

GRADE 9 TERM 4 PLANET EARTH AND BEYOND 2021



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A. THE EARTH AS A SYSTEM

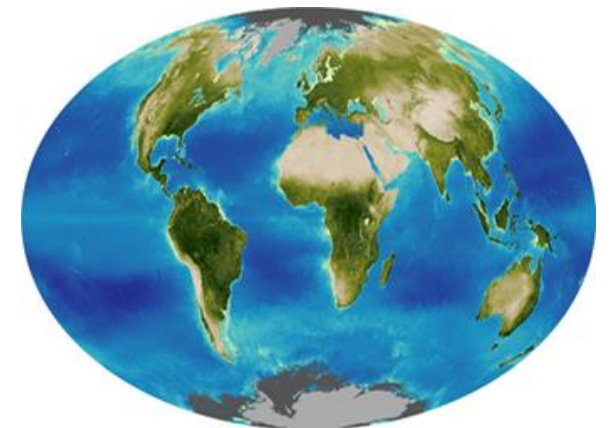
KEY WORDS

1. **System** – is the number of components working together for a common purpose.
2. **The biosphere** – consists of all living plants and animals and their interactions with rocks, soil, air and water
3. **The hydrosphere** – is the layer of the Earth which includes all the water on the planet.
4. **The Lithosphere** – is the layer of the Earth which includes the Earth's crust and the upper part of the mantle.
5. **The Atmosphere** – is the layer of gases which surrounds the Earth.

The Earth as a 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

<https://www.youtube.com/watch?v=N3EqcUNdIl8>



B. THE LITHOSPHERE

- The lithosphere includes the Earth's crust and the upper part of the mantle.
- All mountains, rocks, soil and minerals included in the Earth's crust are part of the lithosphere.
- Even the seafloor is part of the lithosphere, because it is also made up of sediments of sand and rock

<https://youtu.be/et0DcFhX8Iq>

The hydrosphere

- 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

The Lithosphere continued.....



Rock formations.



Sand dunes.

The Lithosphere continued.....



Soil.



Mountains.

The Lithosphere continued.....



Minerals.



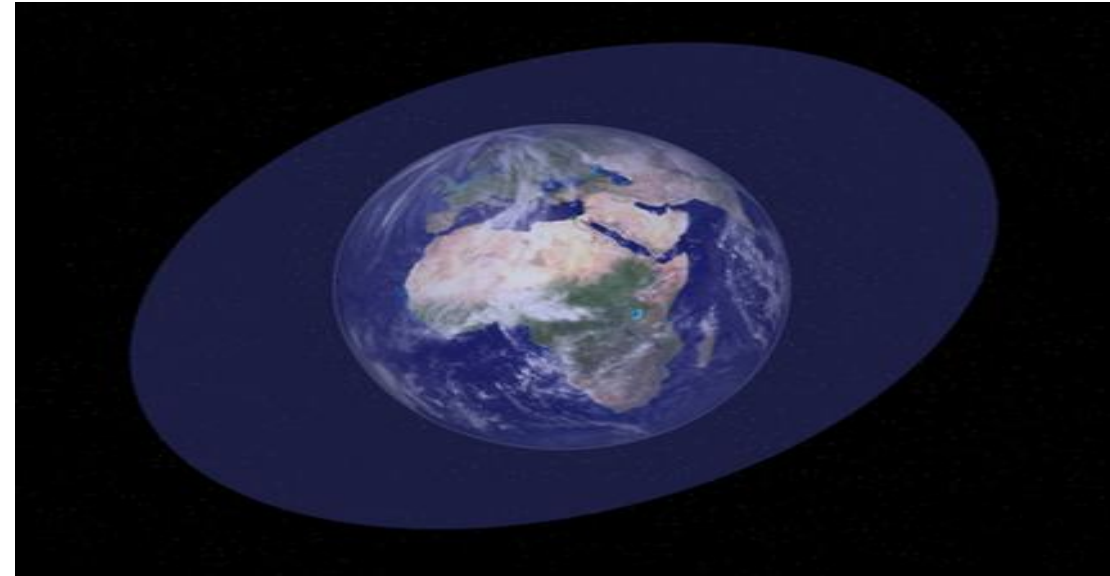
Seafloor

C. THE ATMOSPHERE

- The Atmosphere – is 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

Activity 1

Interaction between the spheres

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

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



Thorn trees.

Questions

1. Identify the four different spheres of the Earth in the example.
2. What will happen if the trees do not get enough water?
3. Describe the interaction between the hydrosphere and the biosphere in this example.
4. What will happen if the carbon dioxide levels change dramatically?
5. Describe the interaction between the atmosphere and the biosphere in this example.
6. Is there any interaction between the lithosphere and the hydrosphere in this example?
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.

Practical activity 1

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 spheres**
- **On a separate page explain how each sphere support life for plants and animal.**

Questions

1. How the hydrosphere support

(a) Plants (2)

(b) Animals (2)

2. How the Lithosphere support

(a) Plants (2)

(b) Animals (2)



Questions

3. How the atmosphere support

(a) Plants (2)

(b) Animals (2)

The Lithosphere (The sphere of rocks and soil)

Key words

- 1. Rock cycle** – is how the rock is formed, disintegrate and be formed again.
- 2. Inner core** – is the innermost solid part of the Earth it is situated at the centre.
- 3. Outer core** – is the liquid part that surround the inner core.
- 4. Mantle** – is a layer above the core of the earth.
- 5. Crust** – is a layer surrounding the crust

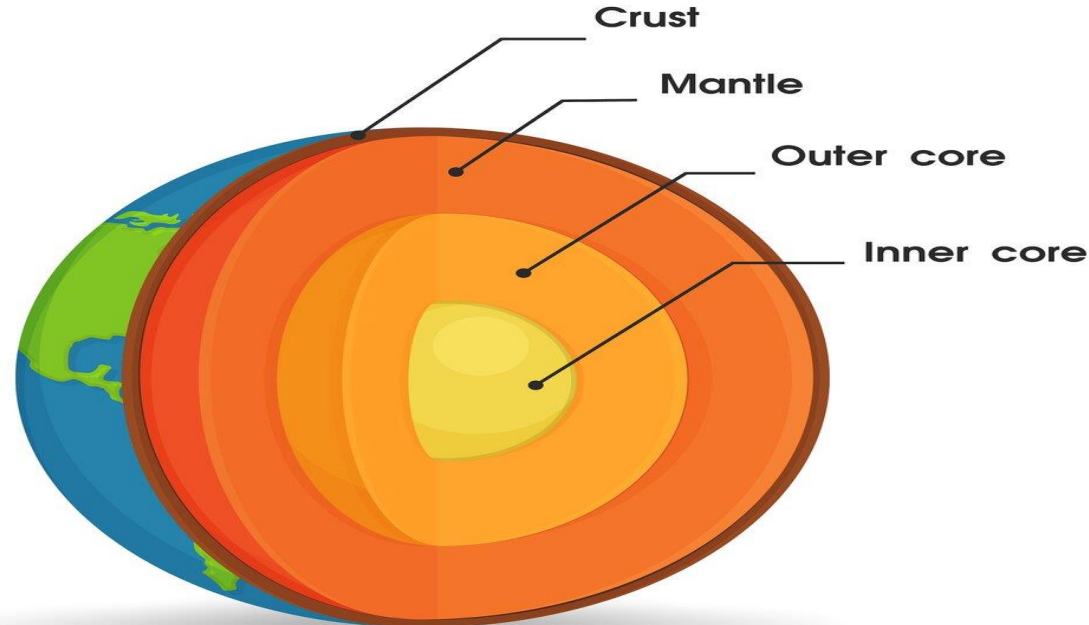
The Lithosphere (The sphere of rocks and soil)

