**Graphing the Atmosphere**

**PART 1: Atmospheric Composition**

The atmosphere is made up of many different gases, and the amount of each type of gas present depends on what layer of the atmosphere you’re talking about. Near the earth’s surface, the atmosphere is made up of 78% nitrogen, 21% oxygen, and 1% other gases. These other gases include mostly argon (0.93%) and carbon dioxide (0.039%), water vapor, and trace amounts of others.

**Directions:**

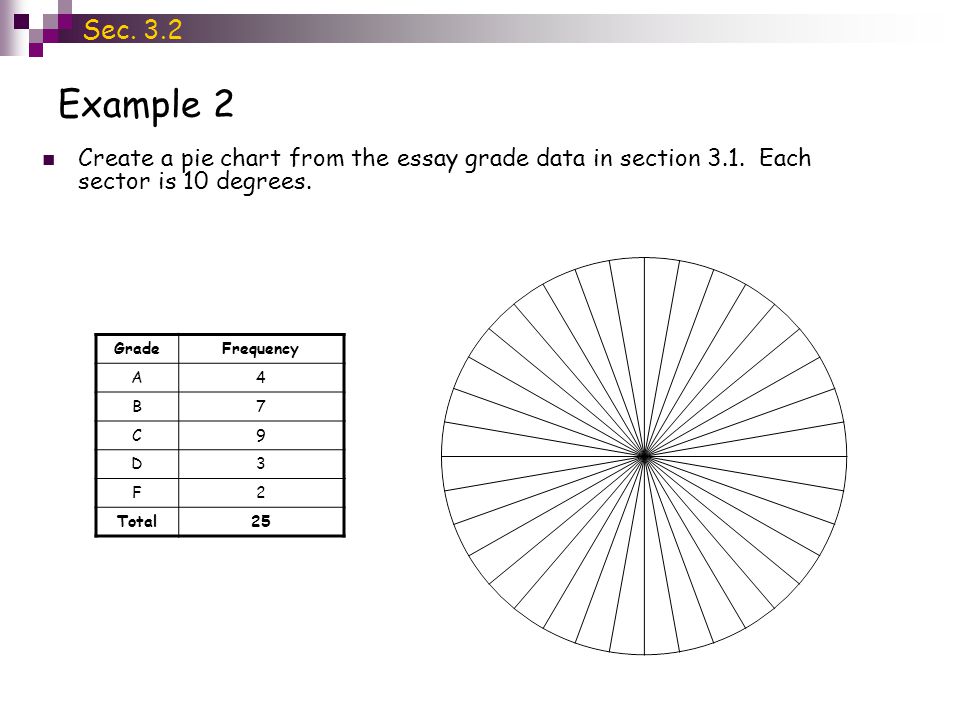
1. You will be using the above information to construct a pie chart below. The entire pie chart equals 100%. The pie chart has been divided into 36 equal pieces. Each piece of the pie equals 2.78%.
2. Calculate the number of pie pieces needed for Nitrogen, Oxygen and Other Gases. For example: Other Gases totals 1 % of the atmosphere, so 1% divided by 2.78% = 0.36 of a piece of the pie

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ pie pieces = 78% nitrogen

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ pie pieces = 21% oxygen

\_\_\_\_\_\_0.36\_\_\_\_\_\_\_ pie pieces = 1% other gases

1. Your graph needs to include: a title; labels and % values for: Nitrogen (78%); Oxygen (21%); Other Gases (1%); correctly sized pie pieces, each colored a different color.

