

Hillcrest High School

NATURAL SCIENCE

NOVEMBER 2023

Grade 9

MARKS: 120

EXAMINERS: Mrs Smith & Mrs Knox-Whitehead

TIME: 2 Hours

MODERATOR: Mrs R. Harmse

Instructions:

1. This question paper consists of **2 SECTIONS: A AND B.**
2. Answer all of the questions from **SECTIONS A** and **SECTION B** in the answer book provided.
3. Non-programmable calculators may be used. Round answers off to **TWO DECIMAL PLACES** where applicable.
4. Number the answers correctly according to the numbering system used in this question paper.
5. Write neatly and in pen.
6. **LEAVE A LINE** between each answer.
7. **RULE OFF** after each question.

FORMULA SHEET

Forces:

$$F_{\text{res}} = F_1 + F_2 + \dots$$

$$W = m \times g$$

$$g = 9,8 \text{ m}\cdot\text{s}^{-2}$$

Circuits:

$$R = \frac{V}{I}$$

$$R_s = R_1 + R_2 + R_3 \dots\dots$$

$$\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} \dots\dots$$

SECTION A : ENERGY AND CHANGE

[60]

QUESTION 1: MULTIPLE CHOICE QUESTIONS

[1 x 5 = 5]

Four options are provided as possible answers to the following questions. Each question has only one correct answer. Write only the letter (A-D) next to the question number (1.1 – 1.5) in the answer book.

1.1 An object becomes positively charged when...

- | | |
|----------------------|--------------------|
| A it gains electrons | C it gains protons |
| B it loses electrons | D it loses protons |

1.2 Which of the following is NOT involved in transporting electricity to our homes on the national electricity grid?

- | | |
|-------------------|--------------|
| A transformer | C substation |
| B circuit breaker | D pylon |

1.3 Which of the following components can be used to adjust the volume on a radio?

- A light dependent resistor
- B LED
- C diode
- D rheostat

1.4 What is the total resistance for a circuit with a 2Ω resistor connected in parallel with a 5Ω light bulb?

- | | |
|-----------------|-----------------|
| A $0,7 \Omega$ | C $1,43 \Omega$ |
| B $1,42 \Omega$ | D 7Ω |

1.5 If the cost of electricity is R2,86 per kWh, what would it cost to run four 100W light bulbs for 6 hours a night for one week?

- | | |
|----------|-----------|
| A R6,86 | C R12,01 |
| B R48,05 | D R48 048 |

QUESTION 2: TERMINOLOGY

[5]

Write down only the correct scientific term / words for the following descriptions.

- 2.1 Giant mirrors used to focus the sun's rays onto a water tower to produce steam. (1)
- 2.2 A component of a circuit that allows current to flow in one direction only. (1)
- 2.3 Opposition to the flow of charge in an electric circuit. (1)
- 2.4 A field force between charged objects. (1)
- 2.5 A component of a circuit that melts when the current exceeds a certain limit. (1)

QUESTION 3: FORCES

[18]

- 3.1 Identify the type of force observed in each of the pictures below. Choose from the following forces:

