



GRADE 9

TERM 4

PLANET EARTH AND BEYOND

LEARNER ACTIVITIES

2021

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NB: The table of contents will continuously be changed.

Visit (<http://www.mstworkbooks.co.za/natural-sciences/gr9/tableofcontents.html>)

1. THE EARTH AS A SYSTEM

Key words

Systems: the number of components working together for a common purpose.

Biosphere: Consists of all living plants and animals and their interactions with rocks, soil, air and water

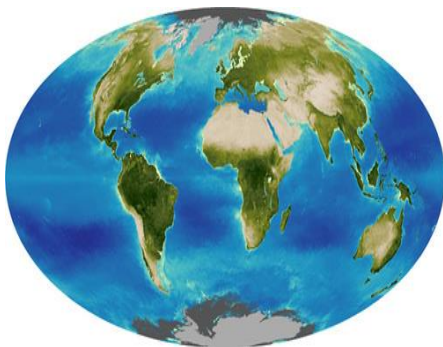
Hydrosphere: Water in all its forms

Lithosphere: Rocks on earth's crust and upper part of the mantle.

Atmosphere: A layer of gases around the earth

Earth system

- A system is components working together to achieve a common goal.
- Different components of the earth are water, gas, soil and rocks.
- **Biosphere** is the sphere of life with plants and animals, this sphere involves all other 3 spheres.



- **Hydrosphere** comprises water in all its forms (oceans, lakes, rivers, ground water, glaciers and ice caps). 70% of the surface of the Earth is covered with water



An iceberg and a sea



A river



Clouds

- **Lithosphere** the Earth's crust and upper part of the mantle



Rock Formation



Sand dunes



Soil



Mountains

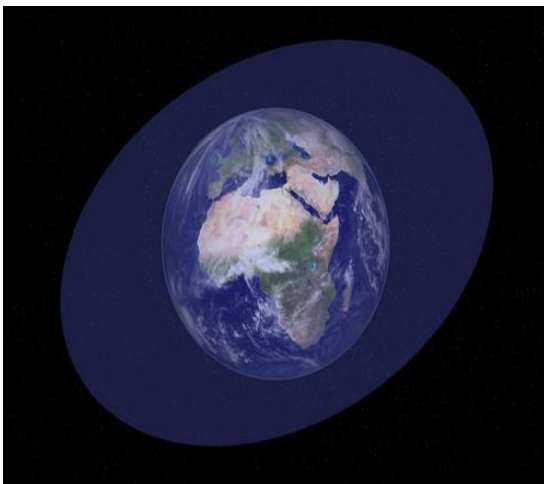


Minerals

- **Atmosphere** all the air above the surface of the Earth up to space.



Top of the Earth's atmosphere



The region of Space occupied by the atmosphere

https://www.youtube.com/watch?v=Y0AOg_fPkog

ACTIVITY 1 Interaction between the spheres

<https://www.youtube.com/watch?v=6j5iHvYBlcg>

INSTRUCTIONS:

1. Study the photo of thorn trees on the savannah.
2. Answer the questions that follow.



Thorn trees.

QUESTIONS:

Identify the four different spheres of the Earth in the example.

What will happen if the trees do not get enough water?

Describe the interaction between the hydrosphere and the biosphere in this example.

What will happen if the carbon dioxide levels change dramatically?

Describe the interaction between the atmosphere and the biosphere in this example.

Is there any interaction between the lithosphere and the hydrosphere in this example?

Use the example you have chosen in the previous activity (Exploring the spheres of the Earth) and describe three different interactions between the different spheres.

Practical activity

Developing a collage on spheres of the Earth

Take three A4 pages

Divide two of the pages into 2 parts, you will be having 4 parts and one full page

Paste all three pages on a cardboard.

In each part have a picture of each of the 4 sphere

On a separate page explain how each sphere support life for plants and animal

Hydrosphere

Support for plants

(2)

Support for animals

(2)

Lithosphere

Support for plants

(2)

Support for animals

(2)

Atmosphere

Support for plants

(2)

Support for animals

(2)

THE LITHOSPHERE (THE SPHERE OF ROCKS AND SOIL)

Key words

Rock cycle how the rock is formed, disintegrate and be formed again.

Inner core the innermost solid part of the Earth it is situated at the centre

Outer core the liquid part that surround the inner core

Mantle a layer above the core of the earth

Crust a layer surrounding the crust

Sedimentary rock when small stones that have been washed away and deposited as sediments solidify

Metaphonic rock A rock that have changed from their original form due to high pressure and heat

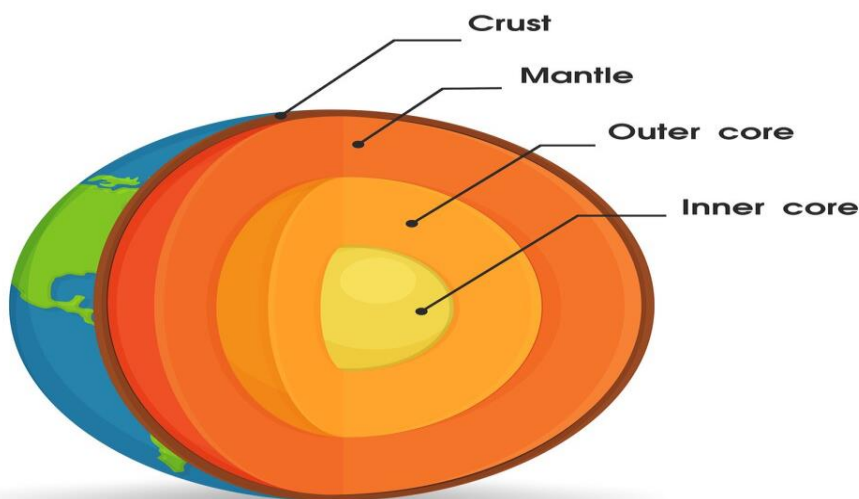
Magma as metaphonic rocks that melts as it moves deeper towards the centre of the Earth