Key words (continued)

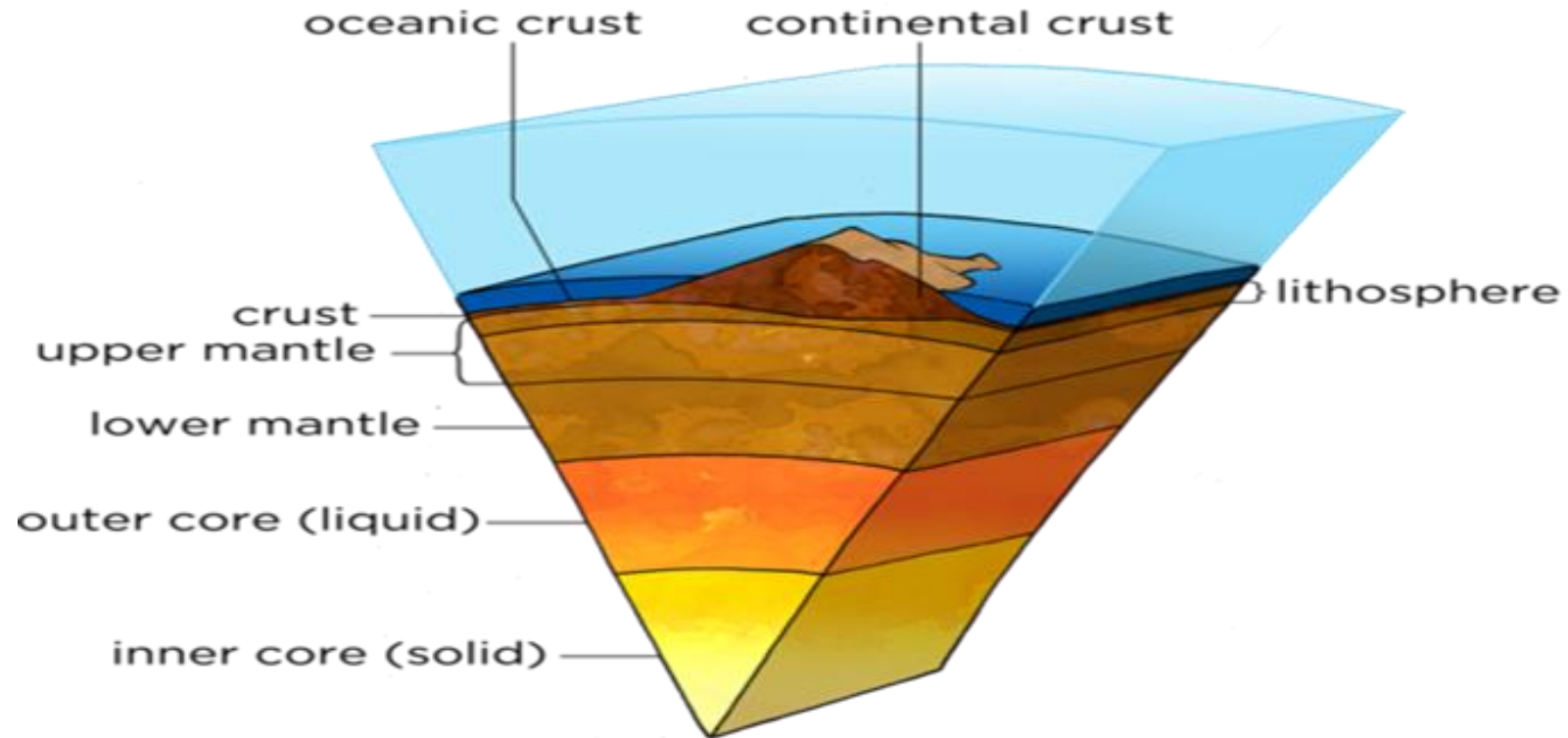
6. **Sedimentary rock** – is formed when small stones that have been washed away and deposited as sediments solidify.
7. **Metaphonic rock** – is a rock that have changed from their original form due to high pressure and heat.
8. **Magma** – is metaphonic rock that melts as it moves deeper towards the centre of the Earth

Layers of the Earth and the Lithosphere

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



Layers of the Earth and the Lithosphere



NB Check where the lithosphere is located

Possible Practical Activity 2

To make/design a model of different layers of the Lithosphere

1. Make round ball of paper Mache. (2)
2. Cut it into half. (2)
3. Use three different painting to illustrate
 - (a) Core,
 - (b) Mantle and
 - (c) Crust (6)

The rock cycle

- Many natural activities take 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:
 1. Sedimentary rock,
 2. Metamorphic rock and
 3. Igneous rock
- Rocks are formed, broken down and reform over long periods of time.

