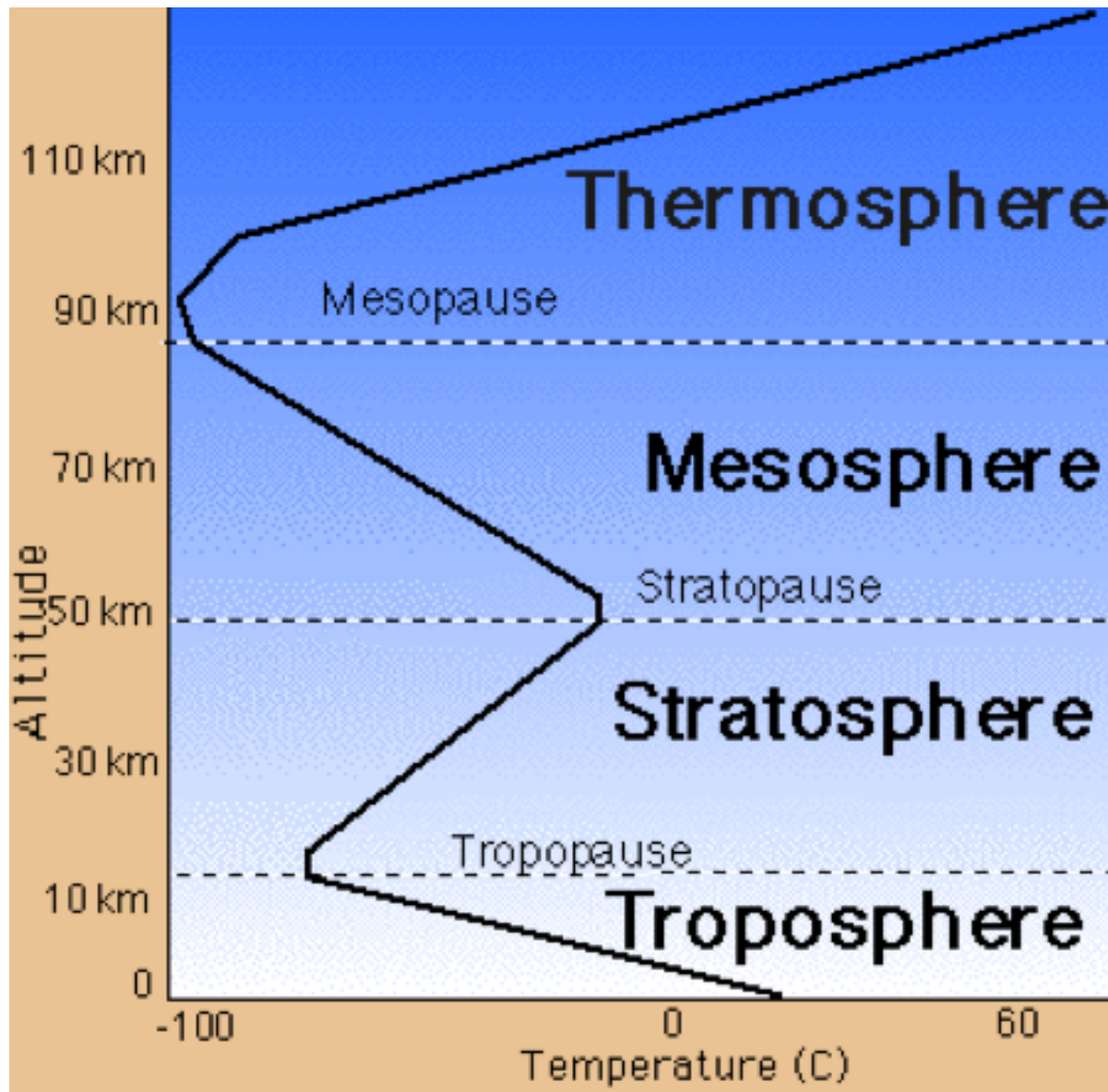


- Communication on Earth depends on satellites.
- Satellites transmit information used for television shows, radio broadcasts, data and photos used in weather reports, and long distance telephone calls.

