



basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

NATIONAL ASSESSMENT GENERAL EDUCATION CERTIFICATE (GEC)

2023 GRADE 9 PILOT STUDY Exemplar

SUBJECT: Natural Sciences

MARKS: 60

DURATION: 90 Minutes

The test consists of 27 pages excluding the cover page.

Instructions to the learner

1. Read all the instructions and questions carefully.
2. Answer all the questions.
3. Use the provided answer book to write all your answers.

The test starts on the next page.



Do not turn the page until you are told to do so.

SECTION A

1. Which of the following is a non-contact force?

- A Tension force
- B Normal force
- C Friction force
- D Electrostatic force

(1)

An astronaut has a mass of 70 kg on Earth.

2. What is the relationship between the mass and the weight of the astronaut on the moon?

- A The mass and the weight will both remain the same.
- B The mass and the weight will both become less.
- C The mass will be the same and the weight will be less.
- D The mass will be less and the weight will be the same.

(1)

Lightning is a giant electrostatic discharge.

3. What precautionary measures should you follow when you find yourself in lightning storms?

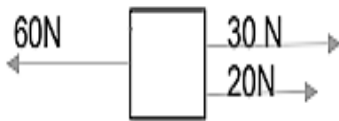
- A Run home as fast as possible.
- B Find shelter under nearby trees.
- C Stand next to tall objects.
- D Become the shortest object.

(1)



4. What forces are being exerted on the bag above?
- A It is only the Earth's gravitational force on the bag.
 - B It is only the muscular force of the boy's arm on the bag.
 - C The force of gravity and the boy's muscular force on the bag.
 - D The normal force of the boy's hand and the weight of the bag. (1)

The figure below shows three forces acting on the object.



5. What is the magnitude and direction of the net force?
- A 10 N to the left
 - B 10 N to the right
 - C 110 N to the right
 - D 110 N to the left (1)

A man rubs a balloon on his jersey and the balloon obtained a negative charge.

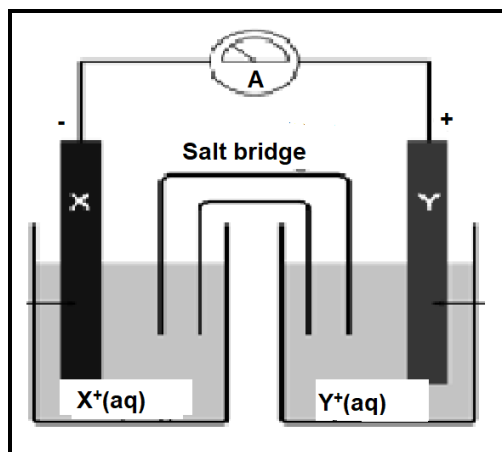
6. How did the balloon obtain the negative charge?
- A Protons were transferred from the jersey to the balloon.
 - B Electrons were transferred from the jersey to the balloon.
 - C The protons and electrons were transferred from the jersey.
 - D The balloon initially had too many negative charges. (1)

Electric cells supply energy needed for electrons to move around an electric circuit. Fruit cells, e.g. lemons, can be used as electric cells.

7. Why can lemons be used as electric cells?

- A The lemon cells have an acidic juice which acts as an electrolyte.
- B The lemon cells consist of copper and zinc which are electrolytes.
- C The lemon cells have a salt bridge which completes the circuits.
- D The lemon cells have an acidic juice which produces electricity. (1)

The diagram shows an electrode made up of an X metal placed in an X^+ solution, while a Y metal is placed in a Y^+ solution. The two half cells are connected by a U-tube salt bridge. The X and Y metal plates are both connected to an ammeter.



8. What will the direction of the electrons in this electro-chemical cell be?

- A Electrons will flow from the anode to the cathode.
- B Electrons will flow from the cathode to the anode.
- C Electrons will flow from the anode to the salt bridge.
- D The salt bridge will transfer electrons to the cathode. (1)

9. Define what the electrical resistance of a conductor is.

- A A flow of electric charges throughout a circuit.
- B An electrical component with a high resistance.
- C A source that transfers electrical energy to charges.
- D An opposition against the movement of charges.

(1)

The table below shows the results of an investigation on how different lengths of a conductor affect the resistance in a circuit.