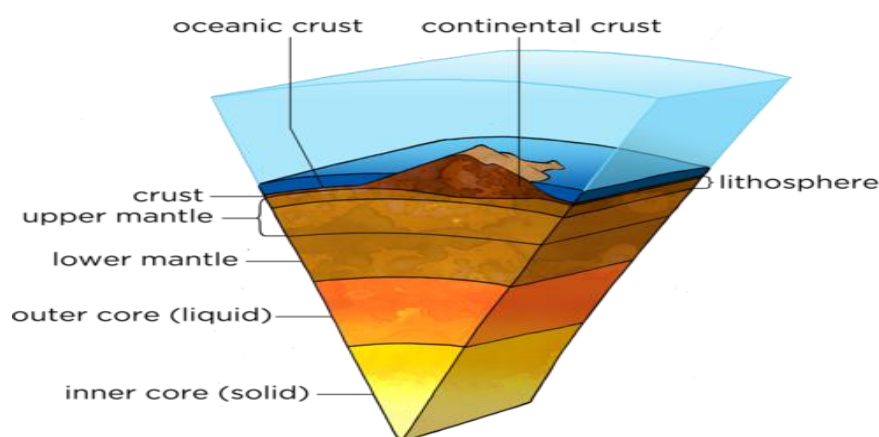
As magma moves through volcanic pipes it cools down and form **Igneous rock**

The upper part of the core and the crust form the **lithosphere**

Layers of the Earth and the Lithosphere

<https://www.youtube.com/watch?v=i6wsxFtgGQU>





NB Check where the lithosphere is located

POSSIBLE PRACTICAL ACTIVITY 2

- | | |
|---|---|
| 1. Make round ball of paper Mache | 2 |
| 2. Cut it into half. | 2 |
| 3. Use three different painting to illustrate core, mantle and crust. | 6 |

The rock cycle

Many natural activities are taking place at the lithosphere, i.e. pressure, heat, weathering, chemical reactions which lead to the formation of different rocks.

There are basically three types of rocks namely:

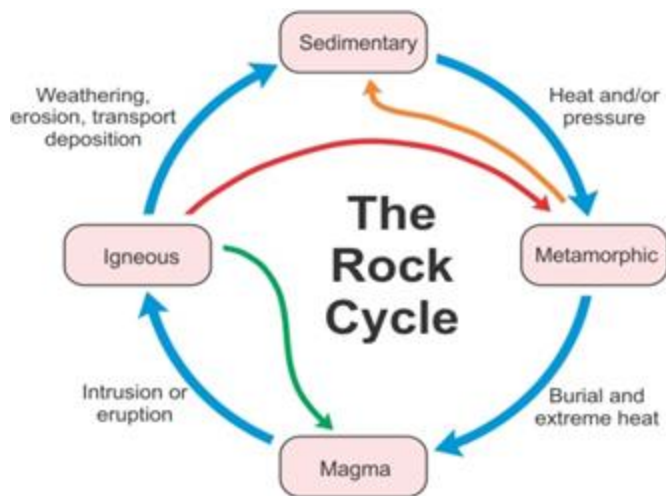
- i. Sedimentary rock,
- ii. Metamorphic rock and
- iii. igneous rock

Rocks are formed, broken down and reform over long periods of time.

<https://www.youtube.com/watch?v=7CnjoCu1154>

Different rock formation

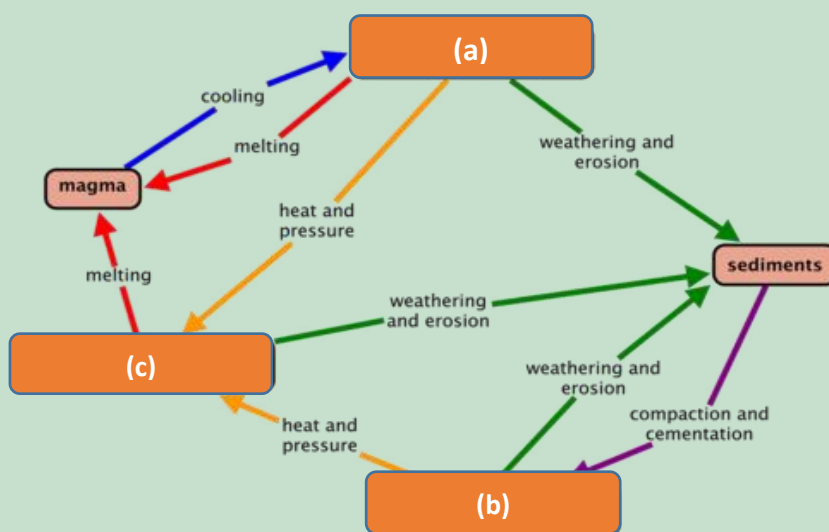
1. Wind and water wash the sands and deposit them in oceans and lakes as **sediments**, this process is called **deposition**. As more and more sediments are deposited there is more pressure which compact at the bottom and lead to formation of **sedimentary rocks**.
2. When this process continues as the sedimentary rocks get compacted and move deeper beneath the surface of the Earth, **heat and pressure leads to change in chemical reactions leading to the formation of metamorphic rocks**.
3. As the process continues metamorphic rocks move deeper into the Earth melt and become **magma**. Hot magma cools down on its way to the surface and forms **igneous rock**, magma can break down on the surface of the earth as **lava** in **volcanoes**.