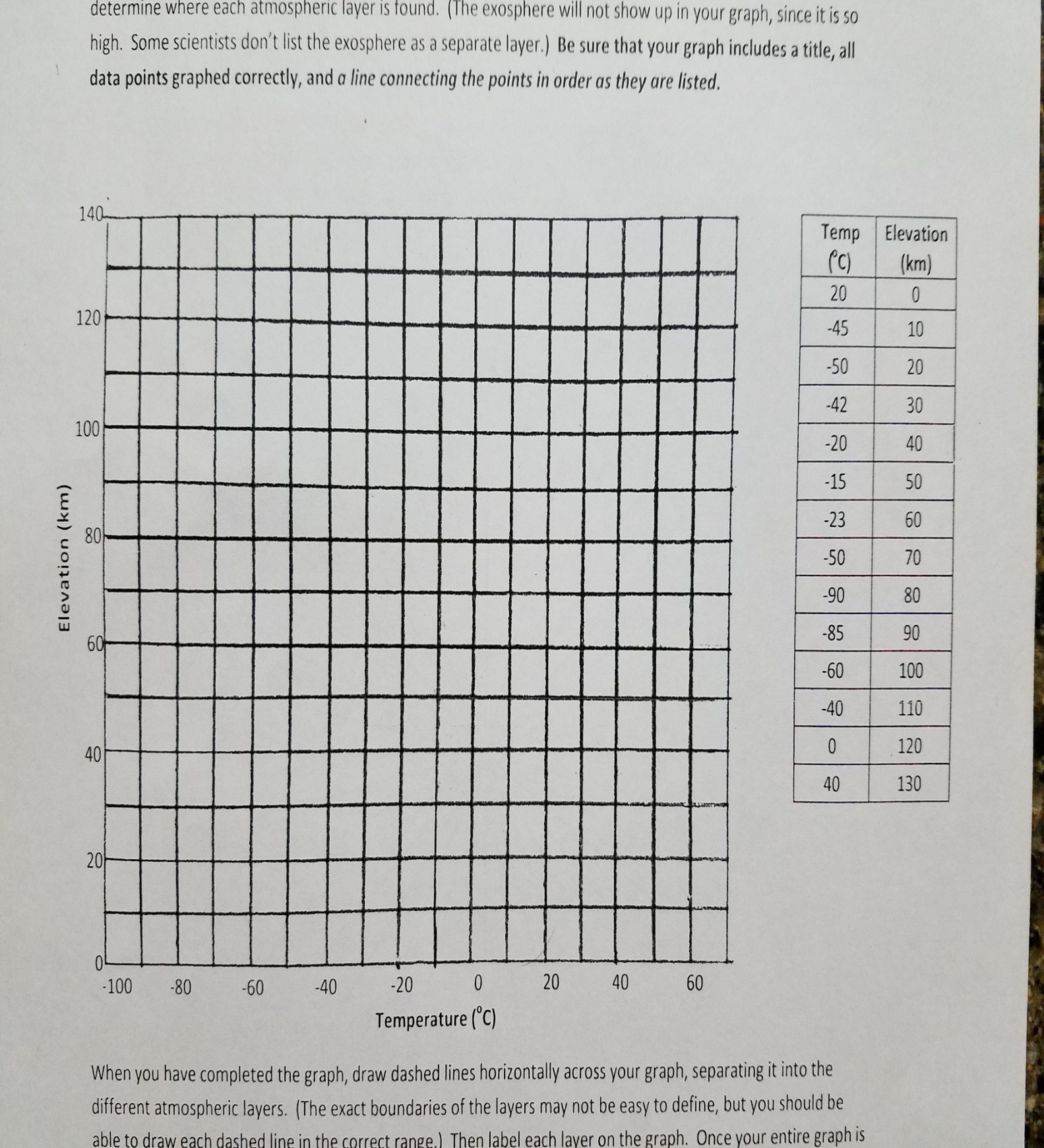
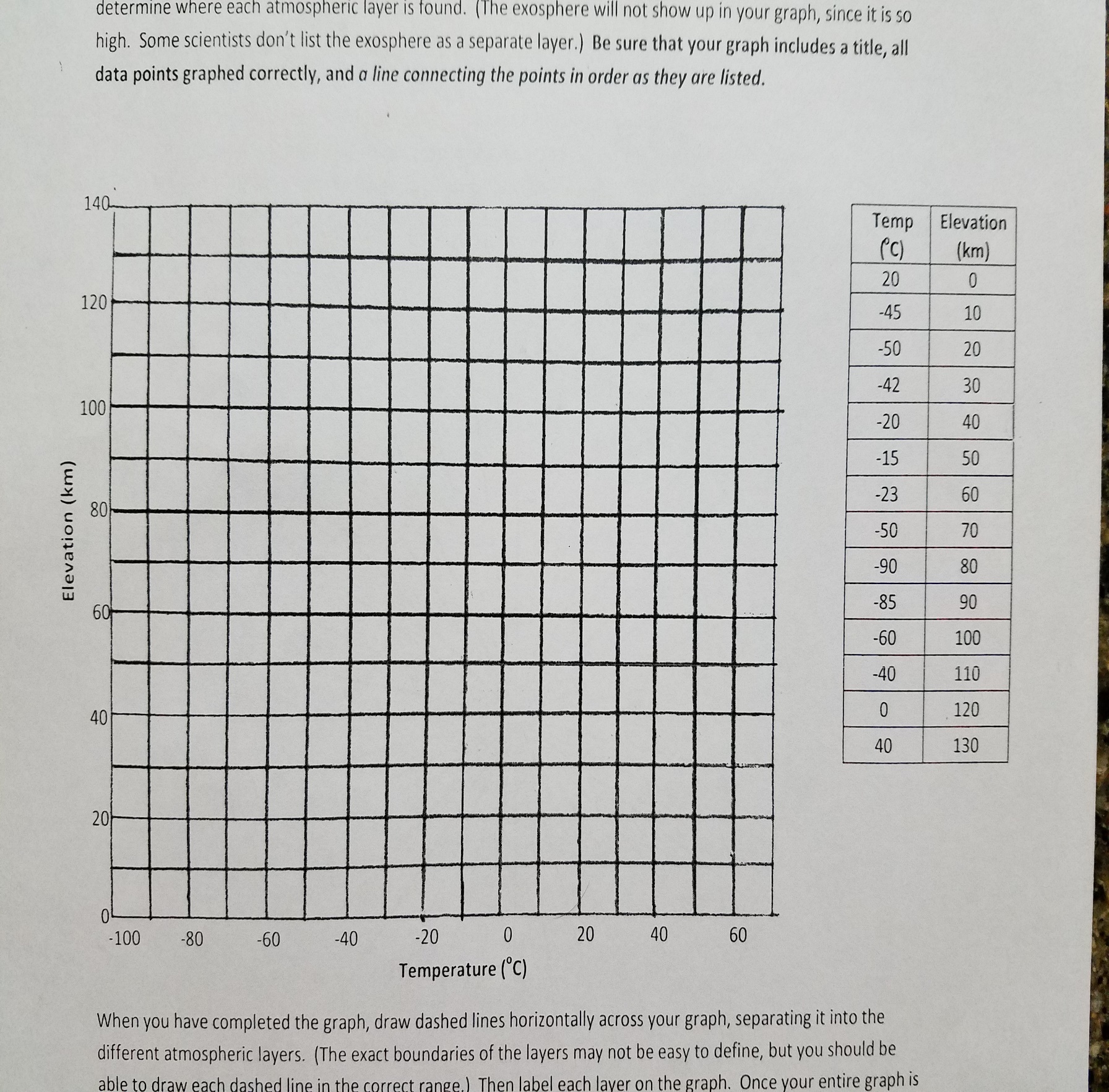
[](https://www.google.com/url?sa=i&rct=j&q=&esrc=s&source=images&cd=&cad=rja&uact=8&ved=2ahUKEwjI3dLg_8TaAhVkh-AKHfwiBCwQjRx6BAgAEAU&url=http://slideplayer.com/slide/5687813/&psig=AOvVaw35sHEOAp7mceYafqKR57LX&ust=1524181209330029)