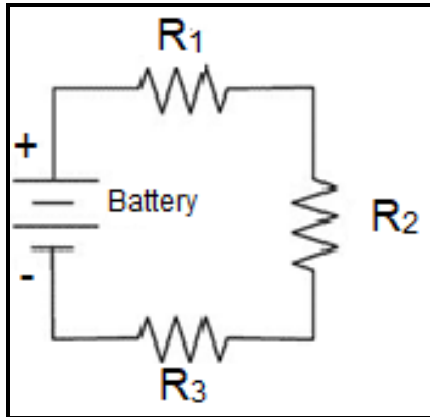
Conductor	Length (cm)	Current (A)	Potential difference (V)	$R = V/I$ (Ω)
X	20	0.5	0.6	1.2
W	40	0.5	1.2	2.4
P	60	0.5	1.8	3.6
Z	80	0.5	2.4	4.8

10. What is the relationship between the length and the resistance of the conductor?

- A The shorter the conductor the higher the resistance.
- B The longer the conductor the higher the resistance.
- C The length of the conductor has no effect on the resistance.
- D The longer the conductor the lower the resistance.

(1)

The diagram below represents a circuit with a battery and three resistors connected in series. $R_1 = 2\ \Omega$, $R_2 = 3\ \Omega$ and $R_3 = 4\ \Omega$



11. What is the total resistance in this circuit?

- A $2\ \Omega$
- B $8\ \Omega$
- C $9\ \Omega$
- D $5\ \Omega$

(1)

The diagram below shows the investigation of how an increasing number of cells in parallel affects the brightness of the bulb in a circuit.

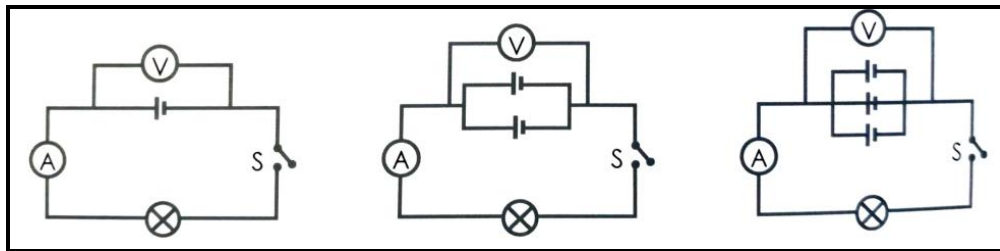


Figure 1

Figure 2

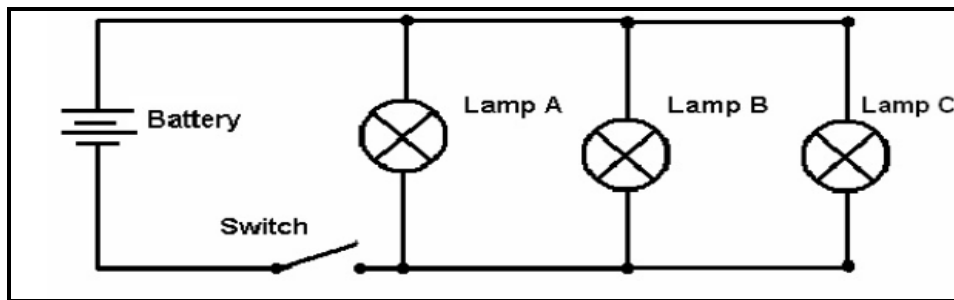
Figure 3

12. What happened to the voltmeter reading and brightness of the bulb in the sketches as the number of cells increased?

- A The voltmeter reading and the brightness of the bulb increased as the number of cells increased.
- B The voltmeter reading decreased as the number of cells increased but the brightness of the bulb remained the same.
- C The voltmeter reading and the brightness of the bulb decreased as the number of cells increased.
- D The voltmeter reading and the brightness of the bulb remained the same as the number of cells increased.

(1)

The circuit diagram shows a battery, a switch and three identical lamps (A, B and C) connected in parallel.

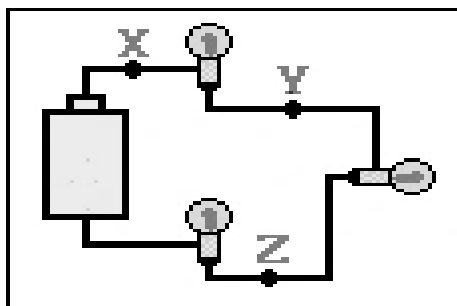


13. Which of the following best describes the parallel circuit if the switch is closed?

- A The flow of charges happens through multiple pathways.
- B The flow of charges happens through a single pathway.
- C If one of the lamps is taken out, then the other lamps will stop glowing.
- D The potential difference of lamp A will be higher than that of lamps B and C.

(1)

The diagram shows three identical light bulbs connected to a cell.