Activity 2. Summarising the rock cycle

QUESTIONS:

1. Complete the diagram by filling in which type of rock belongs where: Sedimentary rock, Metamorphic rock, Igneous rock.



2. Name the process by which igneous rock is formed.
3. Which type(s) of rock form sediment?
4. What conditions are needed for metamorphic rock to form?

5. Explain what 'weathering and erosion' of rock mean.

6. Explain what 'compaction' means.

7. What type of rock is formed through compaction?

8. What is magma? Explain the role of magma in the rock cycle.

THE ATMOSPHERE

Key words

Troposphere: The atmospheric layer just above the Earth's surface.

Stratosphere: The atmospheric layer above the troposphere

Mesosphere: The atmospheric layer above the stratosphere

Thermosphere: The atmospheric layer above the Mesosphere

Exosphere: The outermost sphere where there is less or no force of gravity.

Greenhouse effect: The natural phenomenon of warming the Earth so as to sustain life on it.

Composition of the atmosphere

The mixture of gases held around the Earth by gravity

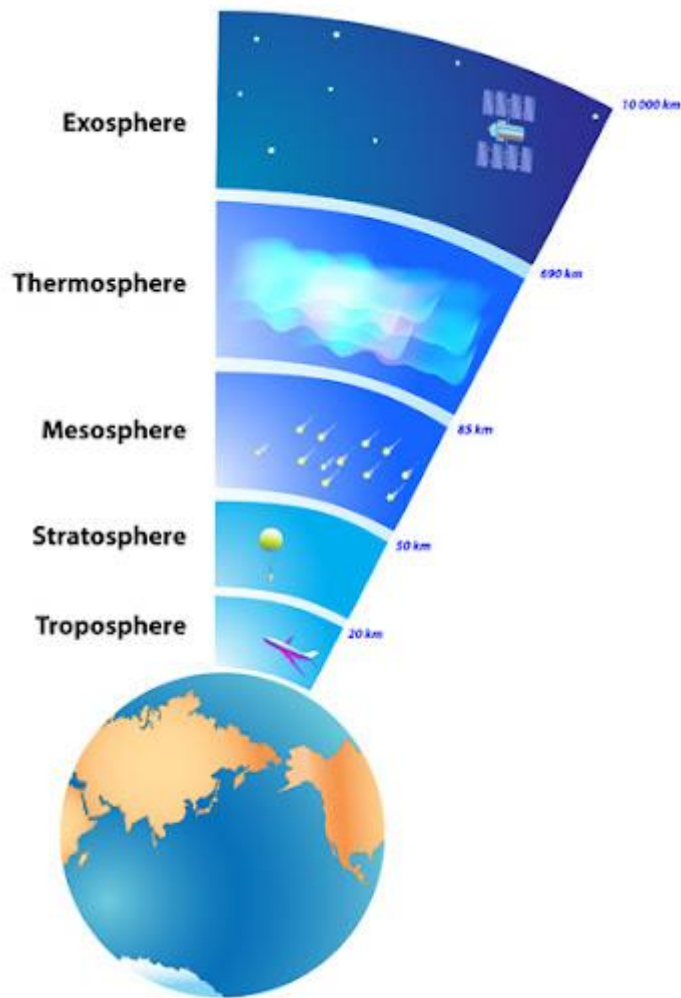
The mixture consists of 78% nitrogen, 21 % oxygen, less than 1% carbon dioxide and other gases less than 1 %.

As one moves, away from the surface of the Earth, density of the gas particles decreases.

There are basically 4 layers of the atmosphere bound by gravity: troposphere, stratosphere, mesosphere and thermosphere with different temperature gradient.

https://www.youtube.com/watch?v=Y0AOg_fPkog

The fifth uppermost layer which is the exosphere experiences none or less gravity hence we will not discuss it.



Temperature gradient is how temperature changes with height above sea level

Layers of the atmosphere

Troposphere

This layer stretches from sea level to approximately **10 KILOMETRES**

This is the densest and the heaviest layer of the atmosphere

It contains 70% of the mass of the atmosphere

Plants and animals live on this layer

Weather occurs on this layer

The temperature decreases as the distance from the surface of the Earth increases

Stratosphere

This layer stretches from **10 to 50 KILOMETRES** above sea level.

Some of the Aeroplanes fly at this level

It had a band of ozone gas (O₃) which absorbs ultraviolet light

This absorption increases the temperature of the stratosphere, thus protecting animals and plants from too much radiation.

Mesosphere

This layer stretches from about **50 – 80 KILOMETRES** above sea level.

The air is extremely thin and very cold.

There is still enough air to burn small rocks entering from space.