FRICTION	TENSION	COMPRESSION
MAGNETISM	ELECTROSTATIC FORCE	GRAVITATIONAL FORCE

3.1.1



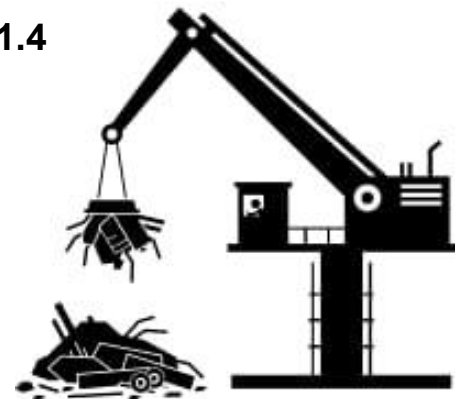
3.1.2



3.1.3

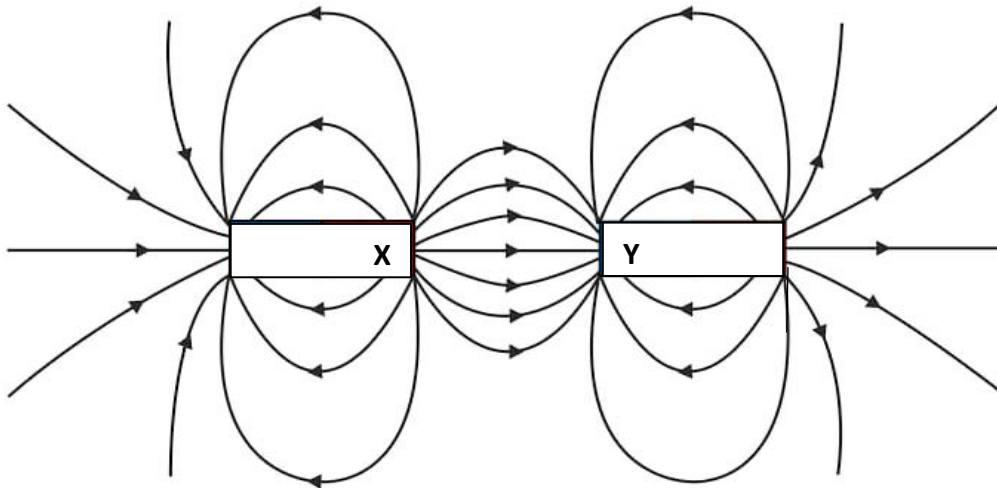


3.1.4



(4)

3.2 Study the diagram below and write down the correct labels for **X** and **Y**. (2)



3.3 Study the picture below of forces being applied to a chair.



3.3.1 Ben is pushing the chair with a force of 125 N and Dan is pulling the chair with a force of 70N. Calculate the total force applied to the chair. (3)

There is also a frictional force acting between the chair and the floor.

3.3.2 Which direction is the frictional force acting? (1)

3.3.3 If the net / resultant / overall force being experienced by the chair is 187,5 N, calculate the size of the frictional force, showing all workings. (3)

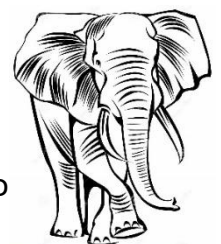
3.4 An elephant has a mass of 2 700 kg.

3.4.1 Calculate the weight, **W**, of the elephant on earth. (3)

3.4.2 How would the weight of the elephant change if it were taken to the Moon?

Choose from INCREASE, DECREASE or STAY THE SAME. (1)

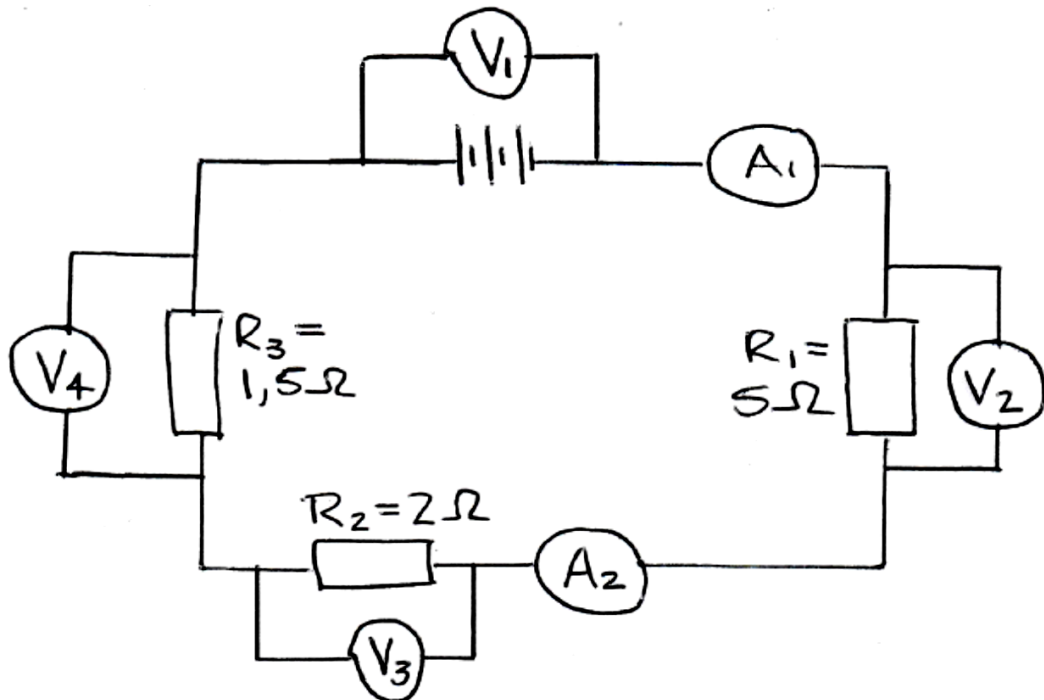
3.4.3 Explain your answer to QUESTION 3.4.2 using your knowledge of the factors that affect gravitational force. (1)



QUESTION 4: CIRCUITS

[14]

4.1 Study the diagram below. Assume the resistance of the ammeters can be ignored. Round off your answer to 2 decimal places where applicable.



