Change throughout the history of Life.
A summary of content covered

1. Changes in the atmosphere
2. Changes in climate
3. Geological events
4. Biogeography
Changes in the composition of the atmosphere

*Increase in the Oxygen Levels.*

It is believed that between 4 to 6 million years ago there was little or no oxygen on earth.

The lack of oxygen allowed for the formation of organic molecules.

Can you name some organic molecules?

Prokaryotes developed about 3.5 billion years ago.

They did not need oxygen for their activities.

They undergo anaerobic respiration. Can you explain what this means?
Changes in the composition of the atmosphere
*Increase in the Oxygen Levels.*

Different types of bacteria began to develop about 3.5 to 2.5 billion years ago. These bacteria included the blue-green bacteria. The blue –green bacteria are special because they can photosynthesize. Remember during photosynthesis carbon dioxide is taken in and oxygen is given off. This means that the levels of oxygen increased.
Changes in the composition of the atmosphere

Increase in the Oxygen Levels.

As the levels of oxygen increased more and more oxygen dependent organisms developed.
These are organisms that respire aerobically.

Can you explain what this means?
Scientists believed that a lack of oxygen lead to the development of life, but the presence of oxygen lead to a diversity of organisms.

This means that as the oxygen levels on Earth increased, more different types of organisms that needed oxygen for respiration developed.
Cooling of the Earth

The Ice Ages

The ice ages are described as long periods of time when the earth experienced extreme cold.

Four ice ages have been identified since the formation of earth. These four ice ages occurred:

a) 700 million years ago
b) 320 million years ago
c) 286 million years ago
d) 3 million years ago (this is the current ice age.)
Cooling of the Earth
The Ice Ages

Large sheets of ice were formed. These large sheets of ice are called glaciers. The process during which these glaciers are formed is called glaciation.

The glaciation and the sudden cooling lead to very low temperatures. These temperatures were so low that they did not support life.

This led to the death of many life forms.
Cooling of the Earth
The Ice Ages

Scientists believed that glaciation were caused by a number of factors.

Some of these factors are:
- the changing positions of continents,
- the upward movement of the continent blocks,
- the reduction of carbon dioxide in the atmosphere and
- the changes in Earth’s orbit.
All continents were once one big land mass called Pangea.

Pangea was also called a super continent.
Continental drift
Break up of Pangea

Between 225-200 million years ago Pangea started to break up into two large masses.
They were called **Laurasia** in the northern hemisphere and **Gondwanaland** in the southern hemisphere.
Continental drift
Break up of Gondwanaland

Gondwanaland then broke up into South America, Africa, Madagascar, Australia, India and Antarctica.
Continental drift
Break up of Laurasia

Laurasia then broke into the continents of the northern hemisphere.
These were North America, Europe, the Middle East, Asia and China.
Continental drift
Theory of Continental Drift.

This theory also says that Antarctica was once close to the Equator.
It had a temperate climate, with lush, swampy vegetation. Coal deposits found in Antarctica proved this idea, because these coal deposits came from tropical plants. The land mass underwent rapid cooling as it drifted towards the south pole.
This rapid cooling led to the formation of large masses of ice. These masses of ice were called glaciers.
Continental drift
Theory of Continental Drift.

The life forms became \textit{extinct} due to the lower temperatures.
This was extinction on a large scale, called \textit{mass extinction}.
It is believed that the first large scale extinction took place 438 million years ago.
This large scale extinction is associated with the rapid glaciation that occurred around that time.
Diagram to show the continental drift from start to the present day.
Evidence from Biogeography

A discussion

**Biogeography** can be defined as the past and present distribution of individual species.

Similar geological structures and identical plant and animal species in both Africa and South America is used as evidence that these continents were once joined.

It is also believed that Madagascar and Africa were once joined because of similarities between some species.
The Theory of Plate Tectonics

The theory of plate tectonics arose from the theory of continental drift.

According to this theory the Earth is made up of large plates that fit together like a jigsaw puzzle. There are about a dozen of these plates. These plates are able to move apart because they lie on top of hot material.
The Theory of Plate Tectonics

The Ice Ages

The plate movement sometimes cause upward movements of the large continental blocks.

It is believed that the continents rose about 600 meters over the past 15 million years.

This upward movement caused climate changes which led to the extreme cold of the Ice Ages.
Volcanic Activity
Cause of mass extinctions

It is believed that the three greatest mass extinctions were caused by volcanic activity.

Large clouds of rock and lava were thrown up into the air during the volcanic activities.

This would have lead to the sudden death of the life forms.
Fossil Evidence

What are fossils?

The study of fossils is called **paleontology**.

The remains of ancient life forms that have been preserved in rock are called **fossils**.

Remember, though that fossils are also found in **ice, tar and the dried sap of trees**.
The picture alongside is of the Ammonites. They were coiled molluscs that swam or floated in the sea. They belong to the same group as the octopus. However they are extinct. What does this mean?

This picture shows the fossil of the Trilobites. These are marine arthropods. They are distantly related to lobsters and crabs. All Trilobites are extinct.
Marine molluscs with two shells are called **bivalves**. The two shells are **mirror images** of each other and they are **hinged at one end**. **Scallops** are examples of bivalves.

The picture alongside is of a **whale fossil**.
Fossil Evidence
Fossil evidence in South Africa.