This rocks are visible from the Earth and we know them as shooting stars

Thermosphere

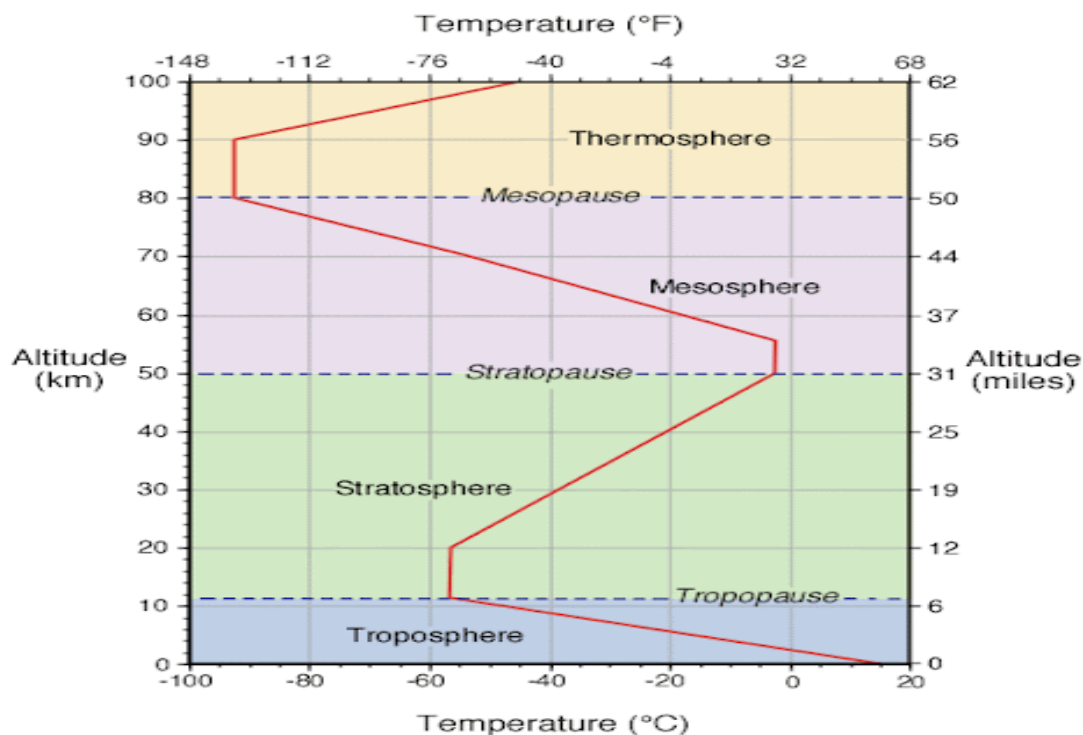
This layer starts from about **80-350 KILOMETRES** above sea level.

At 350 Kilometres this layer diminishes and the empty space starts.

The international Space Station (ISS) is above this layer at 370 kms.

Ultraviolet radiation and dangerous X-rays from the sun are absorbed at this sphere.

Radio waves are reflected back to earth for TV and radio broadcast.



Complete the table below

Activity 3

Type of sphere	Altitude range above sea level	Unique 2 activities at the sphere	Temperature range
Troposphere	1	2	1
Stratosphere	1	2	1
Mesosphere	1	2	1
Thermosphere	1	2	1
Total 16	4	8	4

The greenhouse effect

The greenhouse effect is a natural phenomenon that warms the atmosphere sufficiently to sustain life.

There most common greenhouse gases are carbon dioxide, methane gas and water vapour

These gases trap ultraviolet radiation which then warms the air around the Earth

Damage to this layer can lead to global warming which would cause:

Climate change

Rising sea level

Food shortages

Mass extinction

<https://www.youtube.com/watch?v=SN5-DnOHQmE>

ACTIVITY 4: effects of climate change

Explain with one examples on each how the following would affect life on Earth.

i. Climate change

ii. Rising sea level

iii. Food shortages

iv. Mass extinction

v. What are different Governments of the world doing about this.

vi. Name one organisation that focuses on climate change

Mining of mineral resources

Key words.

Mining is a process of extracting valuable minerals from the Earth

Ores Rocks from which people extract valuable minerals are called

Opencast mining where extraction of minerals take place on the surface.

Underground mining where extraction of minerals occurs underground.

Remote sensing is the term used to gain information from a distance

Geophysical methods make use of geology and the physical properties of the minerals to detect them underground

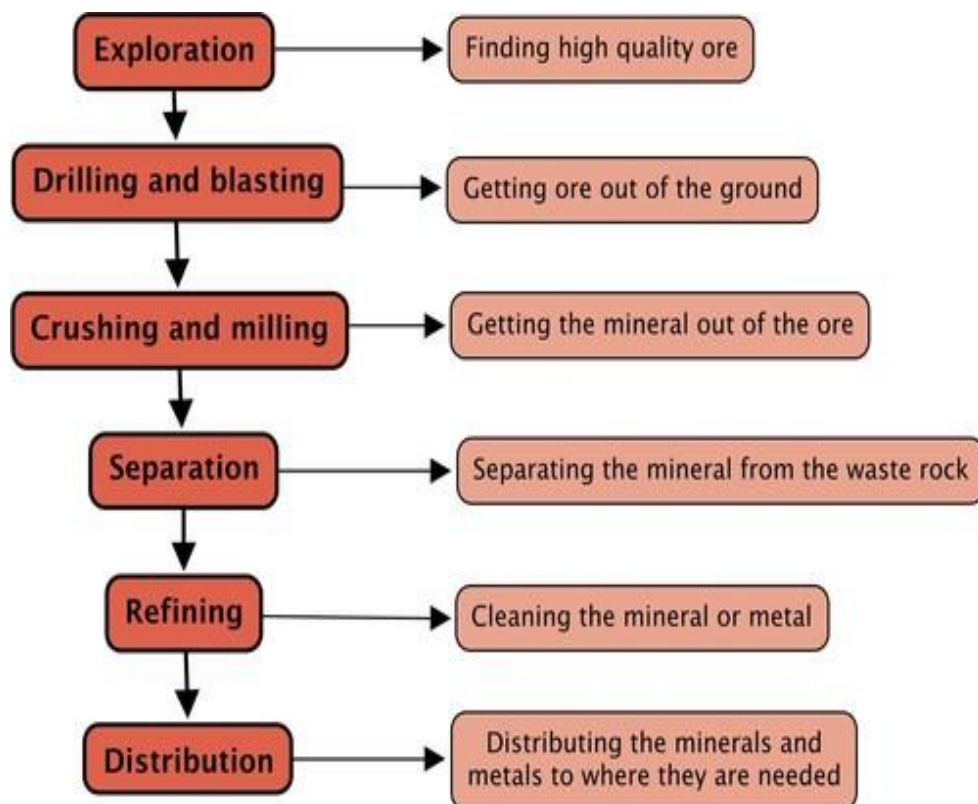
In the lithosphere (the sphere of rocks and sand) there are valuable minerals for mankind

Different minerals have different ways of extracting them.