# What is the atmosphere?



- Thin layer of gases surrounding Earth
- What four gases make up most of our atmosphere?
  - 78% **nitrogen**, 21% **oxygen**, 0.9% **argon**, 0.03% **carbon dioxide**, trace amounts of other gases
- Insulates Earth from **extreme temperatures**
- Made up of **4** layers



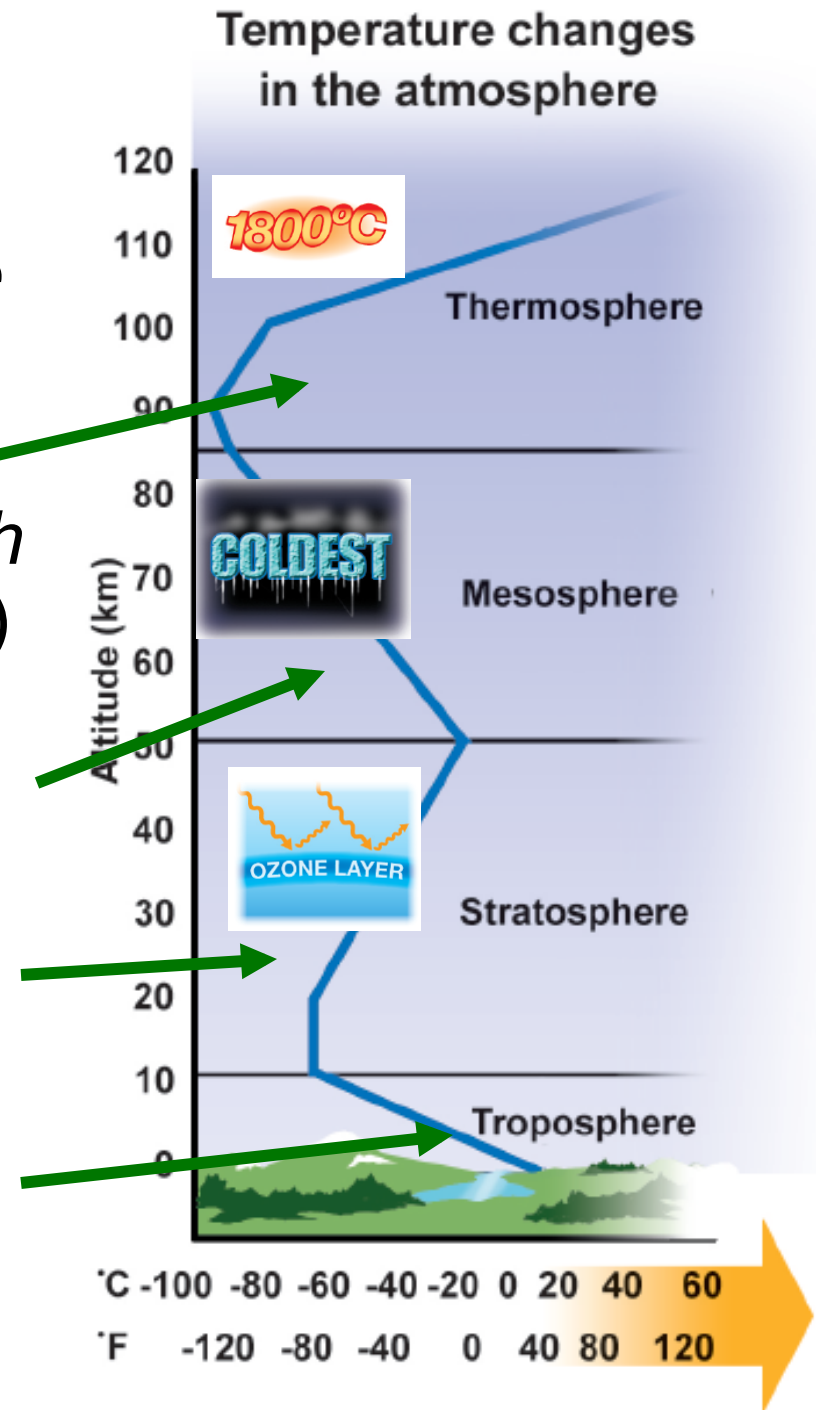
Based on this graph, how is the atmosphere divided into layers?



# Layers of the Atmosphere

The layers of the atmosphere include:

1. The **Thermosphere**-- where satellites orbit Earth (Ionosphere + Exosphere)
2. The **Mesosphere**--where meteors burn up.
3. The **Stratosphere**--which contains the ozone layer.
4. The **Troposphere**--where we live and where all weather occurs.

