4. Atmospheric Regions

1. Can you name some examples of chemical elements?

What do these symbols stand for?

H	N	O	C
Ca	Mg	Hg	Na
Cl	Si	S	Fe
He	Ar	Ne	Cu

2. a) Which gases make up air and what are the proportions of the components?

b) Compare your answer with the text. Complete the text - 3 words will not be needed.

vapor	*pollutants*	*droplets*	*volume*	*gases*	*particulate*
frequent	*abundant*	*molecules*	*by-products*	*constituents*	

The air of the atmosphere is a mixture of many 1 _____ . In addition, the air holds many suspended liquid 2 _____ and solid particles. However, only two gases make up about 99% of the 3 _____ of air near the Earth. This air is composed primarily of nitrogen (78%) and oxygen (21%), with nitrogen being almost four times as 4 _____ as oxygen. Atmospheric nitrogen and oxygen are diatomic (two-atom) 5_____, N_2 and O_2. The other main 6 _____ of air are argon Ar (0.9%) and carbon dioxide CO_2 (0.03%). Minute quantities of many other gases are found in the atmosphere, along with 7 _____ matter. Some of these gases, especially water 8 _____ and carbon monoxide CO, vary in concentration, depending on conditions and locality.

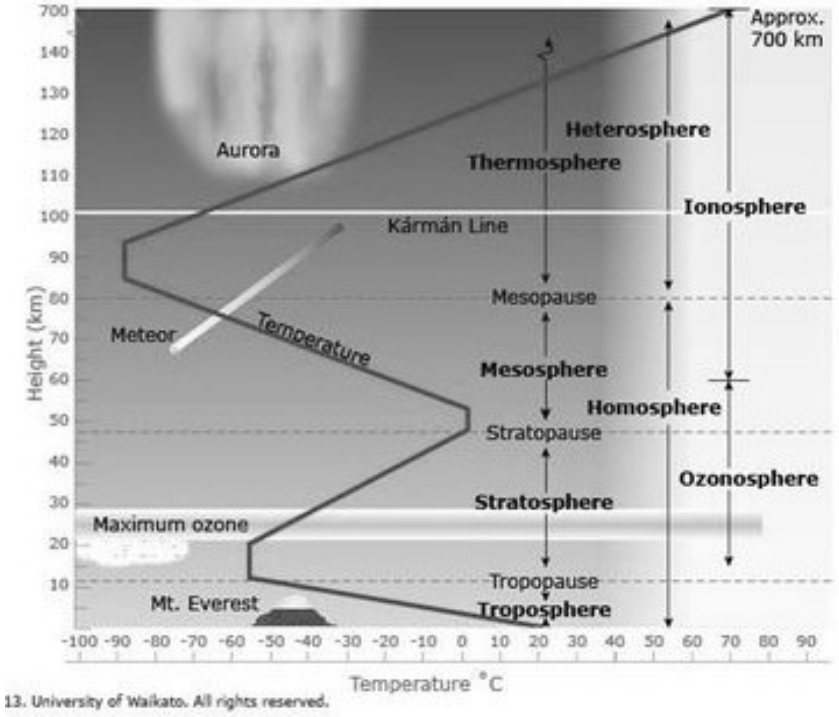
3. Work in small groups and discuss the tasks:

- What regions can the atmosphere be divided into?
- Characterize these regions

4. Describing a curve in a graph: give synonyms for these verbs.

1. GO UP I _ _ _ _ _ _ _ R _ _ _ G _ _ _
2. GO DOWN D _ _ _ _ _ _ _ F _ _ _ D _ _ _ D _ _ _ _ _ _
3. BE ON THE SAME LEVEL REMAINN C _ _ _ _ _ _ _ / REMAIN S _ _ _ _ _
4. BE CHANGEABLE F _ _ _ _ _ _ _ _

5. Study the diagram



1. Here are different criteria for dividing the atmosphere into parts. What are the different divisions according to:
   - The concentration of ozone and ions
   - Temperature variations
   - Uniformity of composition (how well the parts are mixed)
2. In which section is the greatest mass of the atmosphere? Why?
3. Into which part do you locate weather phenomena?
4. How does the temperature change in different divisions?
5. Where is the layer of maximum ozone amount?
6. Where do the auroras (beautiful displays of light) form?

WEATHER

Work in groups of 3, three experts on different topics. Each student has a different text on extreme weather conditions. Read your information and be prepared to answer questions about your topic. The others take turns and ask questions. The purpose is for everybody to complete these sentences.

1. Thunderstorms are produced by …….. columns of …….
2. …… clouds are produced by condensation from warm moist rising air.
3. These massive clouds extending 300 m or more are called ……..
4. They can produce a …… .
5. When ……, the resulting storm is called a thunderstorm.
6. Lightning is a flash of light produced because parts of a cloud have……
7. The lightning causes ……..
8. A blizzard is a …….. snowstorm with …… and …….. .
9. A tornado is a funnel of air that extends down from a …… cloud.
10. The winds in a tornado travel in a …… direction at speeds of up to 800 km per hour
11. When a tornado reaches a ground, it can cause ……. damage.
12. The funnel cloud of a tornado is usually only …… m or less in diameter.
13. Hurricanes are very large circular storms with wind speeds at least 64 knots (which is …… km/hr) and …….. at the center.