There are three main stages of mining, namely:

- i. Identifying minerals to be mined
- ii. Mining the mineral from ore and
- iii. Refining the mineral for use

This process can be represented by the following flowchart diagram:



1. Exploration

At this stages miners try to find areas where minerals are concentrated this saves cost, they search this with advance technological equipment, e.g. to check for iron they may use equipment that can attract.

Geophysical methods make use of geology and the physical properties of the minerals to detect them underground. For example, diamonds are formed deep in the Earth at very high temperatures, in kimberlite pipes of igneous rock. **Remote sensing** is the term used to gain information from a distance

2. Once an area is found an ore is drilled and blasted to get it out of ground, this may occur underground or on surface gold is extracted underground while coal is extracted from the surface.



Blasting an ore for mineral



Drilling for mineral

3. Then it is crushed to get it from other ores, after being mined it comes out it is dirty and needs to be cleaned so the first stage is crushing the big rock into smaller finer parts.



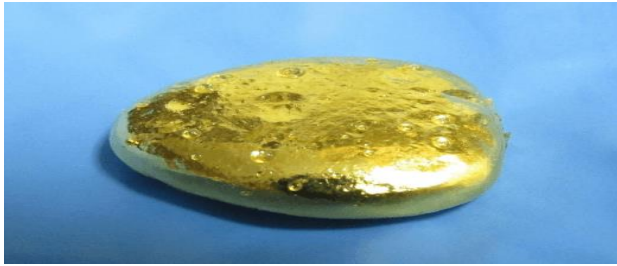
Crushing rocks to separate minerals from waste

4. Separation of minerals from the waste rock, use different method of separation, e.g. sorting by chemical means.



5. Refine by cleaning the mineral or metal, e.g. platinum, phosphorus, gold etc.





6. Distributing to where they are needed, Steel may be taken to car manufacturing industries, coal to Eskom, etc.

There are basically two ways of mining, namely:

- i. **Open cast mining**, mining from above surface e.g. coal,



- ii. **Underground mining, digging**



Mining in South Africa

There table below show mineral and South African towns in which they are mined

Mineral	Where it is found
---------	-------------------

Lead		Aggenys
Andalusite		Namakwaland; north of Lydenburg; Eastern Bushveld Complex
Zinc		Aggenys; between Vryburg and Kuruman
Iron		Vredendal; Postmasburg; Sishen/Kathu, Thabazimbi
Salt		Port Elizabeth; Velddrif; between Prieska and De Aar; Douglas; Koffiefontein; Jacobsdal; Petrusburg, Upington
Limestone		Port Elizabeth; Port Shepstone; Saldanha; Lichtenburg; Mahikeng; Zeerust; between Christiana and Bloemhof; West of Thabazimbi
Vermiculite	()	Between Pietermaritzburg and Durban; east of Musina; west, south and east of Makhado, Phalaborwa
Diamonds		Kimberley; northwest of Kimberley; Alexander Bay; Luderitz; Port Nolloth; on the west coast north of Vredendal; Mahikeng; north of Ventersdorp; Cullinan; west of Musina
Titanium		West coast north of Saldanha Bay; Richards Bay
Manganese		North of Kuruman; northeast of Ventersdorp
Zirconium		West coast north of Saldanha Bay; Richards Bay
Gold		Virginia; Welkom; Stilfontein; Klerksdorp; Potchefstroom; Carletonville; Johannesburg, Vereeniging; Vryheid[, Barberton; west of Phalaborwa; Evander
Chromium		Western Bushveld Complex; Eastern Bushveld Complex
PGMs		Western Bushveld Complex; Eastern Bushveld Complex; Northern Bushveld Complex
Phosphate		Phalaborwa
Coal		Virginia; Welkom; Bothaville; Kroonstad; Vereeniging; Sasolburg; Vanderbijlpark; Dundee; Newcastle; Utrecht; Vryheid; Ermelo; Standerton; Secunda; Evander; Witbank; Middleburg; Carolina; Lephalale
Nickel		West of Barberton
Copper		Aggenys/Springbok; Phalaborwa; Western Bushveld Complex; Eastern Bushveld Complex
Antimony		West of Phalaborwa

Impact of mining

There are several advantages and challenges of mining in the country, to both humans, plants and the environment.

ACTIVITY 5

- a. **Complete the following table on the impact of mining to society.**

Advantages of mining	Disadvantages of mining

- b. What is the South African government doing to regulate the industry. 4

- c. In South Africa today mining employs approximately how many people? 1

BIRTH, LIFE AND DEATH OF STARS

Key words

Stars a very large luminous (light emitting) body of gas.

Nebulae huge clouds of dust and gas

Fusion combination of atoms to form one.

Light year a distance that light travels in one year.

A constellation is a group of stars that appear to form a pattern or picture.

Stars exist for a limited time.

They are formed, exist for a certain period, then die.

stars form inside huge clouds of gas and dust called nebulae, far out in space

Each star had its own gravity, that is pulling the dust and cloud together

The Sun is also a star

<https://www.youtube.com/watch?v=kCrmN8C5uH0>

Birth of a star

Stars are formed when two hydrogen atoms combine to form helium atom.