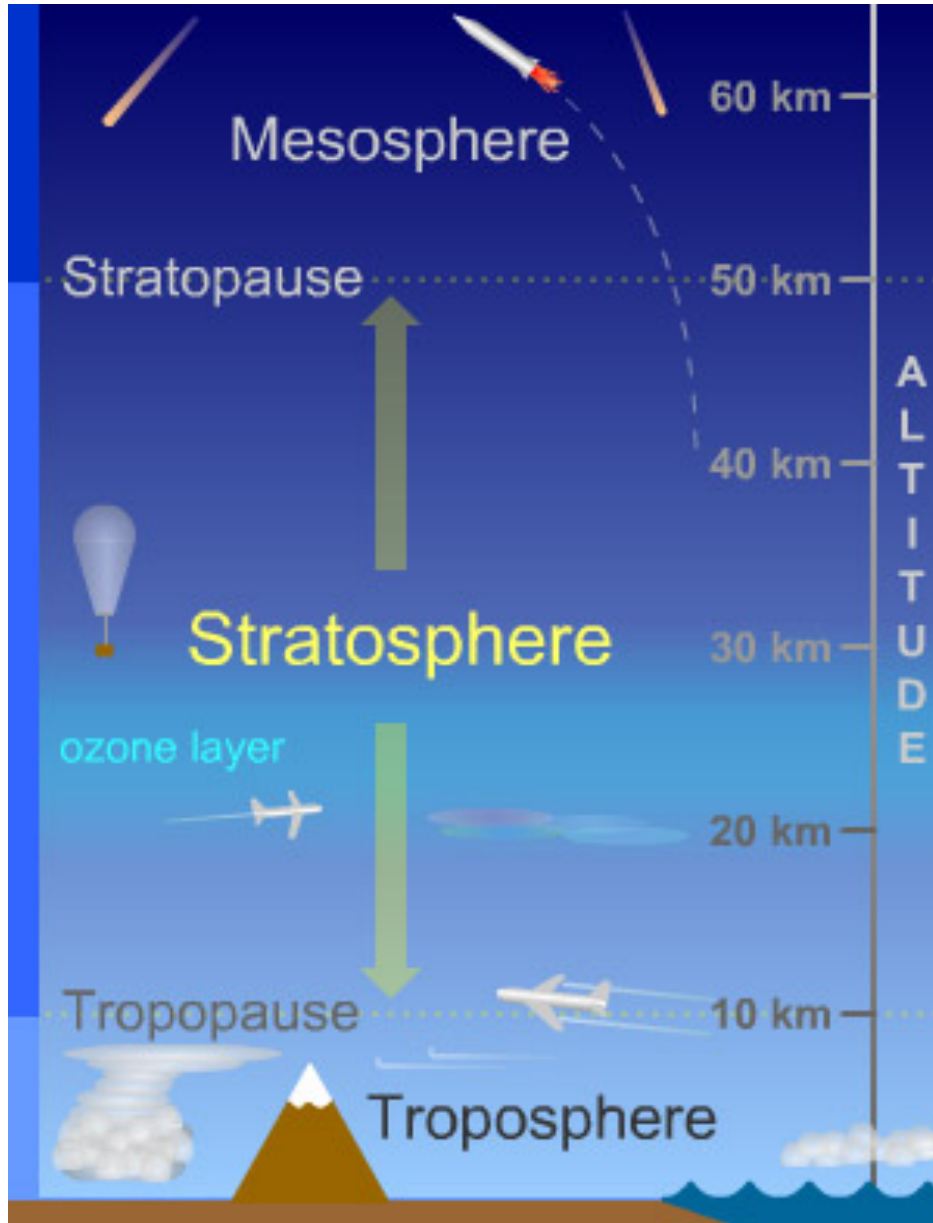


# Troposphere



- **Lowest** and **most dense** layer of the atmosphere
- **50%** of all the atmospheric gases are found
- **9-16** km thick
- Where most of the **weather** occurs
- Air is heated from the **ground** up
  - **Surface** of Earth absorbs energy and heats up faster than the air does
- **Temperature** and **pressure** decrease as you go higher