**Part 2: Atmospheric Layers**

The atmosphere can be categorized into 4 different layers, based on significant changes in temperature that occur at certain heights above the earth’s surface. If you were to move upward through the atmosphere, you would notice a certain trend in air temperature, but you would notice that this trend reverses several times as you continue upward. Each time the trend reverses, you have passed into a new layer of the atmosphere. The layers of the atmosphere are (in order from lowest elevation to highest) the troposphere, stratosphere, mesosphere, and thermosphere.

**Directions**:

1. Plot the temperature data at increasing elevation to complete the graph of elevation versus temperature.
2. Be sure to do the following: title for the graph; all data points are plotted accurately; and a line connecting the points in order as they are listed.
3. After completing the graph, neatly draw three dashed lines horizontally across your graph to separate the different atmospheric layers based on the trends in temperature that occur as elevation increases. Then label each layer on the graph. Remember the troposphere is the lowest in elevation, then the stratosphere, mesosphere and finally the thermosphere.



0

-50

--5050

**Directions:** Answer the following questions using your completed graph.

1. According to your graph, in which layer of the atmosphere is the coldest air temperature found?
2. According to your graph, in which layer of the atmosphere is the warmest air temperature found?
3. According to your graph, the troposphere extends from Earth’s surface up to what approximate elevation?
4. The layers of the atmosphere are determined based on air temperature, which has to do with the energy of the molecules in the air. Where does this energy originally come from?
5. According to your graph, what happens to temperature as elevation increases within the stratosphere?

