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FACULTY OF HEALTH SCIENCES
DEPARTMENT OF ENVIRONMENTAL HEALTH SCIENCE

FINAL EXAMINATION PAPER: MAY 2017

TITLE OF PAPER	ENVIRONMENTAL PHYSICS
COURSE CODE	EHS 106
DURATION	2 HOURS
TOTAL NUMBER OF MARKS	100
INSTRUCTIONS	<ol style="list-style-type: none">1. DO NOT OPEN THIS PAPER UNTIL YOU ARE INSTRUCTED TO DO SO.2. QUESTION ONE IS COMPULSORY. CHOOSE THREE OTHER QUESTIONS IN ADDITION TO QUESTION ONE.3. BEGIN EACH QUESTION ON A FRESH PAGE OF THE ANSWER BOOKLET. ENSURE THAT ALL PAGES ARE NUMBERED CORRECTLY.4. POOR HANDWRITING AND CARELESSNESS IN ENGLISH LANGUAGE GRAMMAR SHALL RESULT IN LOSS OF MARKS.5. NECESSARY STEPS SHALL BE TAKEN AGAINST ANY FORM OF MISCONDUCT DURING THE EXAMINATION.6. MARKS FOR EACH QUESTION (SECTION) ARE SHOWN IN BRACKETS.

QUESTION ONE [25 MARKS]

1. Based on the way it forms, rock is placed in three broad classes (rock types 1, 2 and 3) as shown in Fig 1. Study the diagram and answer the questions below.

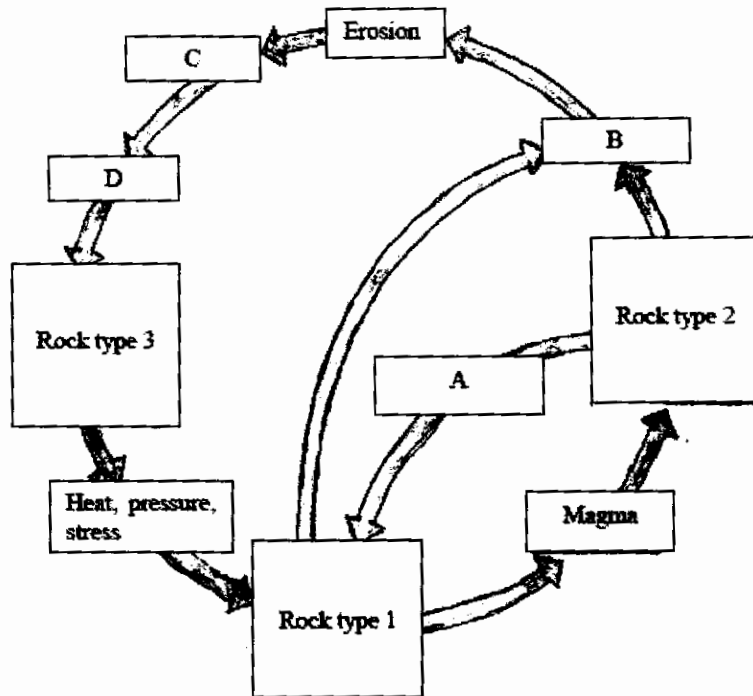


Figure 1: The rock cycle

- 1.1 In an area that was previously a flood plain, the most likely type of rock that may be found is;
 - (a) Rock type 1
 - (b) Rock type 2
 - (c) All rock types
 - (d) Rock type 3
- 1.2 Examples of rock type 1 include;
 - (a) Limestone
 - (b) Granite
 - (c) Basalt
 - (d) Marble
- 1.3 Dead plants, animal remains and dirt particles are involved in the formation of;
 - (a) Rock type 1
 - (b) Rock type 2
 - (c) Rock type 3
 - (d) All rock types
- 1.4 Rocks are recycled over millions of years by three processes, and one of these processes is;
 - (a) Sedimentation
 - (b) Transportation
 - (c) Metamorphism
 - (d) Solidification