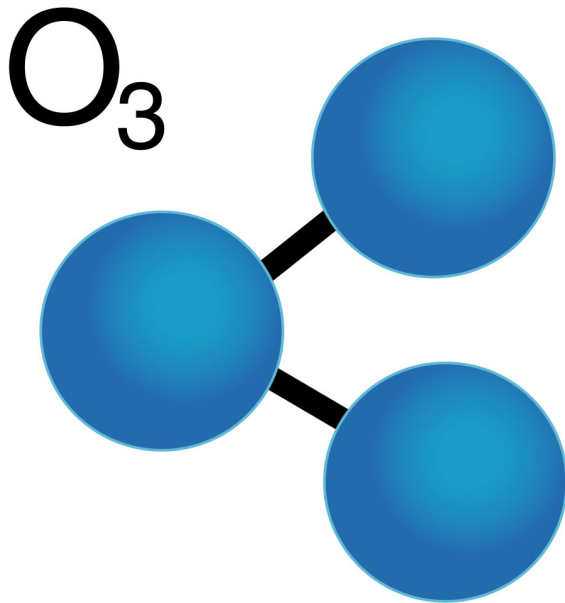
# Stratosphere



- Extends from **16 km** to **50 km**
- No **clouds** or convection currents
- **Jetstream** is at the base
  - Fast moving rivers of air that affect weather
- Contains the **ozone layer**
- **Temperature** increases and **pressure** decreases

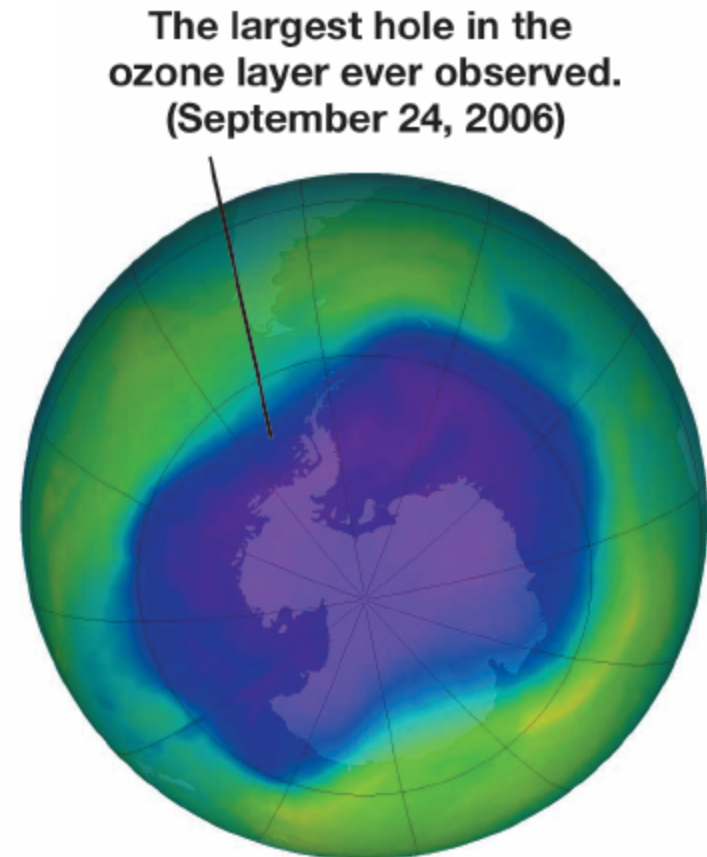
# Ozone Layer

- Part of the **stratosphere**
- Ozone is a form of **oxygen**
- Absorbs harmful **ultraviolet** rays from the sun