Different rock formation – the rock cycle

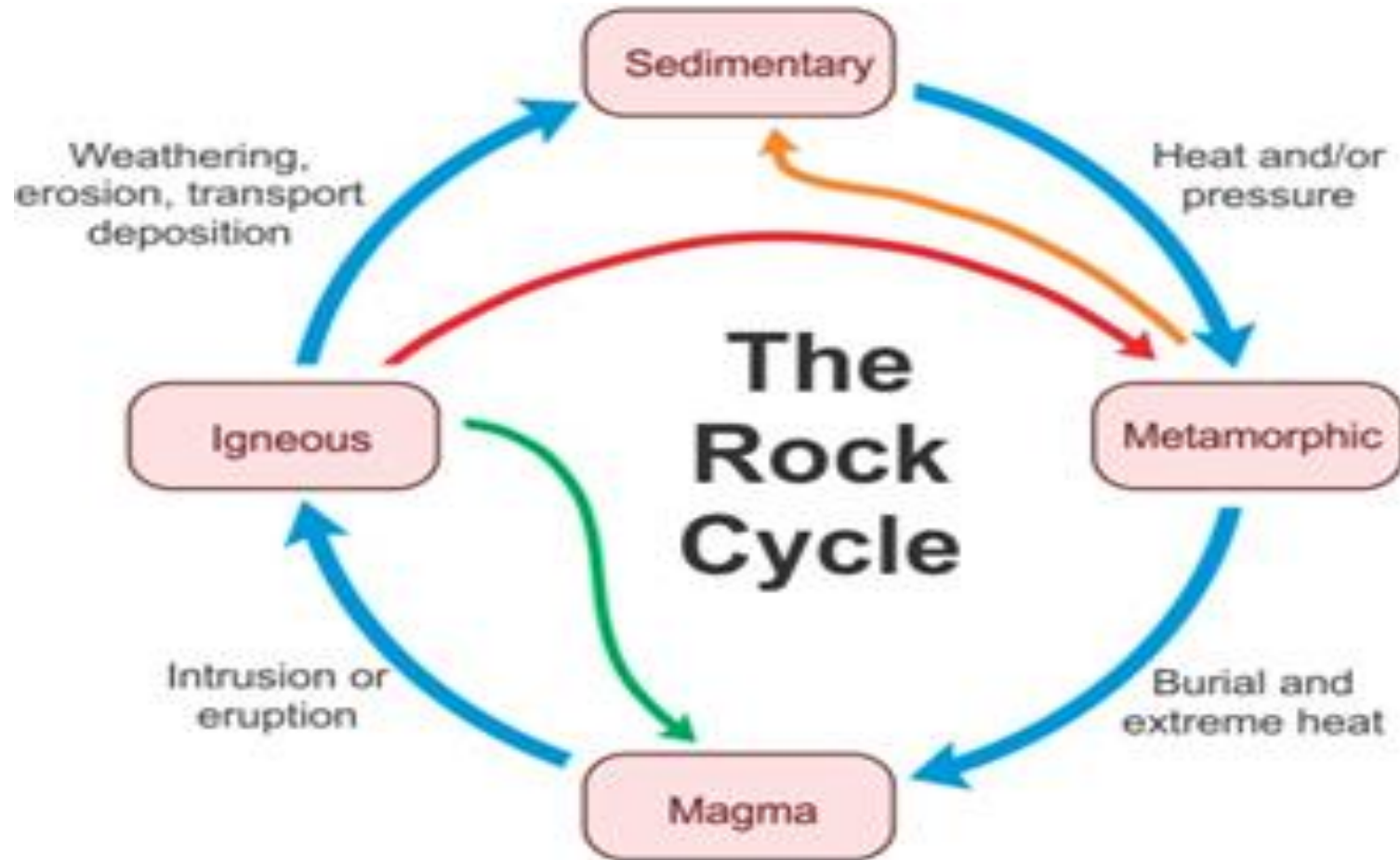
- 1. Wind and water wash the sands and deposit them in oceans and lakes as sediments, this process is called deposition. As more and more sediments are deposited there is more pressure which compact at the bottom and lead to formation of sedimentary rocks.**
- 2. When this process continues as the sedimentary 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.**

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

Different rock formation – the rock cycle

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.

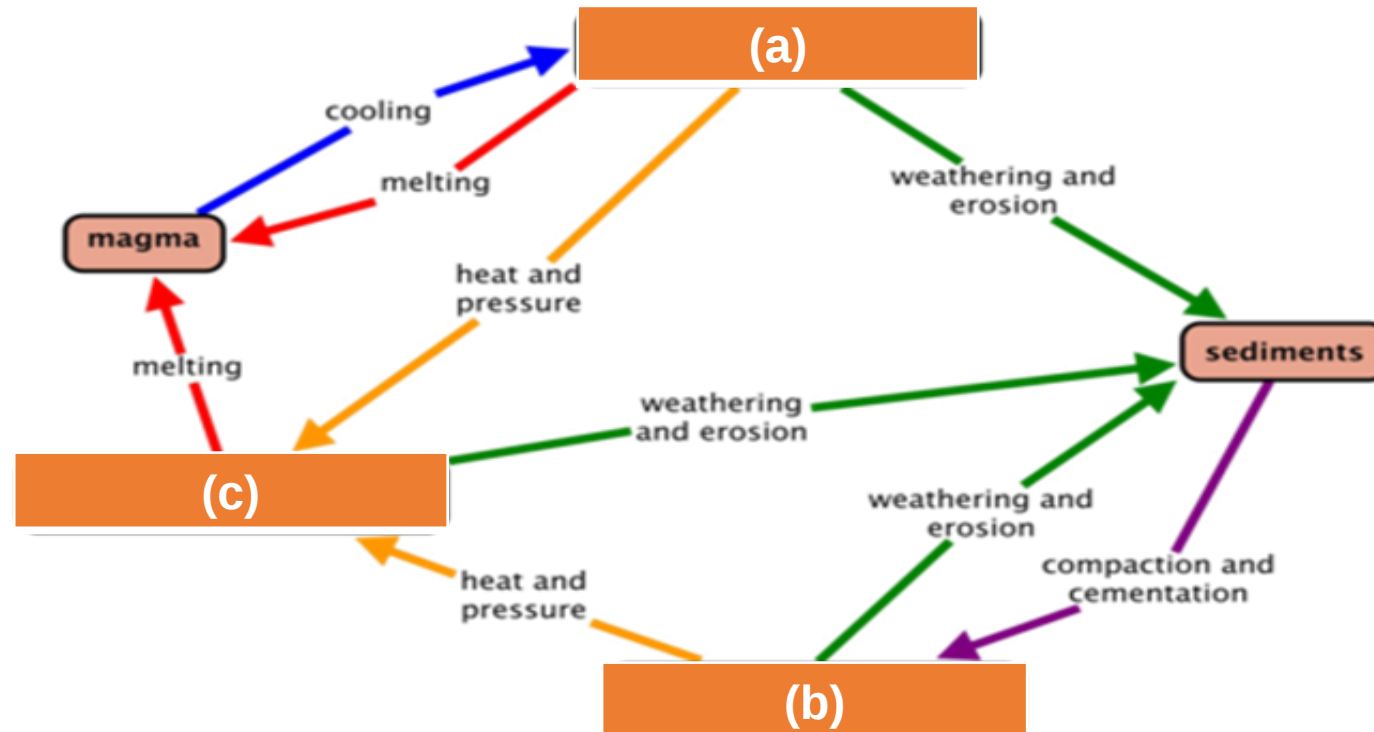
The rock cycle



Activity 2: Summarising the rock cycle

Question:

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



Activity 2: Summarising the rock cycle....continued

- 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:

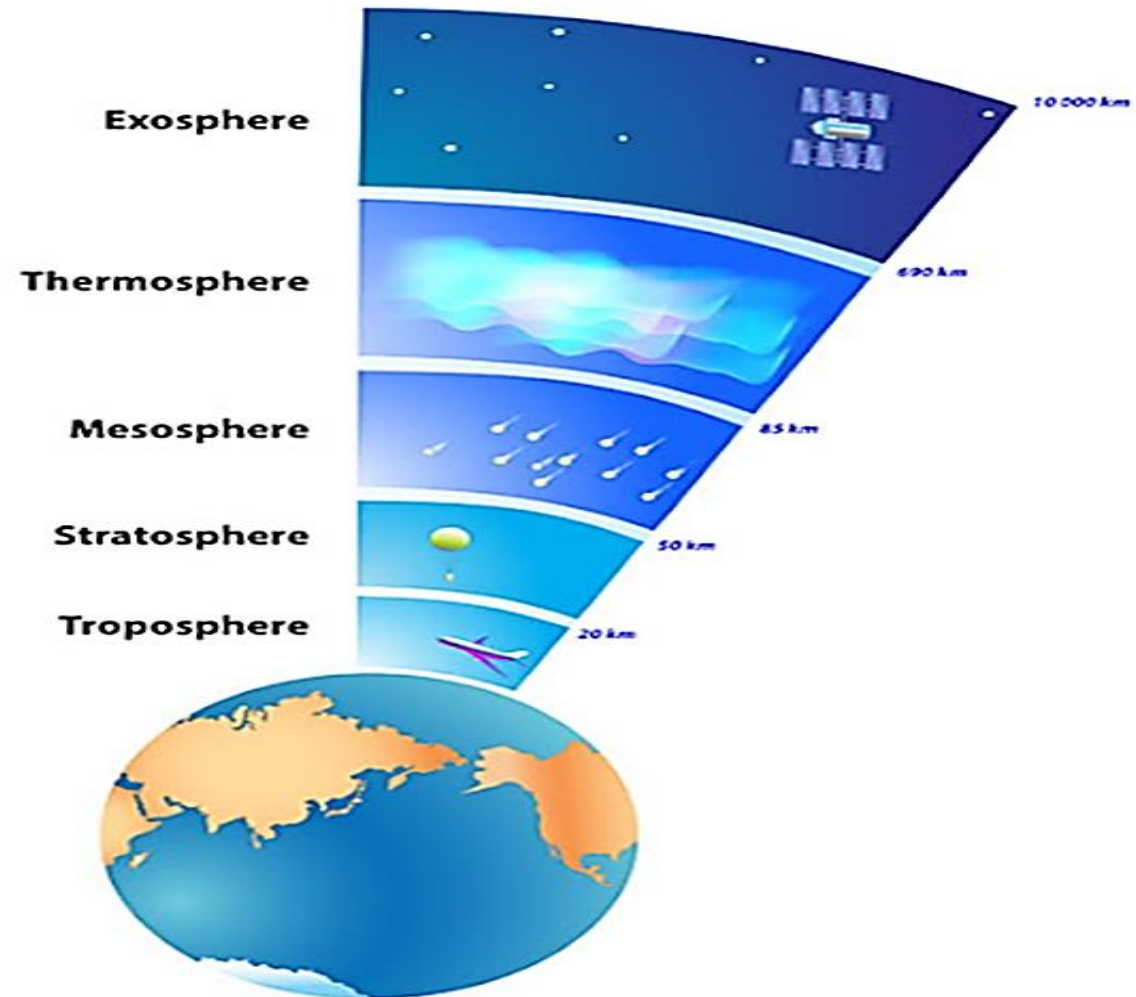
1. **Troposphere** – is the atmospheric layer just above the Earth's surface.
2. **Stratosphere** – is the atmospheric layer above the stratosphere.
4. **Mesosphere** – is the atmospheric layer above the stratosphere.
5. **Thermosphere** – is the atmospheric layer above the Mesosphere
6. **Exosphere** – is the outermost sphere where there is less or no force of gravity
7. **Greenhouse effect** – is the natural phenomenon of warming the Earth so as to sustain life on it.

Composition of the Atmosphere

- **The Atmosphere is 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

Layers of the Atmosphere



Layers of the Atmosphere continued

1. 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**

Layers of the Atmosphere continued

2. Stratosphere

- This layer stretches from 10 to 50 KILOMETRES above sea level.
- Some of the Aeroplanes fly at this level.
- It has a band of ozone gas (O_3) which absorbs ultraviolet light.
- This absorption increases the temperature of the stratosphere, thus protecting animals and plants from too much radiation.