- 1.5 The bulk of the earth's crust consist of;
 - (a) Rock type 1
 - (b) Rock type 2
 - (c) Rock type 3
 - (d) A mixture of rock types 1 and 3
- 1.6 The rock type that leads to the buildup of the earth's surface when it is formed is;
 - (a) Rock type 1
 - (b) Rock type 2
 - (c) Mostly rock type 1 and occasionally rock type 3
 - (d) Rock type 3
- 1.7 The influence of energy from the sun is often involved in many processes of the rock cycle, except in
 - (a) A
 - (b) B
 - (c) C
 - (d) D
- 1.8 The main source of many nonfuel mineral resources is;
 - (a) Rock type 2
 - (b) Rock type 3
 - (c) Rock type 1
 - (d) Mostly rock type 1 and occasionally rock type 2
- 1.9 Lignite and bituminous coal are examples of;
 - (a) Rock type 1
 - (b) Long-term metamorphism
 - (c) Rock type 2
 - (d) Rock type 3
- 1.10 Places such as downstream, downhill, downwind and underwater are good places for the formation of;
 - (a) Rock type 1
 - (b) Rock types 1 and 2
 - (c) Rock type 2
 - (d) Rock type 3
2. The measure of how useful a form of matter is as a resource is;
 - (a) Entropy
 - (b) Energy quality
 - (c) Matter quality
 - (d) Entropy quality
3. The measure of the disorder or randomness of a system or its environment is;
 - (a) Energy quality
 - (b) Matter quality
 - (c) Entropy
 - (d) Entropy quality
4. The greater the disorder of a sample of matter;
 - (a) The higher its quality
 - (b) The higher its entropy
 - (c) The higher its energy content
 - (d) Both (b) and (c) are correct

5. The greater the order of a sample of matter;
 - (a) The lower its quality
 - (b) The lower its entropy
 - (c) The lower its energy content
 - (d) Both (b) and (c) are correct
6. About 99% of the energy required on earth by living organisms for survival comes from;
 - (a) The sun
 - (b) Nuclear power plants
 - (c) Renewable resources
 - (d) Fossil fuels
7. The direct input of solar energy from the sun produces other indirect forms of solar energy such as;
 - (a) Wind
 - (b) Natural gas
 - (c) Crude oil
 - (d) Fossil fuels
8. Organisms that live in severe environmental conditions are referred to as;
 - (a) Chemosynthesis
 - (b) *Pyrobolus fumarii*
 - (c) Heat resistant organisms
 - (d) Extremophiles
9. The process in which inorganic chemicals, such as H₂S or H₂, provide energy for synthesis of organic molecules is;
 - (a) Photosynthesis
 - (b) Terrestrial synthesis
 - (c) Rock synthesis
 - (d) Chemosynthesis
10. The concentration of naturally occurring material from the earth's crust that we can extract and process into raw materials and useful products at an affordable cost is;
 - (a) A mineral resource
 - (b) A non-metallic mineral resource
 - (c) An ore mineral
 - (d) A high-grade ore
11. A good example of metallic minerals is;
 - (a) Phosphate salts
 - (b) Aluminum
 - (c) Sand
 - (d) Gravel
12. A rock that contains a large enough concentration of a particular mineral, often a metal, to make it profitable for mining and processing is;
 - (a) High-grade ore
 - (b) Low-grade ore
 - (c) An ore
 - (d) Both (a) and (b) are correct
13. Usually, electrical and communications wiring are often manufactured using;
 - (a) Manganese
 - (b) Chromium
 - (c) Aluminum
 - (d) Copper

14. The major difference between high-grade and low-grade ores is mainly with regards to;
 - (a) The type of rock in which they are found
 - (b) The concentration of the desired mineral
 - (c) The quality of the mineral that can be extracted from the ores
 - (d) Profits that can be made
15. Identified resources from which minerals can be extracted profitably at current prices are referred to as;
 - (a) Reserves
 - (b) High-grade ores
 - (c) Deposits
 - (d) Renewable mineral deposits
16. In non-renewable mineral terminology, economic depletion is closely related with;
 - (a) The economic down-turn that results in shut down of mining firms
 - (b) economic logic in continuing to extract minerals
 - (c) The time when it costs more than it is worth to find, extract, transport and process mineral resources
 - (d) The combination of lack of sophisticated mining technologies and lower prices of mineral resources