# The Ozone Layer

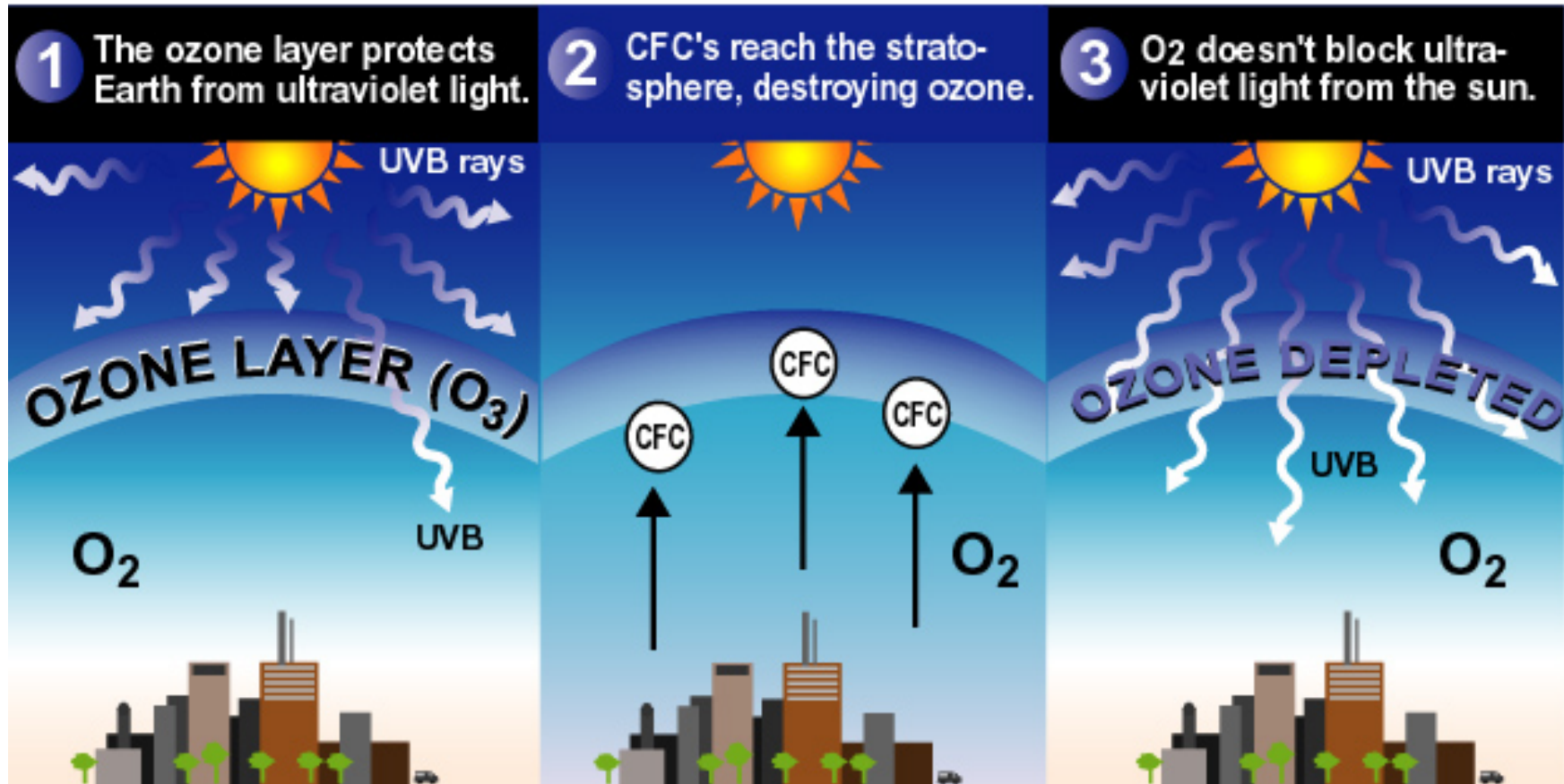
- In the 1970s, scientists noticed that the ozone layer in the Stratosphere above Antarctica was thinning.



# Chlorofluorocarbons and the Ozone Layer

- A group of chemicals called chlorofluorocarbons (or CFCs) were once commonly used in air conditioners, in aerosol spray cans, and for cleaning machine parts.
- Scientists discovered the CFCs were damaging the ozone layer.

# Chlorofluorocarbons (CFCs) and Ozone Depletion



# Checking for Understanding...

- Think, Pair, Share the following questions..
  - Explain how the ozone layer is important in supporting life on Earth.
  - Explain how air pollution has affected the ozone layer.