**Directions:** Read the “Layers of the Atmosphere” on the back of this packet and answer the following questions.

1. What reason does the ”Layers of the Atmosphere” reading give for the temperature trend in the stratosphere mentioned in question #5?
2. According to the reading, what causes layers of electrically-charged atoms to build up in the thermosphere?

Use the “Layers of the Atmosphere” reading and your graph to match the following facts with the correct layer of the atmosphere.

1. Troposphere b. Stratosphere c. Mesosphere d. Thermosphere
2. \_\_\_\_\_\_\_\_\_\_ Layer we live in and breathe
3. \_\_\_\_\_\_\_\_\_\_ Outermost layer
4. \_\_\_\_\_\_\_\_\_\_ Thinnest layer
5. \_\_\_\_\_\_\_\_\_\_ High concentration of UV-absorbing ozone
6. \_\_\_\_\_\_\_\_\_\_ Layer that contains the ionosphere layers
7. \_\_\_\_\_\_\_\_\_\_ Molecules here can escape into outer space
8. \_\_\_\_\_\_\_\_\_\_ Where almost all weather occurs
9. \_\_\_\_\_\_\_\_\_\_ Where magnetic storms called auroras occur

**Layers of the Atmosphere – Reading**

The atmosphere describes all the air surrounding the earth, from the ground all the way up to the edge of deep space. The atmosphere is composed of several layers, each defined because of the various phenomena which occur within the layer. These transitions are gradual, and most heights and measurements mentioned below refer to the average area of transition from one layer to another.

**Troposphere**

Oxygen and nitrogen make up the majority of the gases in the earth’s atmosphere, even at much higher altitudes. But it is the lowest level of earth’s atmosphere where the right mixture works to support life. Here, living things are also free from the radiation showers which flow down through most of the earth’s atmosphere.

Compared to the rest of the atmosphere, the troposphere is a tiny layer, with an average altitude of just 7 miles (11 km) above earth’s surface. Within this small layer almost all of our weather is created, such as the short term changes in temperature, wind, pressure, and moisture that we experience as part of our daily lives. The lowest altitudes are the warmest part of the troposphere, in part because the earth’s surface absorbs solar radiation and transfers this heat to the air. Generally, as altitude increases, temperature decreases steadily. Towards the top of the troposphere temperatures fall to an average low of -70 degrees F (-57 degrees C) and wind speeds increase significantly.

**Stratosphere**

The gradual change from the troposphere to the stratosphere begins at approximately 7 miles (11 km) high. The temperature in the lower stratosphere is extremely stable and cold at -70 degrees F (-57 degrees C). Here, strong winds occur as part of defined circulation patterns. High cirrus clouds sometimes form in the lower stratosphere, but for the most part there are no significant weather patterns in the stratosphere.

From the middle of the stratosphere and up, the temperature pattern undergoes a sudden change, sharply increasing with height. Much of this temperature change is due to increasing levels of ozone concentrations which absorb ultraviolet (UV) radiation.

**Mesosphere**

The transition to the mesosphere occurs at approximately 30 miles (50 km) above the earth’s surface. In this layer, temperature once again begins to fall as altitude increases, to temperatures as low as -130 degrees F (-90 degrees C) near its top, 50 miles (81 km) above the earth. Such extreme cold allows the formation of so-called noctilucent clouds, thought to be made of ice crystals clinging to dust particles.

**Thermosphere**

The transition from the mesosphere to the final layer, the thermosphere, begins at a height of approximately 50 miles (81 km). The thermosphere receives its name from the return to increasing temperature which can reach a staggering 3,600 degrees F (1,982 degrees C). These extreme temperatures are caused by the absorption of the sun’s shortwave ultraviolet radiation. This radiation penetrates the upper atmosphere, stripping atoms of their electrons and giving them a positive charge. Electrically charged atoms build up to form a series of layers within the thermosphere. These charged layers are often referred to as the ionosphere, which deflects some radio signals. Before the modern use of satellites, this deflection by the ionosphere was essential for long distance radio communication.

Beautiful auroras, also known as the Northern and Southern lights, occur in the thermosphere when solar flares from the sun create magnetic storms near the poles. These magnetic storms strip atoms of their electrons. Brilliant green and red light is emitted when the electrons rejoin the atom, returning the atoms to their original state. Even higher, above the auroras and the ionosphere, the gases of this final atmospheric layer begin to dissipate, until finally, several hundred miles above the earth, they fade off into the depths of space.