Fossils of bivalves and Ammonites have been found in the Makhatini Flats which are in Kwa Zulu Natal.

Trilobite fossils have been found in the Karoo.

Whale fossils have been found in the Sarah Desert.
Fossil Evidence
What does the presence of these fossils in these areas mean?

Remember that these are marine fossils, meaning that they were found in the oceans.

It means that these areas in which these fossils were found were once covered by the ocean.

The extinct organisms are no longer alive today and they may look very different from the present day organisms, examples of such extinct organisms are the Ammonites and Trilobites.

Since the bivalves are still in existence today and existed millions of years ago it means that some organisms did not change much over millions of years.
Terminology
Here are some terms that you should know.

**Marine fossils**, they were fossils that were found in the oceans.

**Bivalves** are marine molluscs with two shells.

**Trilobites** are marine arthropods that are distantly related to lobsters and crabs.

**Ammonites** are extinct coiled molluscs that swam or floated in the sea.

**Paleontology** is the study of fossils.

**Fossils** are the remains of ancient life forms that have been preserved in rock.
Terminology
Here are some terms that you should know.

The **theory of Plate Tectonics** states that the Earth is made up of large plates that fit together like a jigsaw puzzle.

**Biogeography** can be defined as the past and present distribution of individual species.

**Extinct** when there is no reasonable doubt that the last individual of the species has died.

**Extinction** is the process by which plants or animals die off so that not even one individual member of the entire species exists.

**Mass extinction** was extinction that took place on a large scale.
Terminology
Here are some terms that you should know.

**Glaciation** is the process during which these glaciers are formed.

**Glaciers** are large masses of ice.

**Pangea** is the name given to the one big land mass that was made up of all the continents.

**Laurasia** the large continent in the northern hemisphere that arose when Pangea broke up.

**Gondwanaland** was the large continent in the southern hemisphere that was formed when Pangea broke up.
Terminology
Here are some terms that you should know.

Ice ages are described as long periods of time when the earth experienced extreme cold.

Aerobic respiration is respiration that occurs in the presence of oxygen.

Anaerobic respiration is respiration that occurs in the absence of oxygen.

Prokaryotes are organisms that do not have true nuclei.
Something for you to do:

1. The original land mass that spilt up into two continents is known as:
   A. Laurasia
   B. Pangea
   C. Gondwanaland
   D. Earth
2. The process of the formation of large sheets of ice is called...
   A. Glaciation
   B. Glaciers
   C. Iceation
   D. Ice age
3. The theory that suggests that the Earth is made up of large plates that fit together like a jig-saw puzzle...
   A. Continental drift
   B. Mass extinction
   C. Theory of Plate Tectonics
   D. Paleontology
4. The period described as long periods of time when the earth experienced extreme cold.
   A. Ice age
   B. Glaciation
   C. Mass extinction
   D. Iron age
5. The large continent in the northern hemisphere that arose when Pangea broke up.
A. Gondwanaland
B. Laurasia
C. Pangea
D. Earth
6. The marine arthropods that are distantly related to lobsters and crabs are called...

A. Bivalves
B. Ammonites
C. Whales
D. Trilobites
7. Type of respiration that occurs in the absence of oxygen is called...
   A. Aerobic
   B. Anaerobic
   C. Photosynthesis
   D. None of the above
8. The past and present distribution of individual species...
   A. Biogeography
   B. Continental drift
   C. Paleontology
   D. Ice age
9. The large continent in the southern hemisphere that was formed when Pangea broke up.
A. Gondwanaland
B. Laurasia
C. Earth
D. Africa
10. Extinct coiled molluscs that swam or floated in the sea.
   A. Bivalves
   B. Trilobites
   C. Whales
   D. Ammonites
11. Organisms that do not have true nuclei.
   A. Eukaryotes
   B. Prokaryotes
   C. Macro organisms
   D. Animals
12. Large masses of ice.
   A. Glaciers
   B. Ice caps
   C. Poles
   D. Antarctica
13. The remains of ancient life forms that have been preserved in rock.
   A. Amber
   B. Tar
   C. Skeleton
   D. Fossils
14. Fossils that were found in the oceans
A. Marine
B. Aquatic
C. Terrestrial
D. Ocean
15. Respiration that occurs in the presence of oxygen.
   A. Photosynthesis
   B. Respiration
   C. Aerobic
   D. Anaerobic
16. When there is no reasonable doubt that the last individual of the species has died.
A. Extinct
B. Extinction
C. Mass extinction
D. None of the above
17. The process by which plants or animals die off so that not even one individual member of the entire species exists.
A. Mass extinction
B. Extinction
C. Extinct
D. None of the above
The study of fossils...
A. Paleontology
B. Biogeography
C. Mass extinction
D. Both A and B
19. Fossils of ammonites and bivalves are found in...
   A. Makhatini Flats
   B. Karoo
   C. Sarah
   D. Namib
20. Super continent that broke up 225-200 million years ago...
   A. Laurasia
   B. Gondwanaland
   C. Pangea
   D. Both A and C
Solution

1. A
2. A
3. C
4. A
5. B
6. D
7. B
8. A
9. A
10. D
11. B
12. A
13. D
14. A
15. C
16. A
17. B
18. A
19. A
20. C