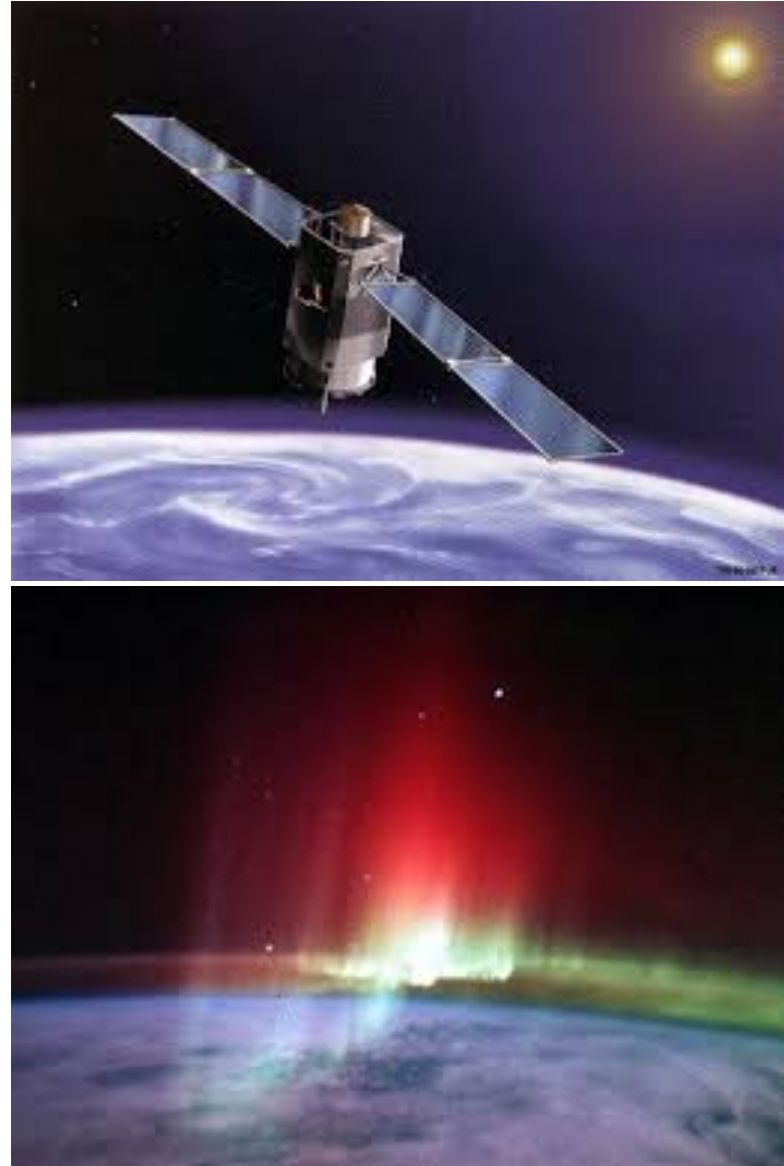


# Mesosphere

- Extends from 50 km to 80 km
- Meteoroids burn up
- Temperature and pressure decrease