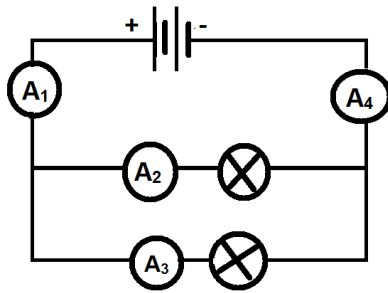


14. Which one of the following statements is correct?

- A All three bulbs will have the same brightness.
- B The bulb between X and Y will be the brightest.
- C The bulb between Y and Z will be the brightest.
- D The bulb between Z and the battery will be the brightest.

(1)

The circuit diagram shows 2 identical cells and bulbs connected to ammeters (A_1 , A_2 , A_3 and A_4).

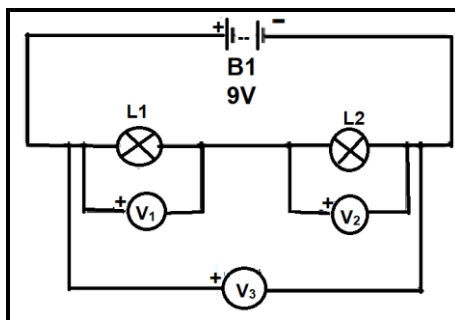


15. Which ammeters will have the same reading?

- A A_1 and A_4 ; A_2 and A_3
- B A_1 and A_2 ; A_3 and A_4
- C A_4 and A_2 ; A_1 and A_3
- D A_4 and A_3 ; A_1 and A_4

(1)

Study the following circuit diagram.

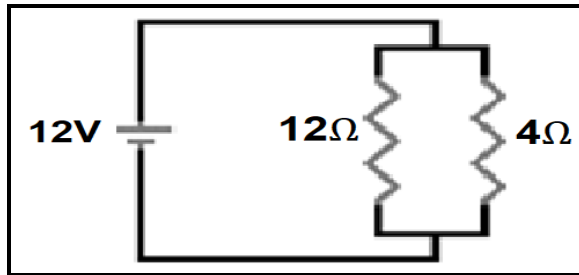


16. How would the reading of Voltmeter 1 and 2 be compared to the reading of Voltmeter 3?

- A The sum of the readings of V_1 and V_2 will be more than the reading of V_3 .
- B The sum of the readings of V_1 and V_2 will be less than that of V_3 .
- C The sum of the readings in V_1 and V_2 will be equal to the reading in V_3 .
- D The sum of the readings of V_1 , V_2 and V_3 will be equal to that of the battery.

(1)

Study the following diagram.

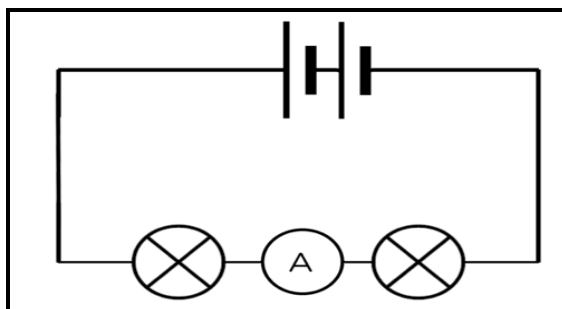


17. What proportion of the current will flow through the $12\ \Omega$ resistor?

- A $\frac{2}{3}$
- B $\frac{1}{4}$
- C $\frac{1}{3}$
- D $1\frac{1}{2}$

(1)

The potential difference of each cell is 1.5 V.



18. What is the potential difference across the battery if the cells are doubled?

- A The potential difference of the battery will be the same.
- B The potential difference of the battery will be halved.
- C The potential difference of the battery will be doubled.
- D The potential difference of the battery will decrease.

(1)

The picture shows illegal electricity connections at a substation.

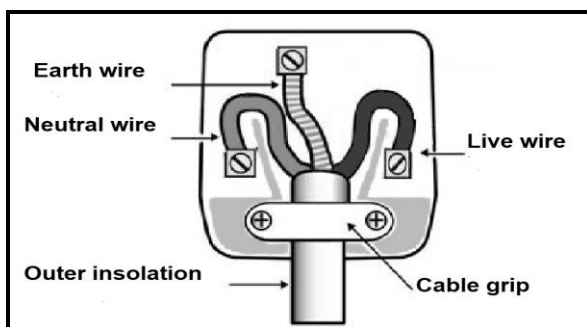


Sourced from: thesouthafrican.com/news/illegal-electricity-connection-leads-to-the-deaths

19. What negative impact does this kind of connection have on the community?

- A People are able to get electricity for free.
- B It assists to prevent Eskom load shedding.
- C It overloads the system which leads to power failures.
- D It gives unemployed people job opportunities.

