

# Layers of the Atmosphere:

## Part I: Scale Model

### Setting up the Layers:

- 1) Holding your paper portrait style, write the title "Scale Model of the Atmosphere" at the top of your paper.
- 2) 4 cm (40 mm) from the bottom of the paper draw a horizontal line across your paper. Label below the line "Earth's Surface".
- 3) Using the scale of 1 mm equals 1 km draw a line across your paper 16 mm above the Earth's surface.
- 4) Label this layer the "Troposphere".
- 5) Using the same scale draw a line 48 mm above the Earth's surface. Label this layer the "Stratosphere".
- 6) Draw a line 80 mm above the Earth's surface. Label this layer "Mesosphere".
- 7) Label the remaining part of the paper the "Thermosphere". Include on the label that it "continues far above the top of the paper".

### Procedures:

#### Earth Surface:

- A. Color the Earth green or brown to represent land.
- B. Draw some houses, trees, or other objects you find on the Earth's surface.

#### Troposphere: The 1st layer of the atmosphere, the troposphere, extends 16 km (10 miles) above Earth.

- A. Within the troposphere label the scale you are using, "Scale: 1 mm = 1 km".
- B. Draw clouds in this layer to indicate this is where weather occurs.
- C. The temperature drops as you move up in the troposphere so label the layer "warm to cold".
- D. At the top of the troposphere are very strong winds moving eastward called the jet stream. This is also the location where passenger planes fly. Draw an airplane and an arrow moving from left to right to symbolize the location and direction of the jet stream.

#### Stratosphere: The 2nd atmospheric layer is called the stratosphere. It extends 48 km (30 miles) above the Earth.

- A. The ozone layer is in the stratosphere. Ozone is made of three oxygen atoms and absorbs harmful ultraviolet radiation. To demonstrate this draw molecules of ozone (O<sub>3</sub>) with lightning bolts going towards the ozone.
- B. Temperature increases in the stratosphere because ultraviolet radiation is absorbed, so label the layer "cold to warm".

#### Mesosphere: The 3rd layer of the atmosphere is called the mesosphere. It extends 80 km (50 miles) above the Earth.

- A. This is the coldest layer with temperatures as low as -85°C (-120°F). Draw a thermometer and snow flakes in this layer to symbolize the cold temps.
- B. Once in this layer you are now above 99.9% of the molecules that make up the atmosphere. The air is extremely thin so label this layer as "less than 0.1% of air molecules".
- C. Many meteoroids burn up in the mesosphere because they're starting to collide with air molecules at extremely high speeds, so draw and label a meteor.

#### Thermosphere: The fourth layer of the atmosphere is the thermosphere. It extends to outer space, thousands of kilometers above the Earth's surface.

- A. The thermosphere is extremely hot because of radiation that is absorbed so draw flames to symbolize the hot temperature.
- B. Satellites orbit the Earth in this layer because there are so few air molecules. Draw and label a satellite at the top of your paper.

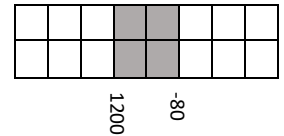
# Layers of the Atmosphere:

## Part II: Graphing Pressure and Temperature

**Purpose:** Analyze the relationship between altitude, temperature and pressure.

**Directions:**

1. Graph temperature and pressure
  - A. Hold a piece of graph paper vertically.
  - B. Place *altitude* on the vertical axis. Number vertically from 0 to 250 using a scale of 1 block = 10 km. Create a break in altitude in your axis and then near the top of the paper put 500 km.
  - C. Both *pressure* and *temperature* will be on the horizontal axis. Number from the origin to the right from 0 to 1200 *millibars* using the scale of 1 block = 100 mb. **Label this axis "Pressure (mb)".**
  - D. Skip approximately two blocks and shade them in vertically to the top of your graph paper.
  - E. Begin labeling the lines for temperature. Begin with -80°C and label up to 60°C using the scale 1 block = 10°C. **Label this axis "Temperature (°C)".**
  - F. Plot the following data and connect the data points. You should end up with two separate line graphs side by side: one for temp and one for pressure.



Altitude (km)	Pressure (millibars)
0	1000
2	850
4	700
6	500
8	300
10	200
14	100
20	50
26	25
31	10
35	5
48	1
500	0

Altitude (km)	Temp (°C)
0	20
10	-57
20	-57
48	0
55	0
80	-80
90	-80
110	20
120	60

2. Layers of the atmosphere
  - A. Draw lines to separate the layers of the atmosphere. These lines will be drawn horizontally across the graph and will be parallel to the horizontal axis. Label the layers.
    - **Troposphere** – 10 km
    - **Stratosphere** – 50 km
    - **Mesosphere** – 80 km
    - **Thermosphere** – Extends 80 km and above
  - B. Label the short vertical lines where the temperature stays steady. (the “pauses”)
  - C. Draw mountains and clouds in the troposphere. Shade the ozone layer pink with colored pencil and draw red ozone molecules in the layer.

**Analysis Questions:** *Answer the following questions in your science journal.*

- 1) Which layer of the atmosphere has the greatest pressure? **Why?**
- 2) Why does temperature increase as you get higher in some layers?
- 3) In which layer of the atmosphere does the weather take place?
- 4) Describe the relationship between altitude and pressure.