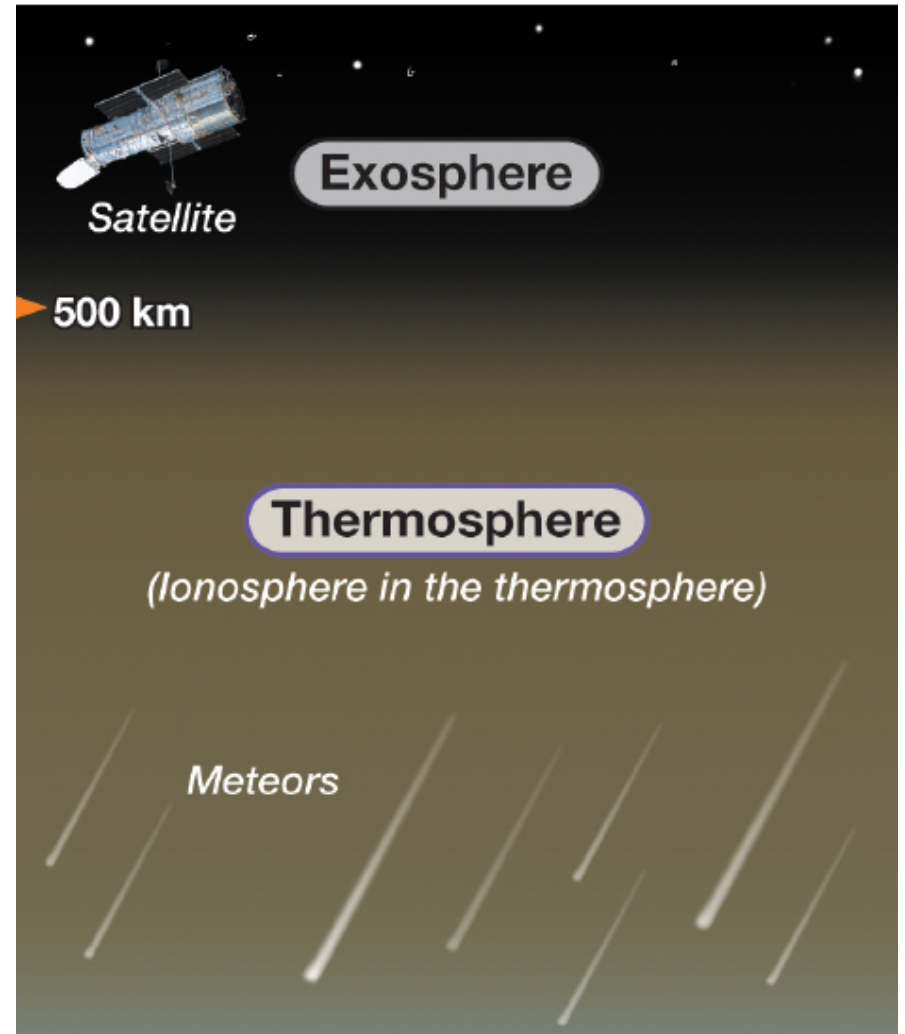
# Thermosphere

- Extends from **80 km** to **400 km**
- Ionosphere and exosphere
- High **temperatures**
- Has **auroras** and orbiting **satellites**
- **Temperature** increases and **pressure** decreases