(1)



20. What is the function of the live wire in a three-pin plug?

- A The current is supplied through the live wire to the appliance.
- B The current flow in the appliance returns to the power outlet.
- C It's a safety wire to protect the users against electrocution.
- D It stops positive and negative current as electrons are pushed around.

(1)

21. What is the main source of electricity in South Africa?

- A Nuclear power
- B Coal
- C Solar power
- D Water

(1)

About 5 % of South Africa's electricity is generated by nuclear power stations which use a metal called uranium.

22. When is heat produced in the nuclear power station?

- A When oil is burned to heat the water.
- B During nuclear fission to heat water.
- C When gas is burned to heat the water.
- D When atoms combine during the reaction.

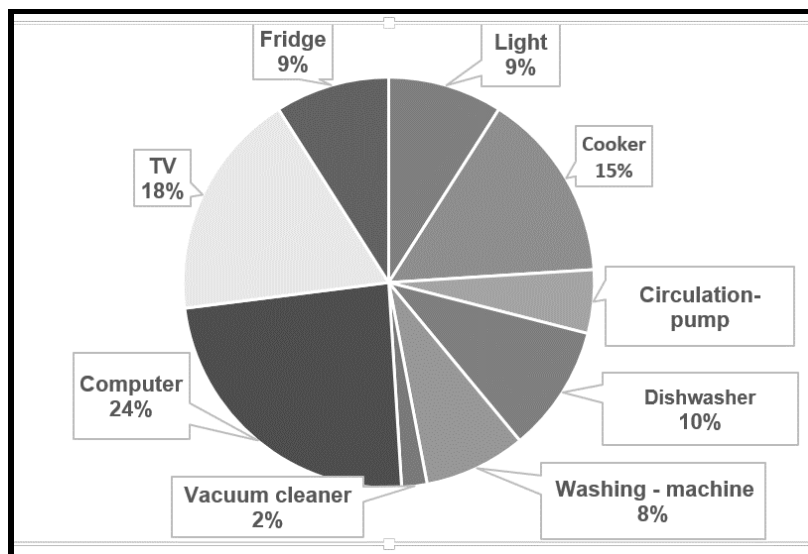
(1)

23. Which energy source will be sustainable and has the least negative impact on the environment?

- A Wind
- B Nuclear
- C Solar
- D Biomass

(1)

The graph shows the use of electrical appliances in a household over a period of a month. The total energy consumption is 330 kWh.



24. What is the amount of energy used by the computer?

- A 330 kWh
- B 79.2 kWh
- C 33.4 kWh
- D 240 kWh

(1)

25. What does kWh stand for?

- A kilowatt
- B kilowatt hour
- C kilometre per hour
- D kilojoules

(1)

The solar panels in solar geysers consist of many solar cells. When the photons (light particles) hit the solar cells, they cause some reaction.

26. What reaction will take place when the photons hit the solar cells?

- A Photons are released.
- B Electrons are released.
- C Protons are released.
- D Solar cells produce electricity. (1)

A hair dryer of 1200 W is used for 30 minutes and the municipal tariff is R1,40 per kWh.

27. Calculate the cost of the energy consumption of the hair dryer.

- A R84,00
- B R50,04
- C R5,40
- D R0,84 (1)

28. What is the most effective and sustainable way of reducing energy consumption in a household?

- A Make use of LED light bulbs.
- B Share the stove with family members.
- C Use normal light bulbs.
- D Leave computers on standby mode. (1)

29. Which is the most correct statement regarding solar geysers?

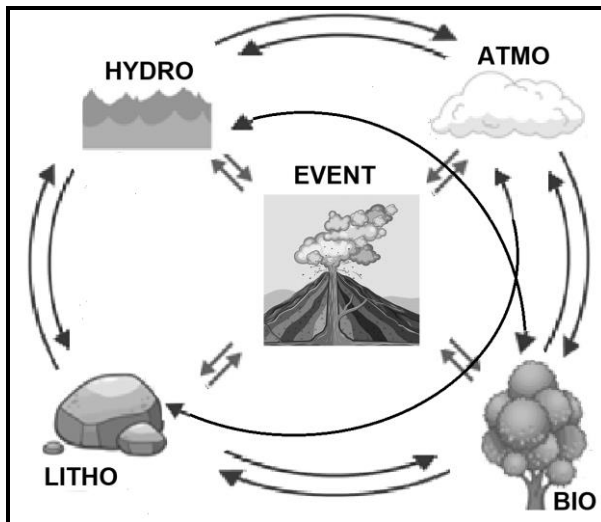
- A The solar geysers cannot get as hot as electrical geysers.
- B The availability of hot water in the geyser depends on the weather.
- C They are not simple to design and very expensive in the market.
- D Panels connected to solar geysers have dangerous pollutants. (1)

30. In which layer of the lithosphere is magnesium found?

- A Outermost layer
- B Solid inner core
- C Semi - solid mantle
- D Liquid outer core

(1)

The diagram shows the interactions amongst spheres of the Earth.