11. A hurricane is accompanied by …… and ……..
12. The diameter of a hurricane …… than that of a tornado.
16. Weather conditions in the center, or eye of the hurricane may be ……..

OZONOSPHRERE AND IONOSPHERE

1. Irregular verbs.

This pair of irregular verbs is hard to remember. Can you complete the forms and pronunciations?

Lie [ ] ……. [ ] ……. [ ]
Lay [ ] ……. [ ] ……. [ ]

2. Pronunciation

ion [ ], positive ion is called ……. [ ], negative ion is …….. …[ ]
aurora [ ]

3. Match the words and the description of their meanings.

associate ionize charge discharge ionization dissociate charged

1. property of matter responsible for electric phenomena
2. having an amount of electricity
3. the release of stored energy by a flow of electricity
4. to link or connect
5. to separate or cause to break
6. to change into ions
7. separation into ions by heat, electrical discharge or chemical reaction

4. Work in pairs. One student reads text A and the other reads text B. After reading, underline the key information in your text. Use the underlined parts to explain your partner three facts about your topic.

A The atmosphere may be divided into two parts based on regions of concentration of ozone and ions; the ozone region lies below the ion region. Ozone O_3 is formed by the dissociation of molecular oxygen O_2 and the combining of atomic oxygen O with molecular oxygen:

$$O_2 + \text{energy} \longrightarrow O + O$$
$$O + O_2 \longrightarrow O_3$$

At high altitudes, energetic ultraviolet radiation from the Sun provides the energy necessary to dissociate the molecular oxygen. Oxygen, however, is less abundant at higher altitudes, so the production and concentration of ozone depend on the appropriate balance of UV radiation and oxygen molecules. The optimum conditions occur at an altitude of about 30 km, and in this region is found the central concentration of the ozone layer. The ozone layer is warm, broad band of gas that extends through nearly all the stratosphere.

The ozone layer in the stratosphere acts as an umbrella that shields life from harmful ultraviolet radiation from the Sun by absorbing most of the short wavelengths of this radiation. The portion of UV radiation that gets through the ozone layer burns and tans our skin in the summer and may cause skin cancer. Were it not for the ozone, we would be badly burned and would find the sunlight intolerable.

Relatively little ozone is found at the Earth's surface. This gas is easily detected by distinct, pungent smell. It is formed by electrical sparkling discharges and sometimes it is classified as pollutant. It is found in relatively high concentrations resulting from photochemical reactions of air pollutants. Such reactions give rise to photochemical smog.

B In the upper atmosphere above the ozonosphere, energetic particles from the Sun cause the ionization of gas molecules. For example,

$$N_2 + \text{energy} \longrightarrow N_2^+ + e^-$$

The electrically charged ions and electrons are trapped in the Earth's magnetic field and form ion layers in the upper region of the atmosphere, called the ionosphere.

Variations in the ion density with altitude give rise to the labeling of three regions or layers – D, E, and F. The D layer strongly absorbs radio waves below a certain frequency. Radio waves with frequencies above this value pass through the D layer but are reflected by the E and F layers, up to a limiting frequency. Thus the ionosphere provides global radio communications via the reflection of waves from ion layers. (Today, satellites relay many radio and television communications.)

Solar disturbances, which produce a shower of energetic particles, are also associated with beautiful displays of light in the upper atmosphere of the polar regions. In Northern Hemisphere, these are called northern lights, or aurora borealis. Light displays of equal beauty occur in the southern polar atmosphere and are called aurora australis.

In general, the ions and electrons trapped in the Earth's magnetic field are deflected toward the Earth's magnetic poles (our polar regions) over which the majority of auroras occur. However, auroras are sometimes observed at lower altitudes. The emission of light is associated with the recombination of ions and electrons. Energy is needed to ionize; and on recombining, energy is emitted in the form of visible light, or radiation.

Source Shipman, Wilson, Todd p. 530

LISTENING Aurora Borealis Explained

https://www.youtube.com/watch?v=1DXHE4kt3Fw

1. Watch a video prepared by the Department of Physics, University of Oslo, explaining what auroras are and where they come from. Answer the questions in the table below.

1. Where do the auroras start?	
2. In high temperature and pressure, hydrogen atoms change into	
3. Heat moves to the surface in convection cells, which are huge	
4. What appears on the Sun when surface cools?	
5. What happens with plasma when the Sun's magnetic field breaks?	
6. Solar storm can reach this speed	km/hour
7. Solar storm reaches the Earth after	hours
8. The magnetic fields create a path for the gas - of this shape	

2. Express these sentences in English. Then watch again and check your translation.

a) Slunce se chová jako obří elektrárna.
b) Jaderná reakce uvolňuje energii.
c) Světlo vyzařuje ven z jádra Slunce.
d) Elektricky nabitý plyn se nazývá plazma.
e) Magnetické pole Země odkloní sluneční bouři.
f) Plyn ze sluneční soustavy proudí podél siločar k pólům.