Layers of the Atmosphere continued

3. Mesosphere

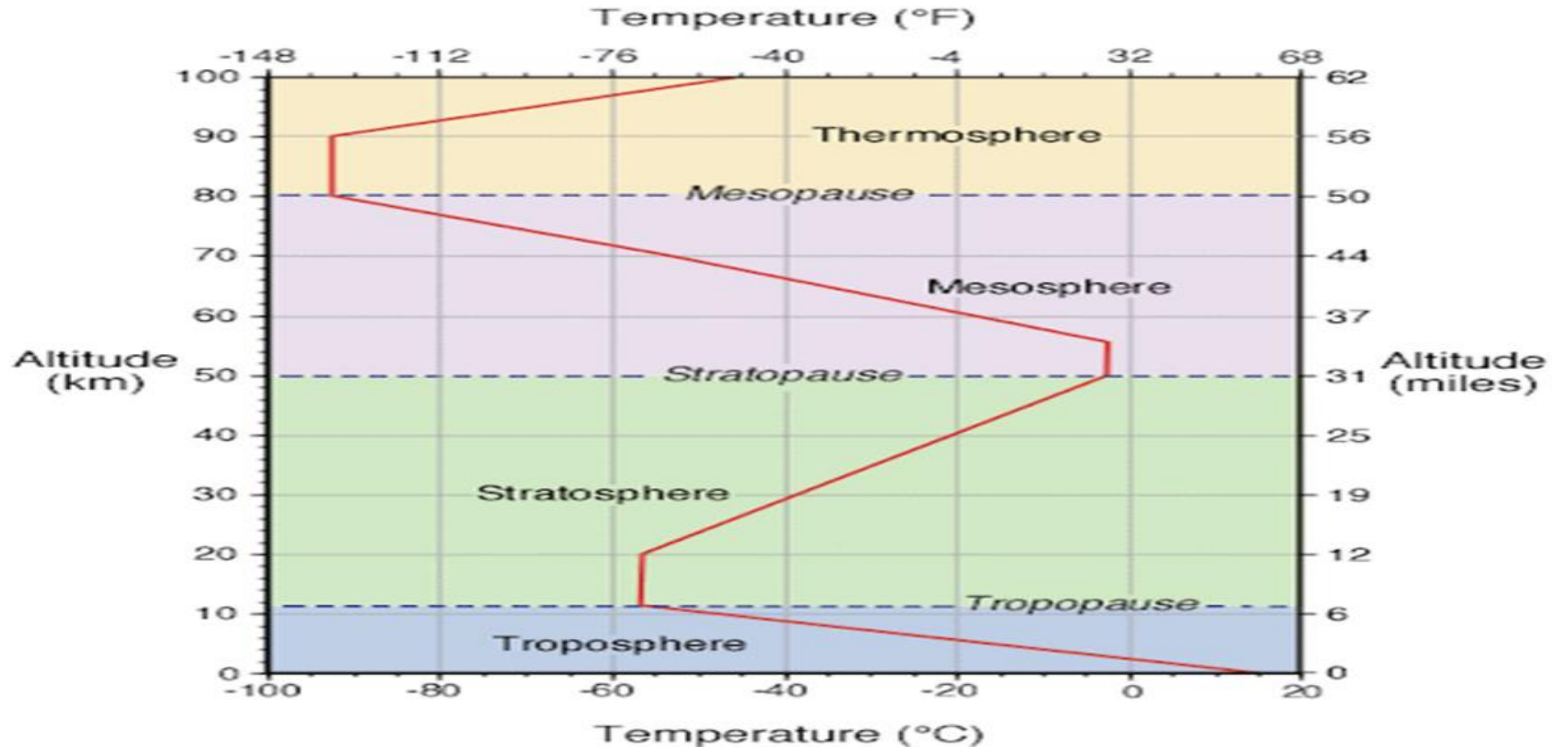
- This layer stretches from about 50 – 80 KILOMETRES above sea level.
- The air is extremely thin and very cold.
- There is still enough air to burn small rocks entering from space.
- These rocks are visible from the Earth and we know them as shooting stars

Layers of the Atmosphere continued

4. 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.

Layers of the Atmosphere continued



Layers of the Atmosphere continued

Complete the table below on layers of the atmosphere.

Types of Spheres	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 effects

- **The greenhouse effect is a natural phenomenal that warms the atmosphere sufficiently to sustain life.**
- **The 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**

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

The greenhouse effects continued

- **Damage to this layer can lead to global warming which would cause:**
 - **Climate change**
 - **Rising sea level**
 - **Food shortages**
 - **Mass extinction**

Activity – Effects of climate change

Explain with one example in 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**

D. MINING OF MINERAL RESOURCES

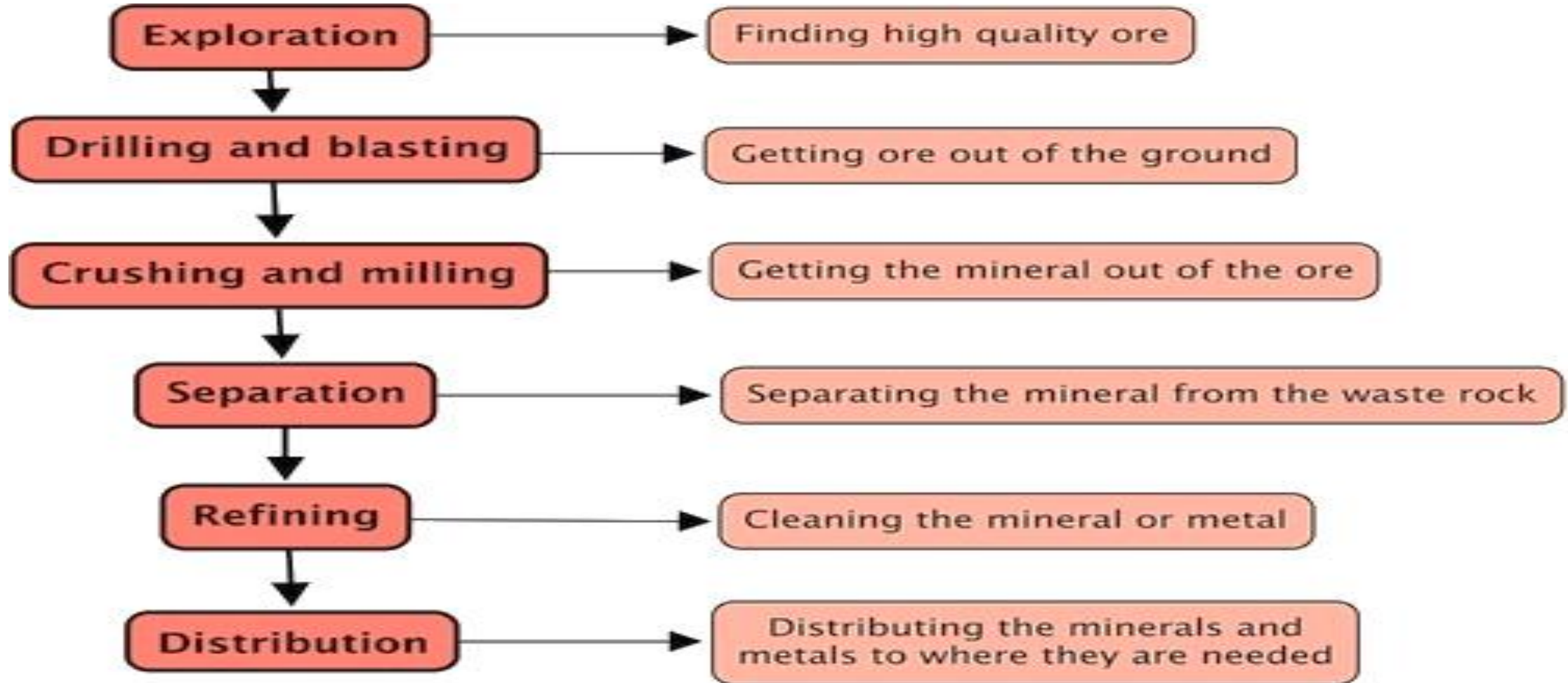
Key Words:

1. Mining – a process of extracting valuable minerals from the Earth.
2. Ores – rocks from which people extract valuable minerals.
3. Opencast mining – where extraction of minerals take place on the surface.
4. Underground mining – where extraction of minerals occurs underground.
5. Remote sensing – is the term used to gain information from a distance
6. Geophysical methods – make use of geology and the physical properties of the minerals to detect them underground.