4.1.1 Calculate the total resistance of this series circuit. (3)

The reading on V_1 is 6V.

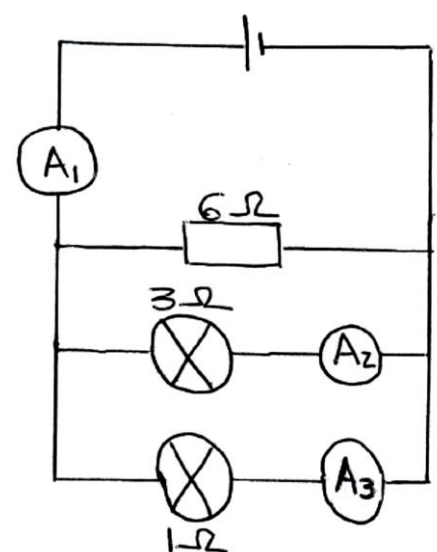
4.1.2 Calculate the reading on A_1 . (3)

4.1.3 Calculate the reading on V_3 . (3)

4.2 Study the parallel circuit in the diagram:

4.2.1 Calculate the total PARALLEL resistance in the circuit shown. (4)

4.2.2 A_1 , A_2 and A_3 all show different readings. List the 3 ammeters in order of DECREASING current strength readings. (1)



QUESTION 5: SCIENTIFIC METHOD**[16]**

Some Grade 9 learners conducted an experiment to determine the relationship between **VOLTAGE** and **CURRENT STRENGTH**. They constructed a series circuit that consisted of one cell, one resistor, a voltmeter connected over the cell and an ammeter. After recording the voltmeter and ammeter readings, they added a second cell and then a third cell, recording the voltmeter reading for the battery and the ammeter reading after each change. The results are shown in the table below:

TABLE SHOWING VOLTAGE AND CURRENT STRENGTH

NO OF CELLS	AMMETER READING (A)	VOLTMETER READING (V)
1	0,6	3
2	1,2	6
3	1,8	9

- 5.1 Name the dependent variable. (1)
- 5.2 Write an investigative question for this experiment.
(Hint: Carefully read the description of the experiment given above). (2)
- 5.3 Draw a circuit diagram of this experiment as the circuit would appear after all 3 readings had been taken. (5)
- 5.4 Plot a line graph of CURRENT STRENGTH vs VOLTAGE.
(Don't forget a heading and label your axes clearly.) (5)
- 5.5 Calculate the resistance of the resistor used in the experiment using any of the values given in the table above. Show your working. (3)

QUESTION 6: ALTERNATIVE ENERGY**[2]**

- 6.1 Name one alternative method of producing electricity that we have studied that does not use coal. Be clear and specific in your name to indicate which process you are referring to. (1)
- 6.2 List one disadvantage of the energy source you named in QUESTION 6.1. (1)

TOTAL SECTION A : [60]

SECTION B : PLANET EARTH AND BEYOND**[60]****INSTRUCTIONS**

1. Start this section at the top of a new page.
 2. Leave a line between each sub question for example, between **QUESTION 1.1 and QUESTION 1.2.**
 3. Rule off after each question for example between **QUESTION 1 and QUESTION 2.**
-

QUESTION 1: MULTIPLE CHOICE QUESTIONS**[1 X 5 = 5]**

Four options are provided as possible answers to the following questions. Each question has only one correct answer. Write only the letter **(A-D)** next to the question number **(1.1 – 1.5)** in the answer book.

