WESTERN PROVINCE **TERM 2**

KARONGI DISTRICT **DURATION: 3 Hours**

ACADEMIC YEAR: 2023_2024

COMBINATIONS: PCM; PCB; MPG,MPC

PHYSICS COMPREHENSIVE ASSESSMENT /100 marks

Instructions:

- **use a blue or a black pen**
- **section A is compulsory**
- **Attempt only three questions in section B**

Useful constants:

- **Plank's constant:** $\boldsymbol{h = 6.626 \times 10^{-34} Js}$
- **Mass of electron:** $\boldsymbol{m_e = 9.11 \times 10^{-31} kg}$

SECTION A / 70 Marks

1. Write true(T) if the statement is true and False (F) if it is wrong?

A. Sound is a transverse wave

B. Sound is a form of energy

C. Sound travels in the form of waves

D. Sound travels faster in vacuum than in air. **(4 mark)**

2. Using the elementary particles, Complete the following sentences

i) One family of bosons of spin 1 called ……which act as force carrier in the theory **(1 mark)**

ii) Two fermions of spin ½ called ----------and …….. **(2marks)**

iii) The first antiparticle found was the …… **(1 mark)**

3. a) Define the term attenuation in optical fibers **(1mark)**

b) From the list below select the devices used to avoid attenuation. **(3 mark)**

(Transmitters; repeaters; radios; regenerators; antenna; optical amplifiers)

4. Name the four fundamental interactions and the particles that mediate each **(6marks)**

5. Match the words in column A to their meaning/definitions or functions in column B

(5marks)

A. Words	**B. Meaning/definition or functions**
i. A transducer	a) An electronic circuits that produce a periodic waveform on its output with only the DC supply voltage as an input
ii. Modulation	b) is a term standing for information put in an appropriate form for transmission.
iii. Oscillator	c) An electronic device that converts energy from one form to another
iv. A message	d) Is used to transmit and receive the signals.
v. An antenna	e) The process of superimpose to a low frequency signal (original signal) a high frequency signal (carrier signal) for transmission.

6. A man standing in between two parallel cliffs, he produces a sound and the first echo is heard from cliff _2 after 2 seconds and second echo is heard from cliff _1 after 3 seconds. If the speed of sound in air is 340m/s. Find the distance between two cliffs. **(5 marks)**

7. If you hear the horn of the car whose frequency is 216 *Hz* at a frequency of 225 *Hz*, what is its velocity? Is it away from you or toward you? The speed of sound is 343 m/s **(4marks)**

8. What are the evidences that shows that climate is changing? **(3marks)**

9. Write a sentence describing the relationship between each pair of terms.

i) Gravity, atmosphere. **(2 mark)**

ii) Temperature, rocks. **(2 mark)**

10. a) With the aid of sketches, differentiate between amplitude and frequency modulation.

(2marks)

b) State one advantage and one disadvantage of FM over AM **(2 marks)**

11. a) Imagine three cities in the desert, all at about the same altitude and latitude. Which city would likely have the highest average summer air temperature and why?

- One city (A) is surrounded by a dark-colored rocky surface.
- Another city (B) is surrounded by a light-colored sandy surface.
- The third city (C) is built on the edge of a large man-made desert lake **(2 marks)**

b) Outline three (types) proportions of the soil? **(3 marks)**

12. Complete each of the following statements using appropriate term from the box.

high pressure	seismic energy	**s**eismograph
low pressure	Temperature	earthquake

a) The Richter magnitude scale measures the amount of **……..**released by an earthquake. **(1 mark)**

b) The intensity of an earthquake is measured with a **…… (1mark)**

The main difference between a cyclone and an anticyclone is that cyclone has …… **……** and anticyclone has a **……..(2mark)**

13. a) What do you understand by half-life of a radioactive nuclide? **(1 mark)**

b) Differentiate between isotopes from isotones **(2marks)**

c) Radioactivity of a radioactive element remains $\frac{1}{10}$ of the original radioactivity after 2.303 seconds. Find the half life period. **(3 mark)**

14. Examine the similarities and differences between positron and proton **(4 marks)**

15. a) State the Heisenberg's uncertainty principle. **(2marks)**

b) An electron is confined within a region of $5 \times 10^{-11} m$

i) Estimate the minimum uncertainty in the component of the electron's momentum. **(2marks)**

ii) What is the kinetic energy of an electron with this magnitude of momentum? Express your answer in both joules and electron volts. **(3marks)**

SECTION B/ 30 marks

- **ATTEMP ANY THREE QUESTIONS ON YOUR CHOICE**

16. a) what do you understand by the term climate change? **(2mark)**

b) Explain how greenhouse gases contribute to the climate change **(3marks)**

c) How does the government of Rwandan support practically the strategies to reduce climate change. Identify any three strategies **(3marks)**

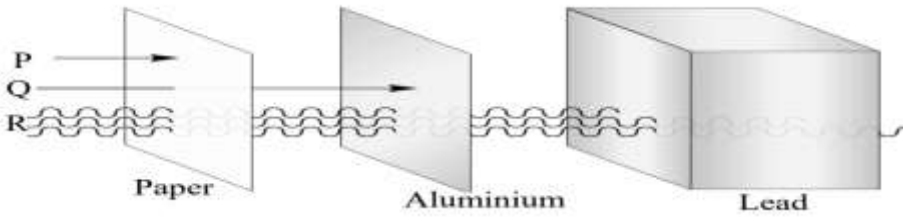
c) Evaluate the extent to which Rwanda is being affected by climate change **(2marks)**

17. a) What is meant by earthquake? **(1 mark)**

b) List three causes of Earthquake **(3 marks)**

c) Contrast the positive and negative impact of earthquake on environment **(6marks)**

18. a) In the figure below, name the radiation labeled P, Q and R **(3marks)**



b) Sketch a diagram to show the deflection of above radiations in electric field and explain why they follow such paths. **(5marks)**

c) Which particle is the most penetrating? Explain your answer. **(2marks)**

19. We are exposed to radiation all the time, indoors and outdoors. This is called background radiation.

a) Give the value of x and y in each of the following equations

i) $^{215}_{84}Po \rightarrow {}^{211}_{82}Pb + x$ **(1mark)**

ii) $^{214}_{83}Bi \rightarrow {}^{x}_{y}Po + {}^{0}_{-1}\mathrm{e}$ **(1mark)**

iii) $^{x}_{y}Ra \rightarrow {}^{222}_{86}Rn + {}^{4}_{2}He$ **(1mark)**

b) Give two examples of sources of this background radiation. **(2marks)**

c) Which organ generally receives the most background radiation, and why? **(3 marks)**

d) There is some concern at the moment that pilots and flight attendants may have significantly higher exposure to radiations than the normal exposure rates for the general public. Why do pilots have a higher exposure to radiations than most other people? **(2 marks)**

20. You are given 6 elements of a simplified block diagram of an optical fibre communication system

Optical transmitter	Input information	coder
Optical receiver	decoder	Output information

a) Construct a meaningful block diagram of an optical fibre communication system. Two successive elements must be linked by an arrow. **(6 marks)**

b) Where does the light that is transmitted into the optical fibre core medium come from? **(2 marks)**

c) Core and cladding are among the parts of optical fibre, which one must have the greater index of refraction and why? **(2 marks)**