Mining of mineral resources continued

- **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:**

A flow diagram representing the mining process



Mining of mineral resources continued

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 it.
- **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

Mining of mineral resources continued

2. Drilling and blasting.

- 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.



Drilling for mineral



Blasting an ore for mineral

Mining of mineral resources continued

3. Crushing and milling.

- 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

Mining of mineral resources continued

4. Separation.

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



Separation of minerals from waste rock

Mining of mineral resources continued

5. Refining.

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



Refining minerals by cleaning

Mining of mineral resources continued

6. Distribution.

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



Distribution of minerals

Mining of mineral resources continued

There are basically two ways of mining, namely:

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



Open cast mining



Underground mining

Mining of mineral resources continued

Mining in South Africa

- The 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

Mining of mineral resources continued

Mineral	Where it is found
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

Mining of mineral resources continued

Mineral	Where it is found
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

Activity – Impact of mining

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

Questions:

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

Advantages	Disadvantages

Activity – Impact of miningcontinued

- (b) What is the South African government doing to regulate the mining industry? 4**
- (c) In South Africa today mining employs approximately how many people? 1**

E. BIRTH, LIFE AND DEATH OF STARS

Key Words:

- 1. Stars** – a very large luminous (light emitting) body of gas.
- 2. Nebulae** – huge clouds of dust and gas.
- 3. Fusion** – combination of atoms to form one.
- 4. Light year** – a distance that light travels in one year.
- 5. A constellation** – is a group of stars that appear to form a pattern or picture.



Birth, Life and Death of Stars continued

- **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**



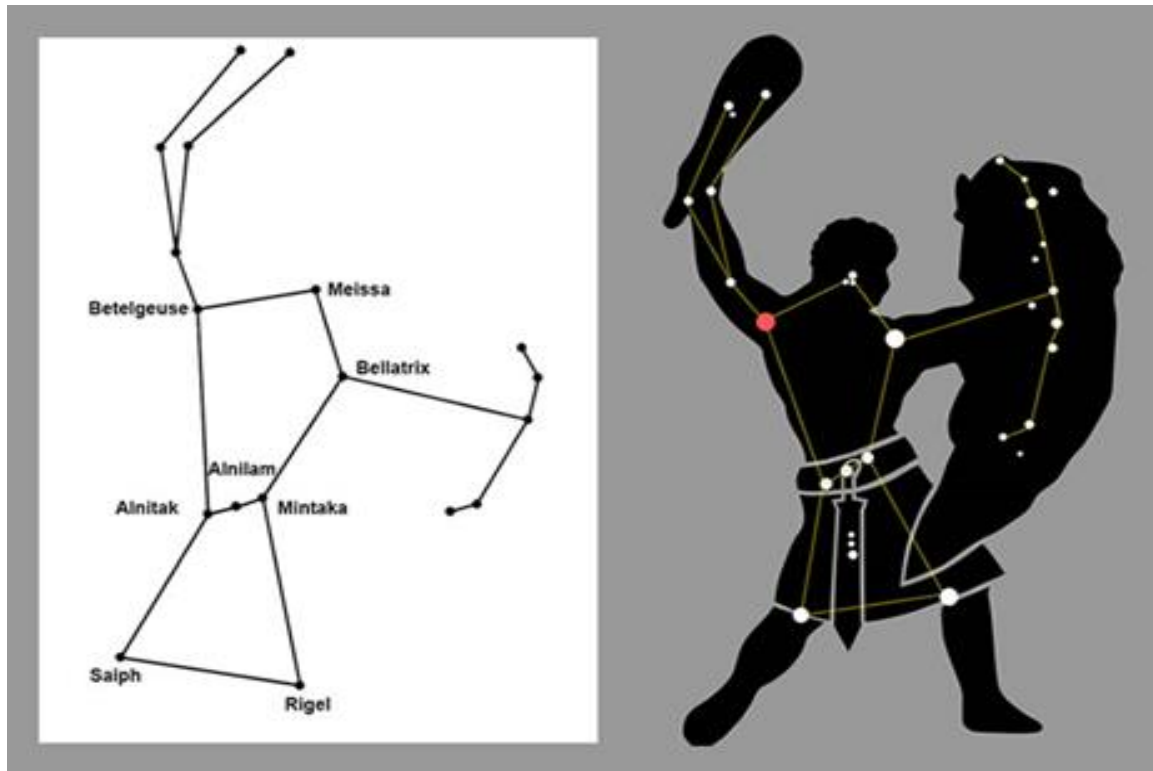
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- https://www.youtube.com/watch?v=a_fNZAXdeXo

Constellations

<https://www.youtube.com/watch?v=1sZ15SUeS9w>



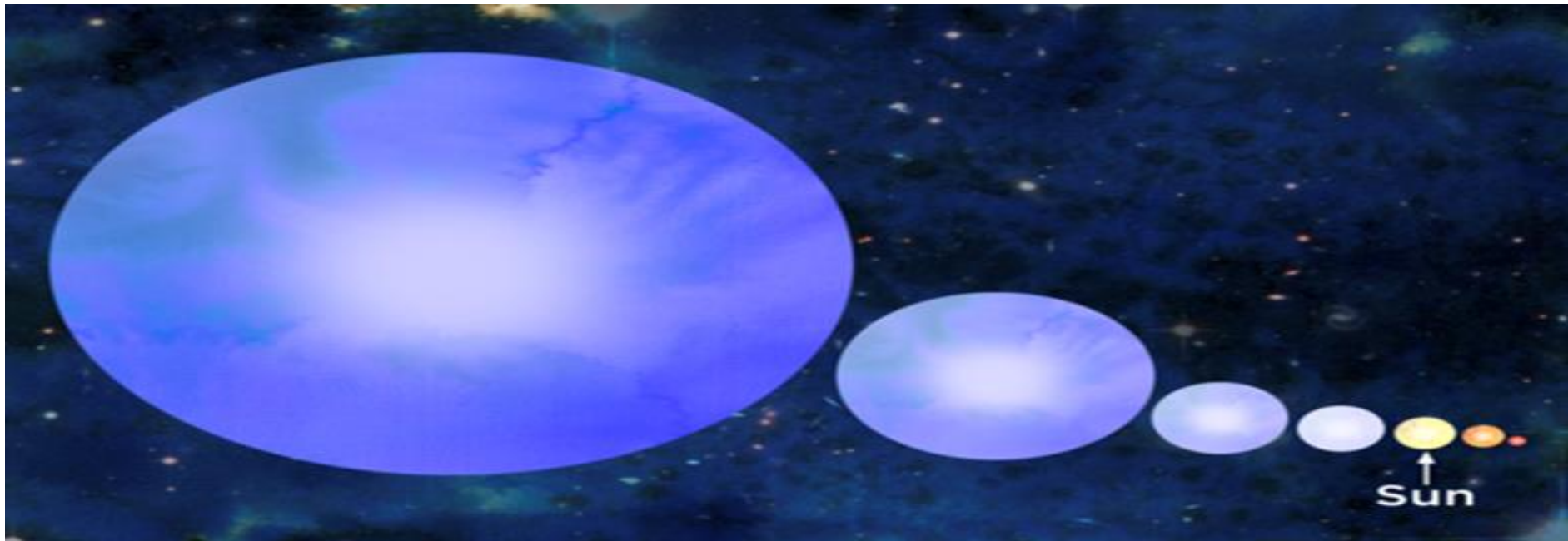
Life of a star

- 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=cRYu8pMg9zQ>



Life of a star continued

- Colour changes associated with the lifespan of stars



At which stage is our Sun?