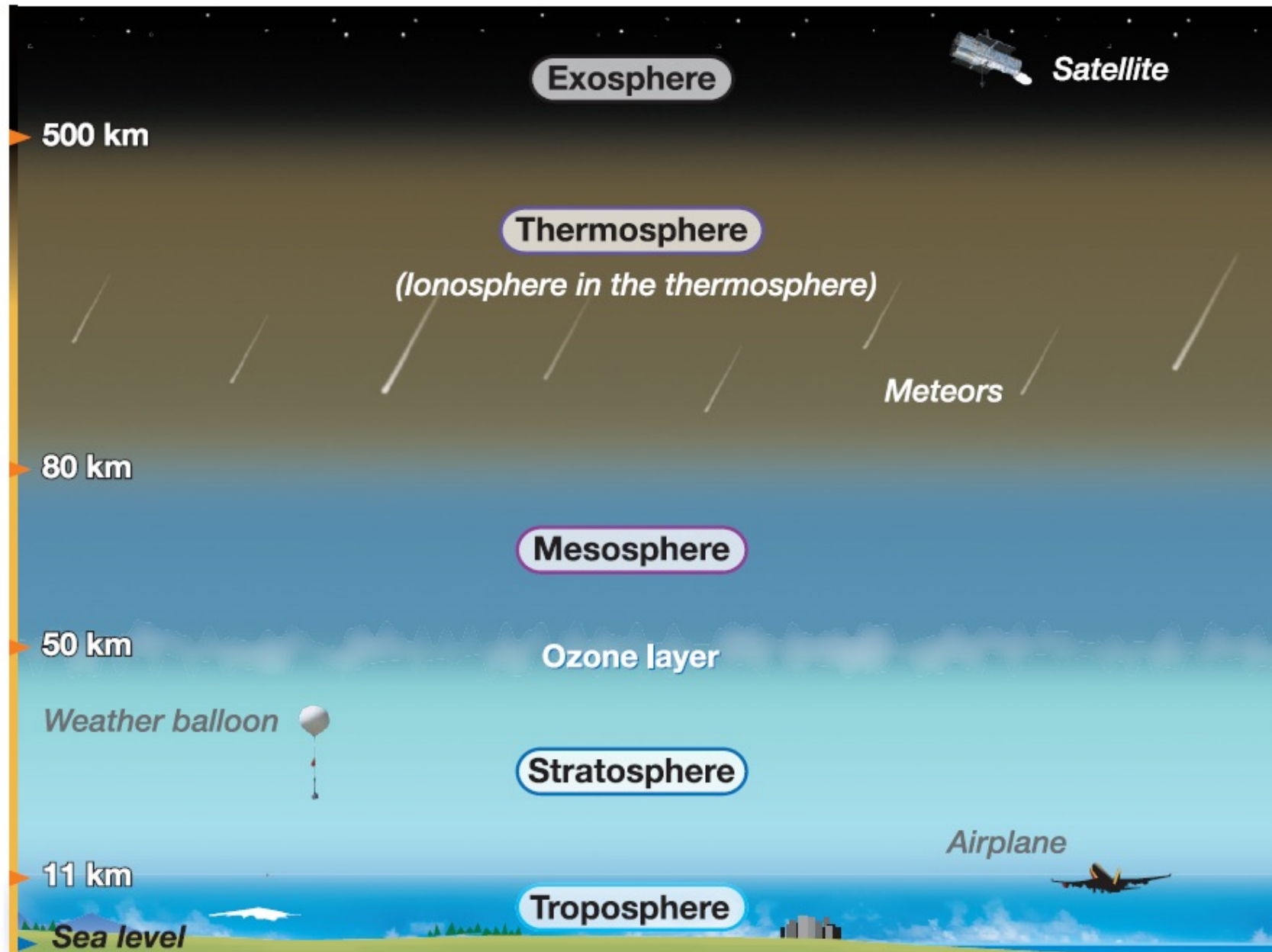


# Exosphere

- Last layer of the **atmosphere**
- **Cold!**
- Extends beyond **400 km**
- **Air particles** are far apart
- **Atmosphere** gradually fades into **space**



# Layers in the Atmosphere

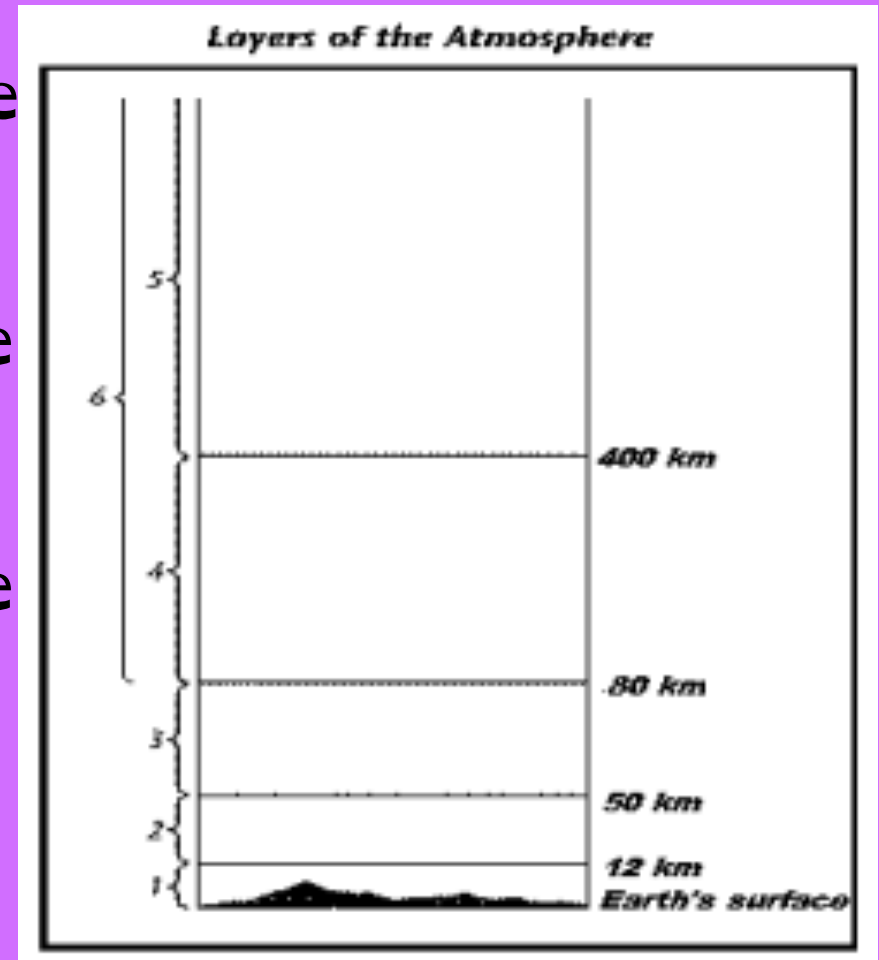


# 7<sup>th</sup> Grade Science Bellringer

## 10-22-13

Use the picture to help answer each question.

1. What are the names of the 6 layers of the atmosphere as shown?
2. Give the number and name of the layer that contains the ozone layer.
3. Give the number and name of the layer in which Earth's weather occurs.
4. About how many times thicker is the mesosphere than the troposphere?



# Free Fall from Space Response