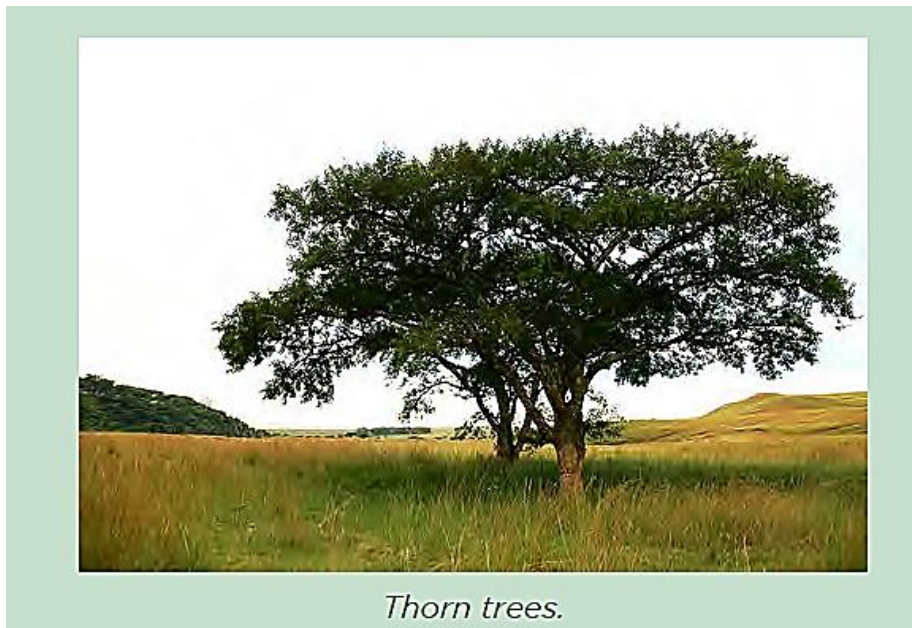
- 1.1 Igneous rock that forms from magma by cooling very slowly on the surface of the Earth is called ...
- | | |
|------------|-----------------|
| A. basalt | C. pumice stone |
| B. granite | D. sandstone |
- 1.2 The lithosphere is made up of the ...
- | | |
|---------------------------|------------------------------|
| A. crust and upper mantle | C. mantle only |
| B. crust only | D. outer core and the mantle |
- 1.3 The type of rock most likely to contain dinosaur fossils is ...
- | | |
|------------|----------------|
| A. magma | C. metamorphic |
| B. igneous | D. sedimentary |
- 1.4 The most abundant gas in the Earth's atmosphere is ...
- | | |
|-----------------|-------------------|
| A. water vapour | C. carbon dioxide |
| B. nitrogen | D. oxygen |
- 1.5 The atmosphere has four layers:
- | |
|---|
| A. thermosphere, mesosphere, stratosphere and troposphere |
| B. water, nitrogen, oxygen and carbon dioxide |
| C. thermosphere, lithosphere, biosphere and stratosphere |
| D. biosphere, ionosphere, mesosphere and thermosphere |
-

QUESTION 2: TERMINOLOGY**[1 x 5 = 5]****Write down only the correct scientific term / words for the following descriptions:**

- 2.1 A gradual increase in the temperature of the Earth's atmosphere.
 - 2.2 Gases like methane, water vapour and carbon dioxide which allow the Sun's energy through but then trap it in the Earth's atmosphere.
 - 2.3 The sphere of the Earth where all life exists.
 - 2.4 The process by which rock is broken down into smaller particles.
 - 2.5 Particles of rock that have been deposited by wind and water .
-

QUESTION 3:**[4]**

Study the photo below of acacia thorn trees on the savannah.



- 3.1 What will happen to the trees if they do not get enough water? (1)
 - 3.2 In not more than 6 lines in total, describe in full sentences any interaction between the **acacia thorn trees** and
 - 3.2.1 the atmosphere (1)
 - 3.2.2 the lithosphere (1)
 - 3.2.3 any other species in the biosphere (1)
-

QUESTION 4:**[7]**

The table below shows mining statistics for the provinces of South Africa from the 2016 census. Look carefully at the table and then answer the questions that follow.

Provinces	Number of mines	Total income (in R millions)*	Total number of employees
Gauteng	118	14 544	159 126
North West	100	13 968	140 522
Mpumalanga	91	13 606	71 585
Limpopo	54	8 717	40 640
Free State	63	8 324	114 384
(A)	71	2 610	12 008
Western Cape	108	898	2 999
Eastern Cape	44	(B)	832
TOTAL IN SA	649	62770	(?)

* This means that the amounts are in millions e.g Gauteng earned R14 544 million
Adapted from www.statssa.gov.za

- 4.1 Identify the province labelled **(A)** in the table. (1)
- 4.2 Which province has the most number of mines? (1)
- 4.3 What total income do the mines in the Eastern Cape **(B)** contribute to the South African economy? Show your working. (2)
- 4.4 The population of SA was 58 million people in 2016.
Calculate the percentage of people in the country that were working in the mining sector at that time . Show all your working. (3)
-

QUESTION 5:**[7]**

Read the article below and then answer the questions that follow.