31. Which statement best represents the interaction amongst spheres during a volcanic eruption?

- A Floods → streamside communities → hot lava → glaciers melt
- B Hot lava → glaciers melt → streamside communities → floods
- C Hot lava → glaciers melt → floods → streamside communities
- D Streamside communities → hot lava → glaciers melt → floods

(1)

32. What is the lithosphere?

- A The lithosphere is the sphere that contains all cold, hard and solid land, and the semi-solid liquid under the crust.
- B The lithosphere is the sphere that contains all the solid, liquid and gaseous water of the planet.
- C The lithosphere is the sphere that contains only living things including micro-organisms.
- D The lithosphere is the sphere that contains all the air in the Earth's system and extends from less than 1m from planet Earth's surface. (1)

33. What is the chemical equation for the reaction taking place when iron reacts with oxygen?

- A $\text{Fe}_2 + 3\text{O}_2 \rightarrow 2\text{FeO}_2$
- B $2\text{Fe} + 3\text{O} \rightarrow \text{Fe}_2\text{O}_3$
- C $4\text{Fe} + 2\text{O} \rightarrow 2\text{Fe}_2\text{O}$
- D $4\text{Fe} + 3\text{O}_2 \rightarrow 2\text{Fe}_2\text{O}_3$ (1)

34. How are igneous rocks (plutonic/intrusive) formed?

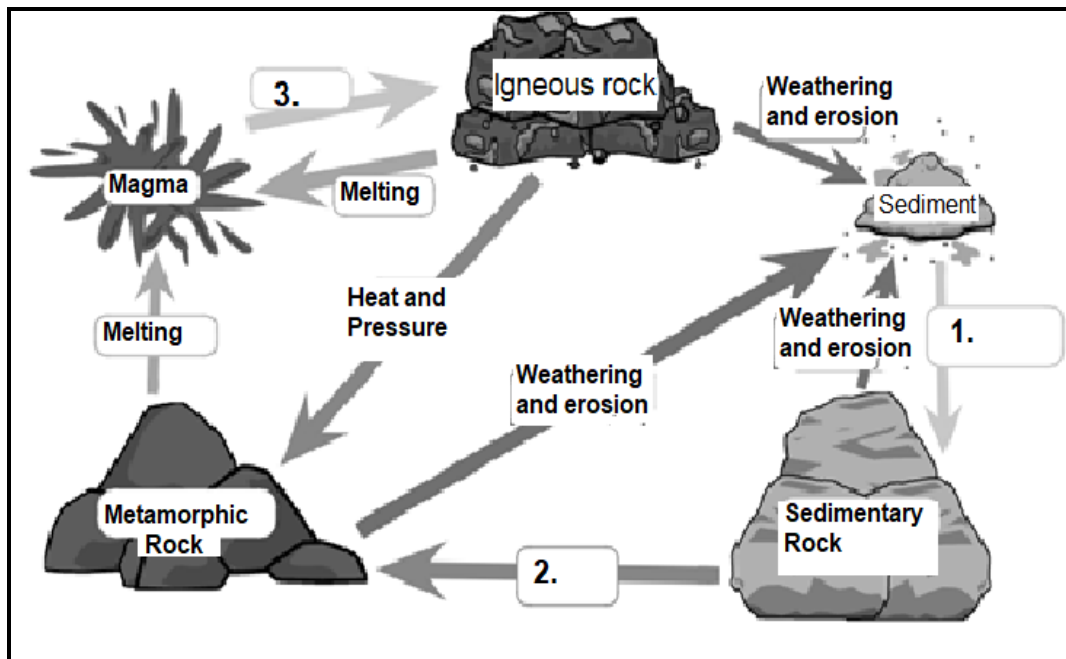
- A Plutonic rocks result when magma cools and crystalizes slowly within the Earth's crust.
- B Plutonic rocks result from magma reaching the surface either as lava or fragmental volcanic pieces.
- C Plutonic rocks result from two minerals having a noticeable difference in grain size.
- D Plutonic rocks result from gas expansion or bubbles which occur during volcanic eruptions. (1)

35. What are the four main elements in the Earth's crust?

- A Copper, hydrogen, silver and iron.
- B Magnesium, iron, silicon and copper.
- C Aluminium, oxygen, silicon and iron.
- D Carbon, oxygen, silver and iron.