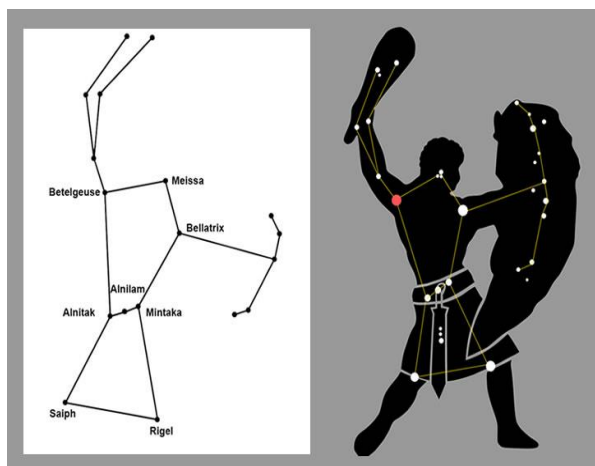
This process of fusion releases a lot of energy into space

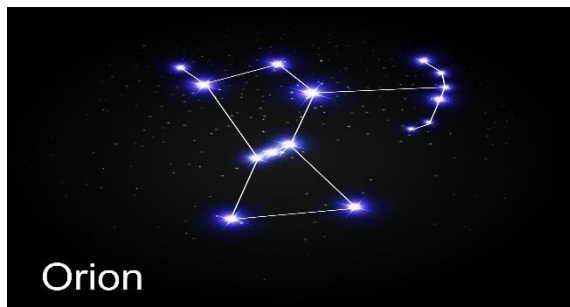
That ball of gas and dust that are held together by gravity releasing a large amount of energy.

Most stars are 100 thousand to 2 million times the mass of the Sun, they appear smaller because they are far away from the Earth as compared to the sun.

As the reaction takes place in the stars they continue to form different shapes and patterns, this is called constellations.

<https://www.youtube.com/watch?v=1sZ15SueS9w>





Life of a Star

Even though stars have a finite lifespan, it is over million and billions of years.

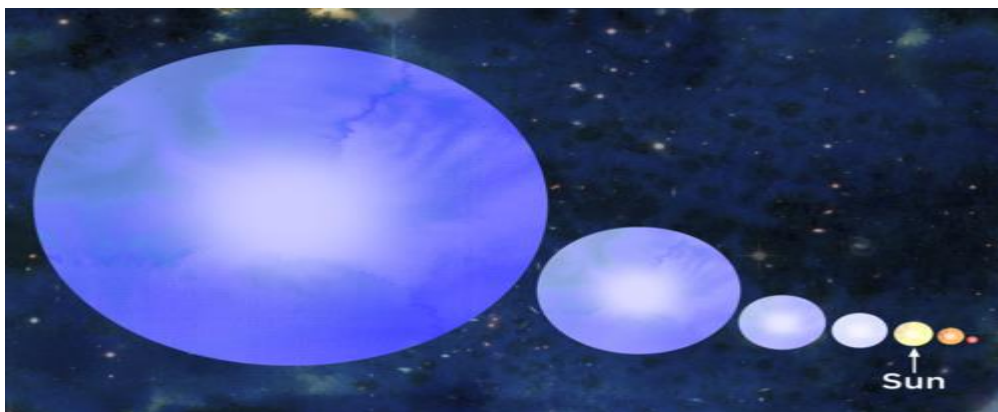
The sun is halfway through its lifespan of 9 billion years

During their lifespan stars change their colour from blue to red

<https://www.youtube.com/watch?v=cRYu8pMq9zQ>



Colour changes associated with the lifespan of stars



At which stage is our Sun?

Death of a Star

Stars become red hot in their final stage.

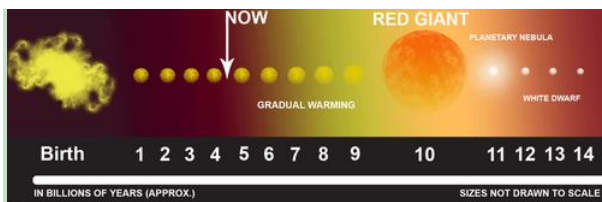
They contract and expand continuously until they break into separate pieces, the outer part leaving the centre.

The centre becomes a white dwarf, the outer red parts break into smaller pieces.

The life cycle of the Sun

INSTRUCTIONS: https://www.youtube.com/watch?v=a_fNZAXdeXo

1. The diagram below shows the life of our Sun. The Sun is a common type of star of average size and mass.
2. Complete the sentences by filling in the gaps which summarize the evolution of our Sun over time.



QUESTIONS:

The Sun is currently about halfway through its lifetime as a _____ star. In about 4.5 billion years time the Sun will swell up to form a _____ star engulfing the Earth as it does so.

After the Sun has become a red giant, it will eventually become unstable and puff off its outer layers forming a beautiful _____. The central core of the Sun will be left exposed in the centre of the planetary nebula.

Once the fuel runs out in the core of the Sun, nuclear reactions will _____. The Sun will then have become a hot _____ star, left behind at the centre of the planetary nebula.

As there are no ongoing nuclear reactions, as the white dwarf shines it slowly cools and will eventually form a _____ dwarf.

ANSWERS TO QUESTIONS

ACTIVITY 1 Interaction between the spheres

INSTRUCTIONS:

3. Study the photo of thorn trees on the savannah.
4. Answer the questions that follow.



Thorn trees.