CLIMATE CHANGE CAN PUT MORE INSECTS AT RISK FOR EXTINCTION

New NASA research is shedding light on how insect populations may respond to climate change. An analysis shows how extreme temperature fluctuations are an important factor in insect extinction risk for the next century. This is very concerning as insects perform many important roles in Earth's ecosystems. They assist with the production of fruits, vegetables, and flowers through pollination. They decompose organic matter. They even help control other harmful pests.

In a recent study, NASA scientists found that 61 percent of the 36 insect populations they studied faced extinction, particularly due to dramatic and erratic temperature swings in their local environments. They expect climate change to negatively affect biological diversity — the amount of variation found in the genes, species, and ecosystems on Earth. This is because temperature changes are particularly threatening for cold-blooded insects because they lack mechanisms to regulate their body temperature during drastic temperature swings.

Maintaining diversity is essential for human health, food security, clean air and water, and for millions of agricultural jobs worldwide. Understanding which species may be most at risk could allow conservationists to more accurately target efforts to combat losses of diversity.

Adapted from "Nature Climate Change" NASA AMES RESEARCH CENTRE 10 Nov 2022

- 5.1 State one important factor that is responsible for increasing the risk of insect extinction. (1)
- 5.2 What is meant by the term 'biological diversity'? (1)
- 5.3 What phenomenon is said to negatively affect biological diversity on the planet? (1)
- 5.4 State two reasons why biological diversity in insects is so vital for human survival. (2)
- 5.5 Calculate the number of insect populations in this study that face extinction in the next 100 years. Choose the correct answer from those listed below. (1)
(Write only A, B, C, D or E)
- (A) 22 (B) 25 (C) 36 (D) 39 (E) 61
- 5.6 Why are insects, in particular, threatened by temperature changes? (1)
Quote directly from the article.

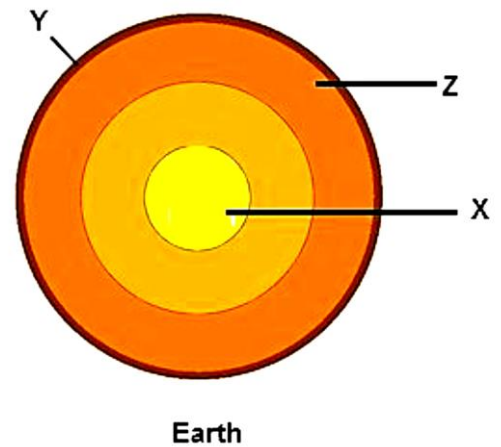
QUESTION 6:

[6]

6.1 The diagram below represents the structure of the earth.

Provide labels for the sections marked:

- 6.1.1 **X** (1)
- 6.1.2 **Y** (1)
- 6.1.3 **Z** (1)



6.2 Complete the following sentences.

Write down only the question number (6.2.1 – 6.2.3) in your answer book followed by the answer. Supply **ONLY** the missing word. (3)

“Rocks form when magma moves towards the Earth’s surface through volcanic pipes from the mantle, cooling slowly on its way to form (6.2.1) _____ rock.

Magma also pushes through the crust, undergoing chemical changes due to high temperatures and pressures, thereby turning it into (6.2.2) _____ rock.

In time, all rocks on the surface of the Earth will become eroded by the elements and be deposited in layers on the sea floors and lakes forming (6.2.3) _____ rock.”

QUESTION 7:

[4]

“Global warming is a potentially life-threatening problem for the biosphere on Earth.”