(1)

The picture shows different stages of the rock cycle.



Source adapted from: storyboardthat.com/lesson-plans/rocks-and-weathering/rock-cycle/amp

36. What are the processes that occur at different stages 1, 2 and 3?

	1	2	3
A	Compaction and cementation	High temperature and pressure	Crystallization of magma
B	Compaction and cementation	Crystallization of magma	High temperature and pressure
C	High temperature and pressure	Crystallization of magma	Compaction and cementation
D	Crystallization of magma	High temperature and pressure	Compaction and cementation

(1)

The atmosphere of the Earth is the layer of gases retained by the Earth's gravity that surrounds the planet and forms planetary atmosphere.

37. Which combination best describes the composition of gases in the atmosphere?

Gases in %				
	Nitrogen	Oxygen	Argon	Carbon Dioxide
A	0.04	21	78	0.93
B	78	21	0.93	0.04
C	0.04	78	0.93	21
D	0.93	0.04	21	78

(1)

38. What is the relationship between density and altitude as you move from the troposphere to the thermosphere?

- A Density decreases as altitude increases.
 - B Density increases as altitude increases.
 - C Density remains the same as altitude decreases.
 - D Density decreases as altitude decreases.
- (1)

39. Which statement best describes the troposphere?

- A The troposphere is the fourth and the thickest layer at about 350 km from the Earth.
 - B The troposphere is the second layer of the atmosphere at about 50 km above the Earth.
 - C The troposphere is the third layer of the atmosphere at about 50 km above the Earth.
 - D The troposphere is the lowest layer of the atmosphere at about 15 km above the Earth.
- (1)

40. Which letter best represents the main characteristics of the mesosphere in the table below?

	Thickness of the layer	Temperature range	What you find in this layer
A	10 – 20 km	-50°C - 20°C	Satellites
B	50 – 80 km	-50°C - 30°C	Meteorites
C	50 – 80 km	30°C - 90°C	Ozone
D	130 – 350 km	-90°C - 50°C	Earth's Surface

(1)

The table below shows the results of an investigation on the global warming phenomenon. The plastic bag represented the atmosphere.

Time (Min)	Temperature inside the plastic bag (°C)	Temperature outside the plastic bag (°C)
15	23	21
17	26	21
19	29	22
21	32	22
23	35	22
25	38	22
27	41	23

41. Which one of the following statements best explains the effects of global warming?

- A An increase in greenhouse gases causes an increase in temperature on Earth.
- B An increase in greenhouse gases causes a decrease in temperature on Earth.
- C The plastic bag has no effect on the reading of the temperature as reading outside increases with time.
- D The plastic bag provides an incorrect reading of the temperature as reading outside increases with time.

(1)

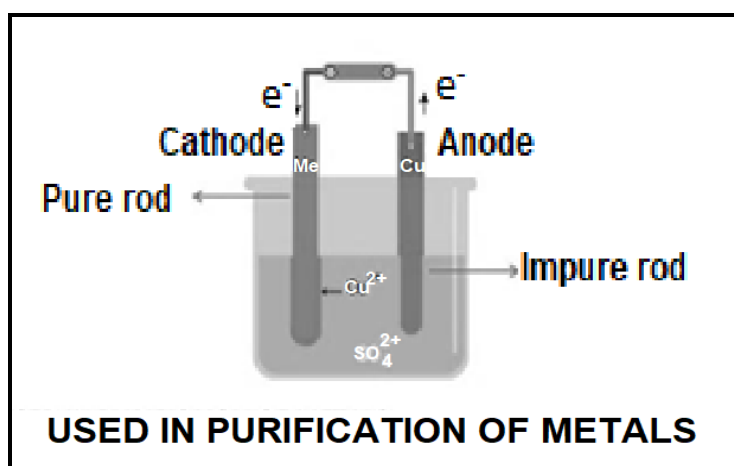
Bloomery was the first mining technique used to extract iron from its ore by mixing charcoal with iron ore. When heating the mixture and blowing air in through bellows, the iron ore is converted to produce iron metal.

42. Which chemical equation represents the above-mentioned process?



(1)

There are several methods used in refining minerals. The picture below indicates one of the main methods of refining metals.



43. Which method of refining mineral is used in the picture?

A Zone refining

B Distillation

C Electrolysis

D Chromatography

(1)

Tourists discovered glittering stones which they thought contained a certain mineral. They crushed the stones to separate the mineral from the stone waste.