QUESTIONS:

1. Identify the four different spheres of the Earth in the example.

Biosphere – the trees, grasses and other plants

Lithosphere – sand, rocks and other minerals

Hydrosphere – ground water (or water in the soil)

Atmosphere – the air around the tree

2. What will happen if the trees do not get enough water?

They will wither and die. They need water to photosynthesize

3. Describe the interaction between the hydrosphere and the biosphere in this example.

Trees and other plants interact with the hydrosphere when they absorb water

4. What will happen if the carbon dioxide levels change dramatically?

Plants will be affected as photosynthesis would not occur normally, they may die due to how drastic the change is.

5. Describe the interaction between the atmosphere and the biosphere in this example.

Carbon dioxide is needed by plants for photosynthesis, and plants give off oxygen to the environment.

6. Is there any interaction between the lithosphere and the hydrosphere in this example?

The minerals in the soil are transported by water to different parts of the plants

7. Use the example you have chosen in the previous activity (Exploring the spheres of the Earth) and describe three different interactions between the different spheres.

The biosphere is held upright by the lithosphere and minerals in the soil are transported by the hydrosphere, with gaseous exchange and photosynthesis taking place in the environment.

Practical activity 1



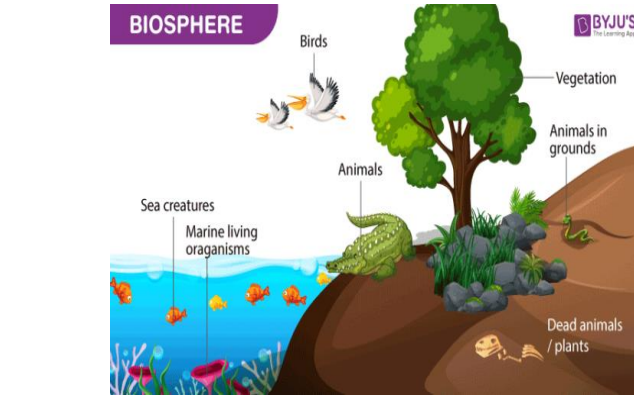
Mountain and plants (Lithosphere)



Clouds (atmosphere)



A river (hydrosphere)



Plants and animals (Biosphere)

Hydrosphere

Support for plants

Assist with transportation of minerals and salts to different part of the plants.

Support for animals. ✓✓ (2)

Assist in keeping the animal hydrated, digestion, blood circulation, takes place with ease. ✓✓ (2)

Lithosphere

Support for plants

Holds the plant upright and stores minerals for plants. ✓✓ (2)

Support for animals

Have food for animals, Make shelter for animals. ✓✓ (2)

Atmosphere

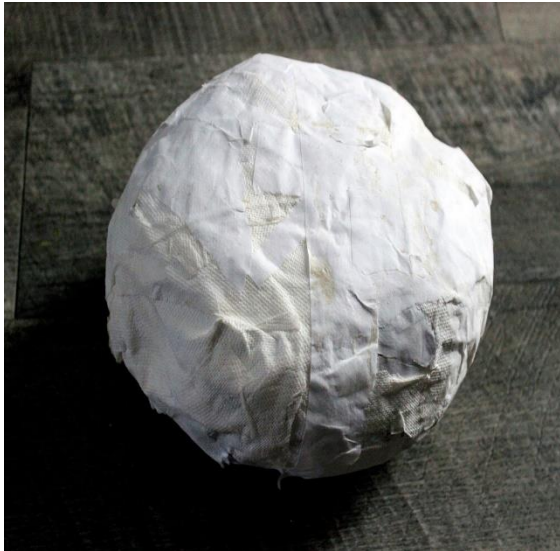
Support for plants

Makes photosynthesis possible and gaseous exchange. ✓✓ (2)

Support for animals

Assist in breathing and gaseous exchange in the body ✓✓ (2)