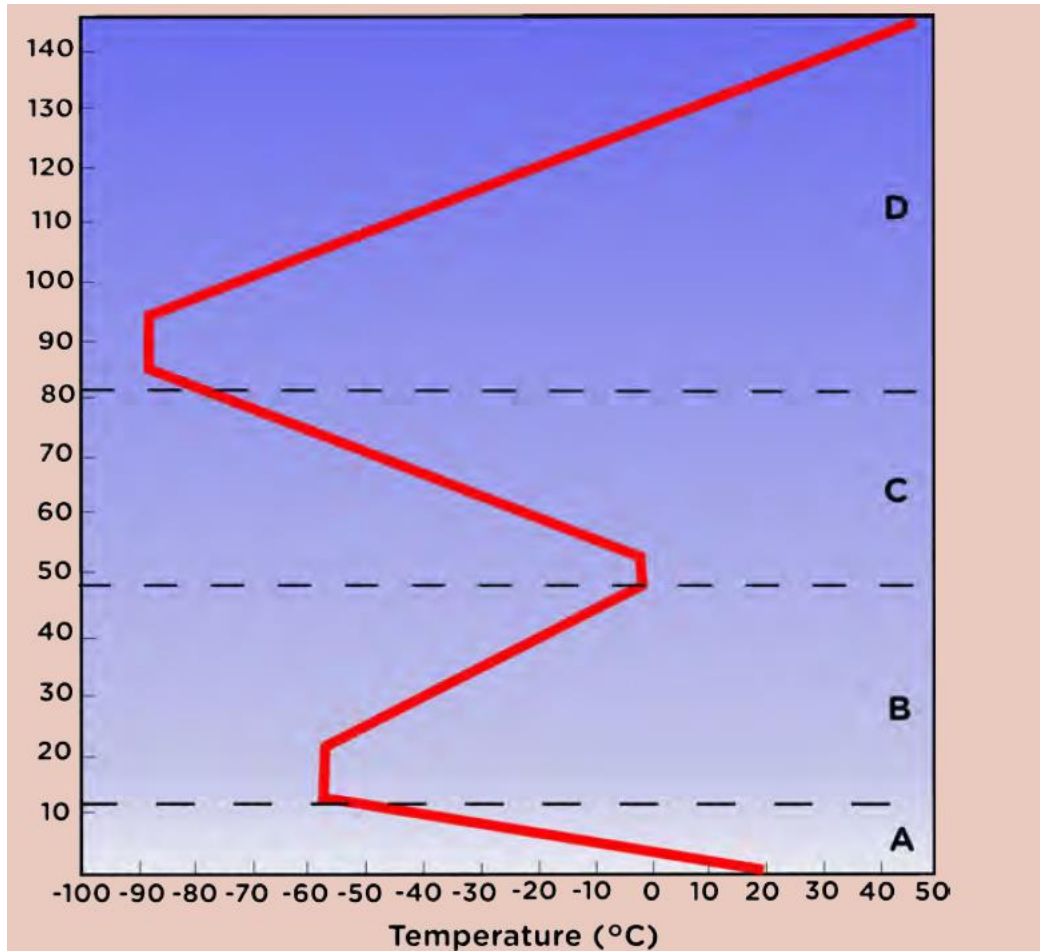
Discuss TWO negative impacts that global warming has on the biosphere, mentioning both the causes and the effects of these impacts.

(Do not exceed more than 8 lines in your answer.)

QUESTION 8:

[17]

Refer to the graph and answer the questions that follow.



- 8.1 Suggest a suitable label and units of measurement for the data on the y-axis. (2)
- 8.2 Consider the information plotted on the two axes and identify the independent variable. (1)
- 8.3 Supply a label for the layers marked:
 - 8.3.1 **A** (1)
 - 8.3.2 **B** (1)
 - 8.3.3 **C** (1)
 - 8.3.4 **D** (1)
- 8.4 What is the approximate altitude range for the mesosphere? Show all your working. (2)
- 8.5 Explain why the temperature in layer **B** increases so dramatically with altitude. (2)

- 8.6 The current temperature in Hillcrest, which is approximately 550m above sea level, is 30°C. Calculate the estimated temperature at Durban's uShaka beach. Show your working.
(**Hint:** temperature changes by 1°C for every 100m change in altitude.) (3)
- 8.7 Ozone absorbs ultraviolet radiation. Too much ultraviolet radiation interferes with life on Earth. Discuss THREE negative impacts that long term exposure to UV radiation can have on the health of human beings. (3)
-

QUESTION 9:**[5]**

Read the following paragraph on stars. Select the correct answer from the choice in the brackets. Write down only the question number (**9.1 – 9.5**) followed by the answer.

*Stars are born inside huge clouds of dust and gas, known as (**9.1 nebulae / constellations**).*

*For most of its life, a star converts the gas (**9.2 helium into hydrogen / hydrogen into helium**) during a process known as nuclear (**9.3 fission / fusion**).*

*Stars that look blue are (**9.4 hotter / cooler**) than stars that appear red.*

*As stars age and run out of fuel all nuclear reactions will cease, and they will eventually contract to form (**9.5 red giants / white dwarfs**).*

TOTAL SECTION B: [60]**FINAL TOTAL: [120]**