QUESTION TWO [25 MARKS]

1. The atmospheric lifetimes (ALT) and atmospheric warming potentials (AWP) of three major greenhouse gases (GHGs) are shown in **Fig 2**. Study the diagram carefully and answer the questions that follow.

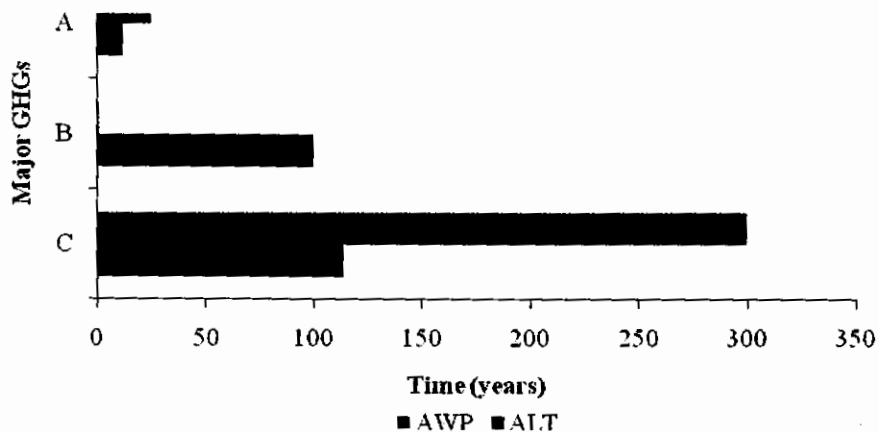


Figure 2: Atmospheric lifetimes (ALT) and warming potentials (AWP) of three major GHGs

- 1.1 GHGs include N_2O , CO_2 , CH_4 , H_2O , O_3 , HFCs, CFCs, HCFCs. Using your knowledge of AWP and ALT, state the three gases represented by A, B, and C [3].
- 1.2 Consider gas Gases B and C carefully. State the gas that is a major contributor to global climate change [2].
- 1.3 Briefly describe one reason to justify your choice in question 1.2 above [2].
- 1.4 From the list of gases given in question 1.1, state one gas that the world is not concerned about, even though it accounts for 66% of the greenhouse effect [2]

- 1.5 From the list of gases given in question 1.1, state any three that are used as refrigerator coolants, cleaners and fire retardants [3].
2. State any three human activities that lead to increased methane emissions [3]
3. State any three natural sources of CO₂ [3].
4. State any three sources of N₂O [3].
5. Prior to their prohibition, CFCs were used in many industrial processes. State any four such uses [4]

QUESTION THREE [25 MARKS]

1. Fig 3 shows three countries with vast reserves of gold, namely Swaziland, South Africa (SA) and Botswana. According to current production rates, it is projected that gold will be depleted in 40 years in Swaziland, in 70 years in SA and in 90 years in Botswana. Study the diagram carefully and answer the questions that follow.