44. How would you advise them to get value for their discovery?

- A Finding of high-quality ore and physical separation.
- B Refining metals by cleaning them and distribution.
- C Floatation and bringing rocks to the surface.
- D Milling mined rocks after sinking ores to the bottom.

(1)

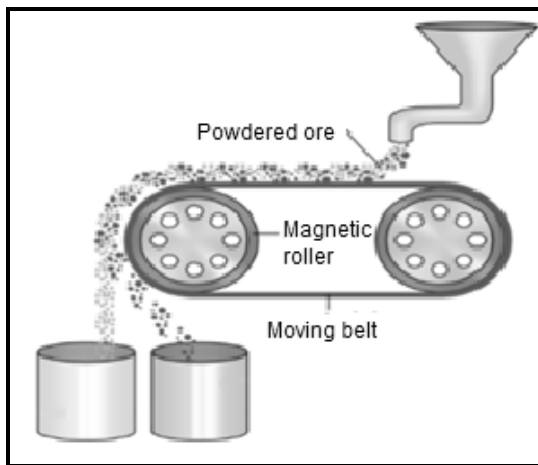
Titanium was discovered on the Xolobeni Coast in Mbizana. Mining rights were granted by the Department of Minerals and Energy. The decision to mine was suspended after legal interventions because of resistance from the community.

45. How would you convince the community of Xolobeni regarding the benefits of mining titanium?

- A People close to mines should be the only beneficiaries to help their families.
- B Mining of resources should only benefit big companies to create employment.
- C Mining should benefit all African people as long as they live in South Africa.
- D Government should own the mines and use profits to improve South Africa.

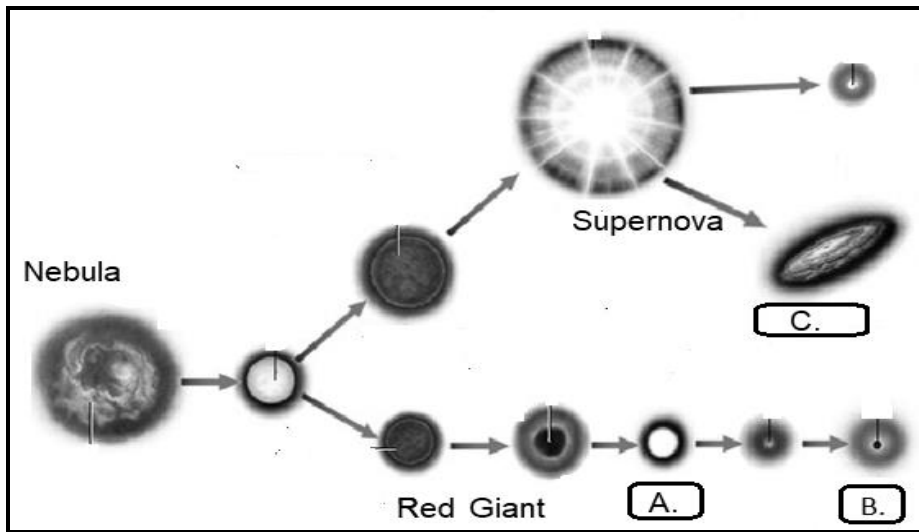
(1)

There are different methods that can be used to separate minerals from waste. The picture below shows the magnetic separation method.



46. How does the magnetic separation method work?
- A The smaller rocks are moved to the mills where large rod mills grind them until it is powder.
 - B Rocks are crushed into smaller pieces using a crusher, and rollers in mills that contain magnets will collect magnetic pieces.
 - C Mineral resources are mixed with water in a pan and a magnet is used to collect the minerals from waste.
 - D Electromagnets remove the magnetic pieces containing iron from the non-magnetic waste. (1)
47. What happens during the main sequence stage of the life of a star?
- A The main sequence phase is when the pressure of gravity pulling into the star is equal to the energy pushing out of the star.
 - B The main sequence is when the star undergoes nuclear fusion from a star and a huge amount of heat and light energy is released.
 - C The main sequence refers to the process whereby nuclear fusion causes the stars to convert hydrogen into helium.
 - D The main sequence refers to a process whereby clouds of dust and gas are pulled together by gravity to form a solid body. (1)

The diagram below shows different stages of the life of a star as they develop in different ways according to their sizes.



Sourced from: [quora.com/what-is-the-birth-and-death-of-a-star](https://www.quora.com/what-is-the-birth-and-death-of-a-star)

48. What are the stages labelled A, B and C?

- A A –neutron star, B – white dwarf and C – protostar.
- B A –white dwarf, B – black dwarf and C – black hole
- C A –red giant, B – red super giant and C - supernova
- D A –black dwarf, B – white dwarf and C – neutron star

(1)

[48]

SECTION B

Answer all questions to the best of your ability.