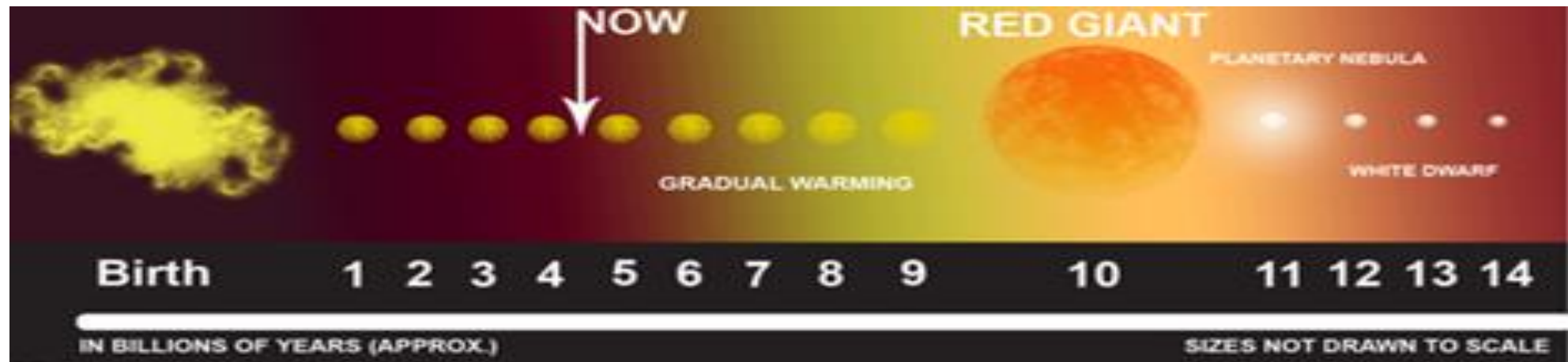
Death of a star

- **Stars becomes 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.**

Activity – 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.



Activity – The life cycle of the Sun continued

Questions:

- 1. 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.**
- 2. 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**



Activity – The life cycle of the Sun continued

- 3. 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.**
- 4. As there are no ongoing nuclear reactions, as the white dwarf shines it slowly cools and will eventually form a _____ dwarf.**



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F. ANSWERS TO QUESTIONS

ANSWERS TO QUESTIONS

Activity 1 – Interaction between the spheres

Instructions:

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



Thorn trees.

Activity 1 – Interaction between the spheres continued

Questions:

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

- (a) **Biosphere** – the trees, grasses and other plants.
- (b) **Lithosphere** – sand, rocks and other minerals.
- (c) **Hydrosphere** – ground water (or water in the soil).
- (d) **Atmosphere** – the air around the tree

Activity 1 – Interaction between the spheres continued

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

Activity 1 – Interaction between the spheres continued

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 gives off oxygen to the environment

Activity 1 – Interaction between the spheres continued

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)

Practical activity 1 continued

Hydrosphere

- Support for plants
- Assist with transportation of minerals and salts to different part of the plants.
- Support for animals. $\sqrt{\sqrt{}}$ (2)
- Assist in keeping the animal hydrated, digestion, blood circulation, takes place with ease $\sqrt{\sqrt{}}$ (2)

Practical activity 1 continued

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)

Practical activity 1 continued

Atmosphere

- Support for plants
- Makes photosynthesis possible and gaseous exchange.
✓✓ (2)
- Makes photosynthesis possible and gaseous exchange.
✓✓ (2)
- Support for animals
- Assist in breathing and gaseous exchange in the
body ✓✓ (2)

Practical activity 2

Developing a collage on spheres of the Earth.