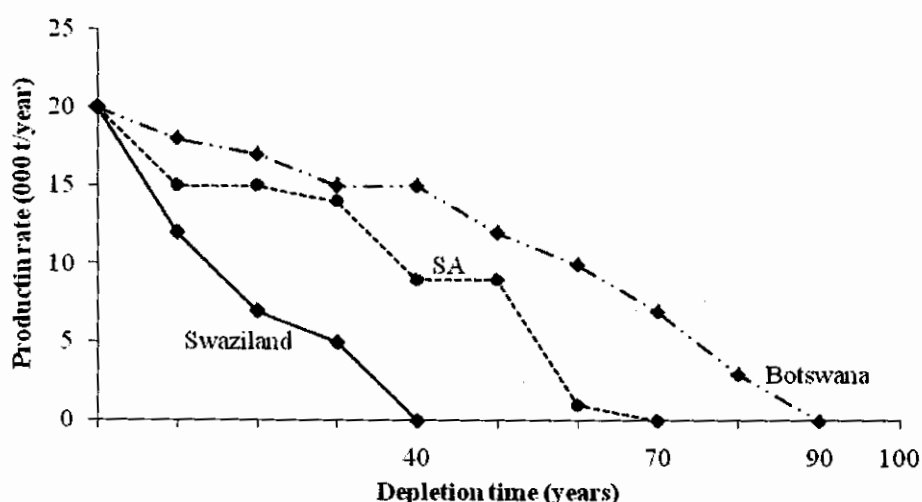


Figure 3: Gold production in three Southern African countries

- 1.1 What do you understand by economic depletion? [2]
- 1.2 Chose the correct answer: When gold is economically depleted, industries that manufacture gold products will [2]
 - (a) Close down their businesses and there will be no gold products ever again
 - (b) Not close down their businesses
- 1.3 State any five points to justify your choice in question (b) above [5]
- 1.4 What do you understand by depletion time? [2]
- 1.5 According to the three graphs shown in Fig 3, it is quite clear that the attitudes and practices of the three countries are different. For each country, state at least two points that justify the depletion times shown [6].
- 1.6 What are reserves? [2]
2. Discuss any three main anthropogenic activities that are said to have influenced the earth's climate [6].

QUESTION FOUR [25 MARKS]

1. Explain briefly the following terms;
 - (a) Fossil fuels [2]
 - (b) Non-renewable energy [2]
 - (c) Energy quality [2]
 - (d) Asthenosphere [2]
 - (e) Mineral [2]
 - (f) Mineral resource [2]
 - (g) Chemosynthesis [2]
2. State any two impacts of smaller, nonfatal doses of UV radiation on plants [3].
3. Discuss any two ecological and economic costs of tree damage, as a result of acid deposition [4].
4. State any three properties of CFCs, which lead to their widespread production [4].

QUESTION FIVE [25 MARKS]

1. The statements given in (a) to (o) below relate to mineral extraction and associated problems. Demonstrate your understanding of these problems by determining the correct answer in each case [True (T) or false (F)] [15].
 - (a) Mining lower-grade ores takes more money, energy, water and other resources, and leads to more land disruption, mining waste and pollution
 - (b) The environmental impacts of mining a metal ore are determined partly by the ore's percentage of metal content or grade.
 - (c) Soil and rock that is often found over shallow mineral deposits, which is often removed before accessing the mineral, is called spoils
 - (d) Surface mining is more applicable to mineral deposits that are located close to the surface.
 - (e) For minerals like copper, gold, sand, gravel, etc, the most suitable mining technique is contour strip mining.
 - (f) The main difference between area strip and contour strip is mainly related to the terrain.
 - (g) The main difference between overburden and spoils is that overburden is natural while spoils are manmade
 - (h) Mountaintop removal is a technique that is used to clear vegetation on top of mountains before digging for minerals.
 - (i) Subsurface mining disturbs less land compare to surface mining.
 - (j) Surface coal miners often experience less black lung diseases problems compared to subsurface coal miners
 - (k) In acid mine drainage, acid is used to dissolve gold from rocks.
 - (l) In acid mine drainage, H₂S is often the main type of acid.
 - (m) In gold mining, cyanide is often used to detoxify contaminated water.
 - (n) Birds and many types of mammals are often victims of some types of non-metallic mineral extraction
 - (o) Subsurface coal mines are notorious for fire explosions; however, these can be controlled successfully using current technologies.
2. State any three problems associated with subsurface mining [3]
3. State any three problems associated with subsidence of land over subsurface mines [3]
4. State any three problems associated with mountaintop removal [2].
5. State any three problems that are associated with metal smelting [2]