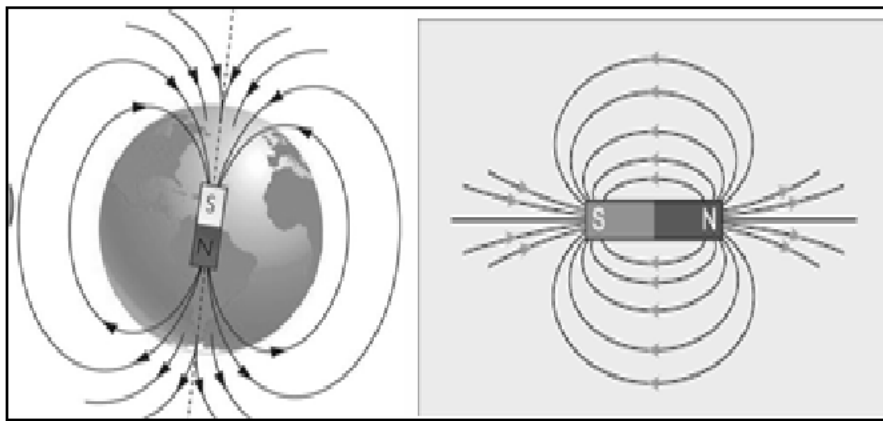


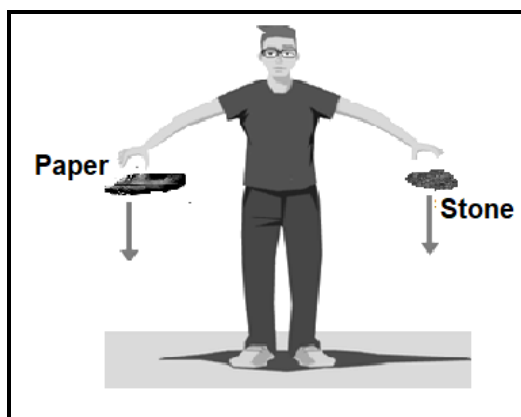
Figure A

Figure B

Sourced from: steemkr.com/steemstem

1. Briefly compare the magnetic field of Figure A to that of Figure B. (1)

The picture shows the demonstration of the effect of gravitational force on falling objects using a paper and a stone in a classroom. Both objects fall from the same height and were released simultaneously.



Sourced adapted from: clarkscience8.weebly.com/friction--gravity.ht

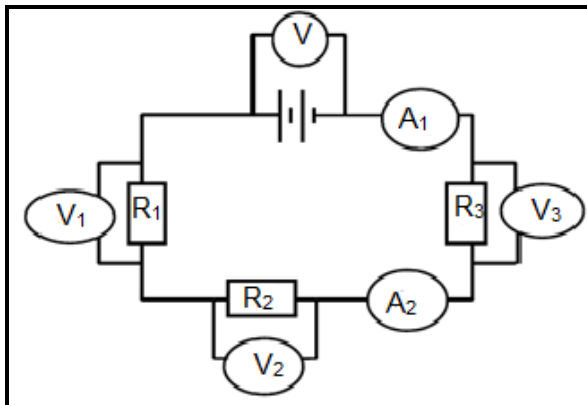
2. Which object will hit the ground first? Give a reason for your answer. (2)

The effect of the thickness of a conductor on its resistance was investigated. The following materials were used:

- 2 cells
- an ammeter
- 4 copper wires of the same length but different thickness (used one at a time).

3. Identify the independent variable in this investigation. (1)

The reading of ammeter A_1 is 3 A and the potential difference across the battery is 5 V. The potential difference across R_1 and R_3 is 1,5 V each.



4. Calculate the potential difference across R_2 . (2)

5. Discuss the advantages of using nuclear power e.g. at Koeberg Nuclear Power station. (1)

6. In which layer of the atmosphere does precipitation take place? (1)

7. Describe the formation of sedimentary rocks. (1)

The ozone layer is the important layer found in the stratosphere and it absorbs harmful ultraviolet radiation before it reaches the Earth's surface.

8. What would you suggest be done to avoid the depletion of the ozone layer? (1)

Mining has a variety of negative impacts in the environment especially near residential areas.

9. Name one negative impact of mining operations close to residential areas. (1)

The colour of a star mostly indicates its temperature and/or age.

Colour	Yellow	Red	Blue
Temp in Kelvin	5 200 – 6 000 K	2 400 – 3 700 K	30 000 K +

10. Arrange these stars in order of age from the youngest to the oldest by referring to their colour. (1)

[12]

End of test

