Earth's atmosphere

Learning objectives

1 Name the distinct layers of Earth's atmosphere.

2 Analyse data on the composition and temperature of Earth's atmosphere.

3 Explain the role of the atmosphere for sustaining life on Earth.

Introduction

The Earth's atmosphere is a mixture of gases that surround the Earth and are held in place by gravity. Scientists have divided the atmosphere into distinct layers based on how the temperature changes within those layers. Earth's atmosphere sustains life by providing breathable air, shielding us from UV radiation and regulating temperature.

Understanding the atmosphere is crucial as it helps us predict and respond to changes in weather patterns, climate change and air quality, enabling us to make informed decisions to protect our environment and wellbeing for the future.

Instructions

- This is a Directed Activity Related to Text (DART). Read the fact sheet and look at the infographic poster before attempting to answer the questions.
- Use your own knowledge and understanding, as well the resources provided, to answer the questions.
- Using the data in the table provided, complete the calculations about the Earth's atmosphere.

Questions

1. Earth's atmosphere is made up of distinct layers. Name the five main layers, starting from the surface and moving outwards.

2. How does the ozone layer protect life on Earth?
Hint: refer to UV radiation in your answer.

3. Choose the correct terms to explain differences between the composition of the Earth's early atmosphere and today's in terms of the most abundant gases.
   - Earth's early atmosphere had **more / less** carbon dioxide than today's.
   - Earth's early atmosphere had **more / less** oxygen than today's.

4. Why did the level of carbon dioxide in the atmosphere decrease with time?

Hint: think about plants and the role of carbon dioxide.

5. Describe the organisms that lived on Earth before the increase in oxygen gas.
Hint: think about the simplest type of living organism.

6. Name the hottest layer in the atmosphere.

7. Explain, in your own words, why this layer is the hottest.

Hint: look at the diagram and see where this layer is positioned. Include UV radiation in your answer.

8. Describe and explain **one** factor that causes an increase in carbon dioxide in the atmosphere, leading to global warming.

9. Suggest a way to reduce carbon dioxide in the atmosphere.

Hint: Think about your answer to question 8.

10. Imagine travelling back in time to the early Earth, over 4 billion years ago. As you step out of your time machine, you find yourself in a world vastly different from today. Describe what you see using the sentence starters below.

The air is thick with a toxic mix of gases including _____

_____

_____

_____

_____

Earth's surface is covered in volcanoes which _____

_____

_____

_____

_____

Over 24 hours the temperature changes _____

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_____

_____

_____

The UV radiation is _____

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_____

_____

_____

Life on Earth is _____

_____

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_____

Earth's atmosphere today: data analysis and calculations

Layer	Altitude (km)	Pressure (kPa)	Temperature (°C)	Nitrogen (%)	Oxygen (%)	Traces of ammonia and methane (%)
Sea level	0	101.3	15	78.08	20.95	1
Troposphere	12	26.5	-50	78.08	20.95	1
Stratosphere	50	5.5	-55	78.08	20.95	1
Mesosphere	80	0.001	-90	78.08	20.95	1
Thermosphere	700	0.0003	2000	78.08	20.95	1
Exosphere	10,000	0	1000	Trace	Trace	Trace

Table: data from NASA's 'Earth Atmosphere Model'

1. Calculate the temperature difference between sea level and the top of the troposphere, using the table.

Hint: read the table and write down the number for the temperature at sea level. Then subtract the value for the troposphere. Take care when subtracting a negative number.

2. Arrange the layers in order of increasing temperature, using the table.

Hint: the lowest temperature is the one that has a minus sign and is furthest from zero: -90°C mesosphere.

3. State what happens to the pressure in kPa as the altitude in km increases. Circle the correct answer.

As the altitude in km increases, the pressure in kPa **increases / decreases.**

4. If there are 1,000,000 molecules of air at sea level, calculate how many of these are oxygen molecules.

Hint: number of oxygen molecules = the percentage of oxygen at sea level x the total number of molecules.

To convert the percentage to a decimal, divide by 100.