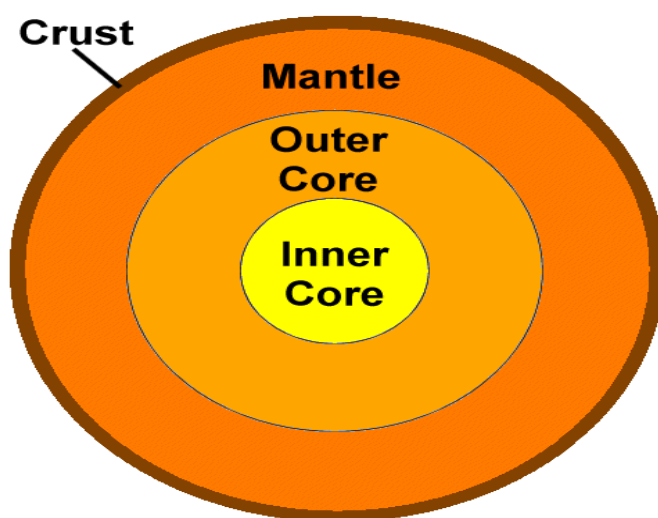
Practical activity 2



Ball of paper mache



half ball of paper mache

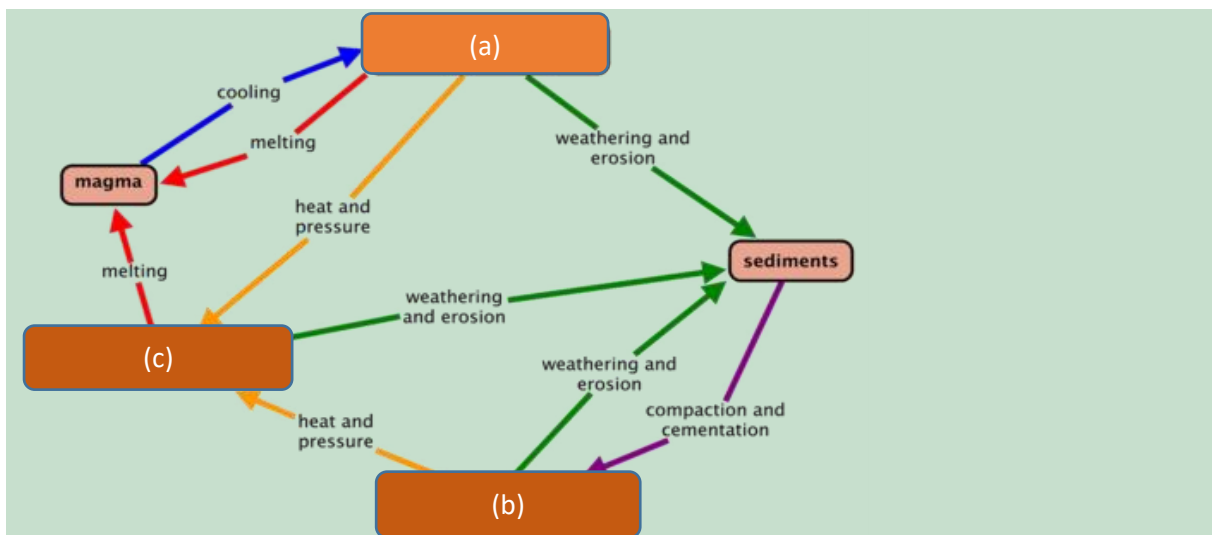


Images showing different paintings (correct paintings 2 mark each).

Activity 2. Summarising the rock cycle

QUESTIONS:

1. Complete the diagram by filling in which type of rock belongs where: Sedimentary rock, Metamorphic rock, Igneous rock.



(a) Igneous rock.

(b) Sedimentary rock.

(c) Metamorphic rock.

2.Name the process by which igneous rock is formed.

Cooling

3.Which type(s) of rock form sediment?

Igneous, metaphoric as well as sedimentary

4.What conditions are needed for metamorphic rock to form?

Increased temperature and pressure

5.Explain what 'weathering and erosion' of rock mean.

It is the action of wind and water which cracks and breaks up pieces of rocks

6.Explain what 'compaction' means.

It is a process where particles are compressed closer together.

7.What type of rock is formed through compaction?

Sedimentary

What is magma? Explain the role of magma in the rock cycle.

Magma is melted rock, which is called lava when it falls into the surface of the Earth, magma and lave forms igneous rock when they cool.

Activity 3

Type of sphere	Altitude range above sea level	Unique 2 activities at the sphere	Average temperature range
Troposphere	1 10 kilometres	2 Weathering The highest density sphere	1 (-50 to 20) ^o C
Stratosphere	1 10-50 kilometres	2 Temperature increases with altitude Very cold Protects against UV rays Some planes fly in this sphere (any 2)	1 (-51 to -15) ^o C
Mesosphere	1 50-80 kilometres	2 Temperature decreases with height The coldest layer Strong winds going from east to west (any 2)	1 (-90) ^o C
Thermosphere	1 80-350kilometres	2 Extremely low density High energy of molecules	1 (50o to 2000) ^o C
Total 16	4	8	4

ACTIVITY 4: effects of climate change

Explain with one examples (where possible) on each how the following would affect life on Earth.

- i. Climate change
The temperature might be too hot or too cold such that some species may die
Rising sea level
- ii. Certain areas may be flooded or sink below and this may require their population to migrate
- iii. Food shortages
Some animals may die thus resulting in the death of human beings as well, the ecosystem may change
- iv. Mass extinction
Certain industries may lack people to occupy them and there may be more new diseases that are not curable

v. What are different Governments of the world doing about this.

They are forming organisations to focus on saving the climate changes

vi. Name one organisation that focuses on climate change

Intergovernmental panel on climate change.

ACTIVITY 5

(a) Complete the following table on the impact of mining to society.

Advantages of mining	Disadvantages of mining
Creates direct and indirect employment	Sinkholes in Carletonville
Larger tax contributions to different	Loss of biodiversity through deforestation
Leads to birth of cities	Affects health of employees
Equipment that are beneficial to human beings, platinum contributes to manufacturing of cars	Changes weather patterns
Any positive impact	Any negative impact

(b) What is the South African government doing to regulate the industry. 4

Issue mining licence to mines
Consult with local communities before mining
Appoint inspectors who monitor compliance
Institute fines where there is no compliance

(c) In South Africa today mining employs approximately how many people?

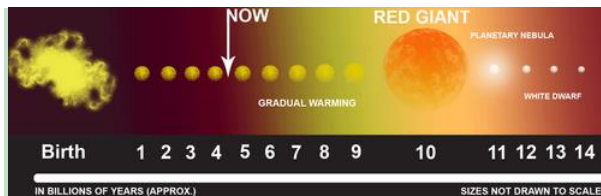
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450 000 people directly.

The life cycle of the Sun

INSTRUCTIONS:

1. The diagram below shows the life of our Sun. The Sun is a common type of star of average size and mass.
2. Complete the sentences by filling in the gaps which summarize the evolution of our Sun over time.



QUESTIONS:

1. The Sun is currently about halfway through its lifetime as a main sequence star. In about 4.5 billion years' time the Sun will swell up to form a red giant star engulfing the Earth as it does so.
2. After the Sun has become a red giant, it will eventually become unstable and puff off its outer layers forming a beautiful planetary nebula. The central core of the Sun will be left exposed in the centre of the planetary nebula.
3. Once the fuel runs out in the core of the Sun, nuclear reactions will **stop**. The Sun will then have become a hot white dwarf star, left behind at the centre of the planetary nebula.
4. As there are no ongoing nuclear reactions, as the white dwarf shines it slowly cools and will eventually form a black dwarf.