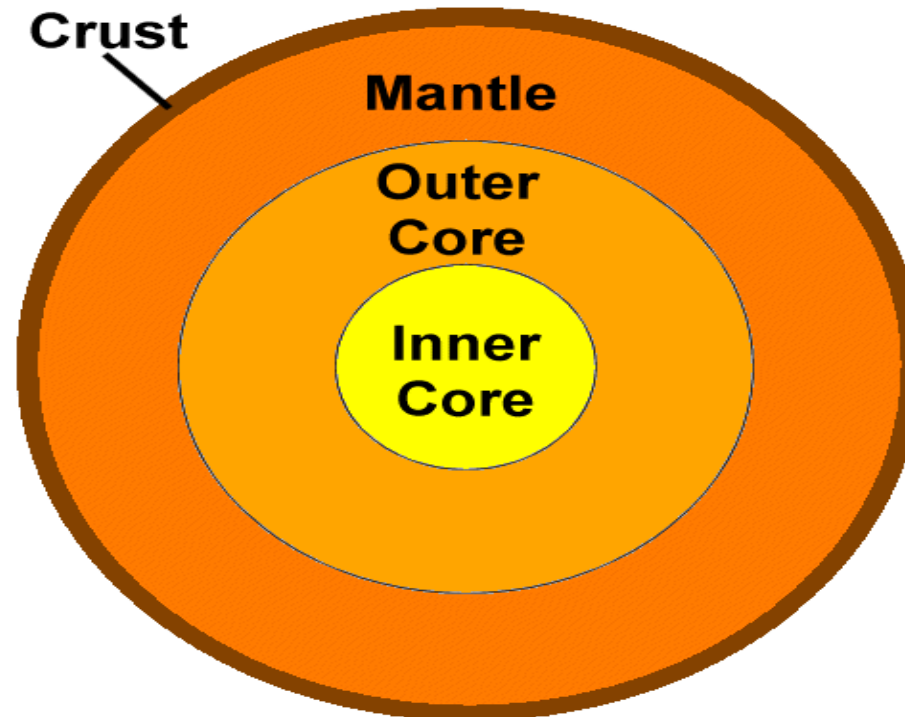


Ball of paper Mache



Half ball of paper Mache

Practical activity 1 continued

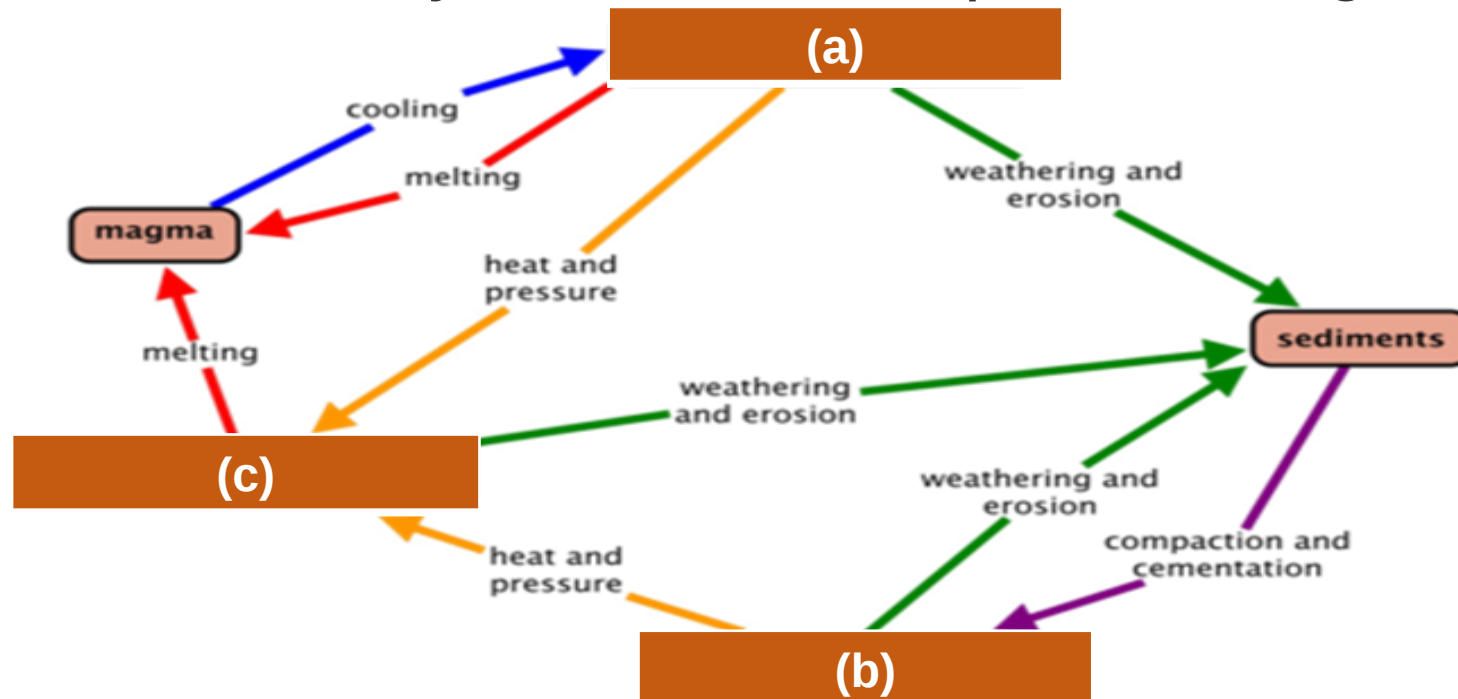


Images showing different paintings (correct paintings
2 mark each).

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.





Activity 2 – Summarising the rock cycle continued

1. (a) Igneous rock.
(b) Sedimentary rock.
(c) Metamorphic rock.
2. Name the process by which igneous rock is formed.
Cooling

Activity 2 – Summarising the rock cycle continued

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

Igneous, metamorphic 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

Activity 2 – Summarising the rock cycle continued

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 rock

8. 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 lava 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	10 Kilometres (1)	Weathering. The highest density sphere (2)	(-50 to 20) ⁰ C (1)
Stratosphere	10 – 50 Kilometres (1)	Temperature increase with altitude. Very cold. Protects against UV rays 1. Some planes fly in this sphere. (2)	(-51 to -15) ⁰ C (1)
Mesosphere	50-80 kilometres (1)	Temperature decreases with height The coldest layer Strong winds going from east to west (2)	(-90) ⁰ C (1)
Thermosphere	80-350 kilometres (1)	Extremely low density High energy of molecules (2)	(500 to 2000) ⁰ C (1)
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.

ii. Rising sea level

Certain areas may be flooded or sink below and this may require their population to migrate.

Activity 4 continued

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



Activity 4 continued

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 patens
Any positive impact	Any negative impact

Activity 5 continued

(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



Activity 5 continued

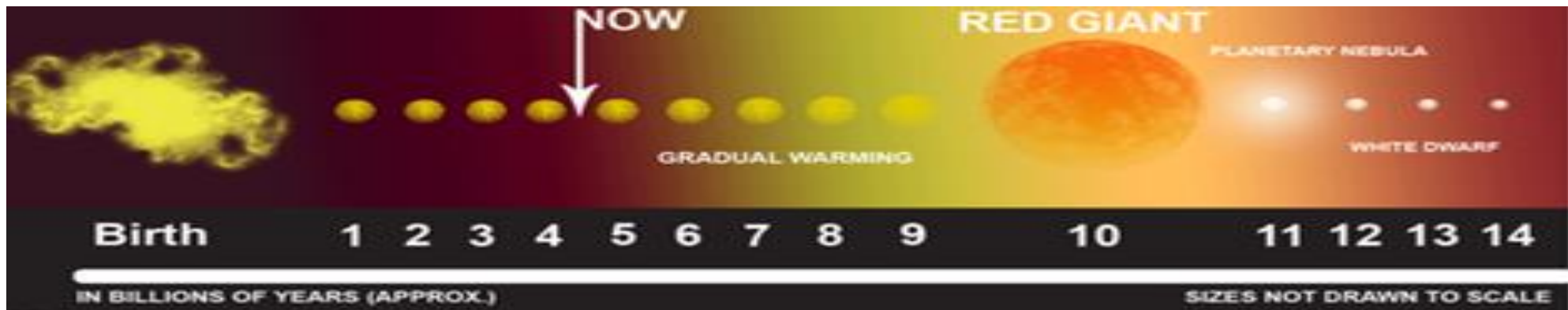
(c) In South Africa today mining employs approximately how many people? 1

- 450 000 people directly

Activity 6 – 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.



Activity 6 – The life cycle of the Sun continued

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.

Activity 6 – The life cycle of the Sun continued

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.