2901/205
EARTH SCIENCE AND WAVE THEORY
Oct./Nov. 2022
Time: 3 hours

THE KENYA NATIONAL EXAMINATIONS COUNCIL

DIPLOMA IN PETROLEUM GEOSCIENCE

MODULE II

EARTH SCIENCE AND WAVE THEORY

3 hours

INSTRUCTIONS TO CANDIDATES

You should have the following for this examination:
Answer booklet;
A Mathematical table / a non programmable scientific calculator (fx-82).
*This paper consists of **EIGHT** questions.*
*Answer question **ONE (COMPULSORY)** and any other **FOUR** questions.*
Maximum marks for each part of a question are indicated.
Candidates should answer the questions in English.

This paper consists of 8 printed pages.

Candidates should check the question paper to ascertain that all the pages are printed as indicated and that no questions are missing.

1. (a) Arrange the following ocean waves in terms of increasing frequency:

Tsunami, capillary, surface wind waves, tidal. (4 marks)

(b) Define the following terms as used in oceanography:

(i) ocean currents;

(ii) surface currents;

(iii) gyres;

(iv) coriolis effect. (4 marks)

(c) Explain **four** earthquake related hazards. (8 marks)

(d) (i) State **two** factors that lead to formation of magma in the earth's crust. (2 marks)

(ii) Name **two** volcanic landforms. (2 marks)

2. (a) Name the type of wave created by each of the following music instruments:

(i) tuning fork;

(ii) flute;

(iii) guitar;

(iv) drum. (4 marks)

(b) Figure **1** shows a waveform.

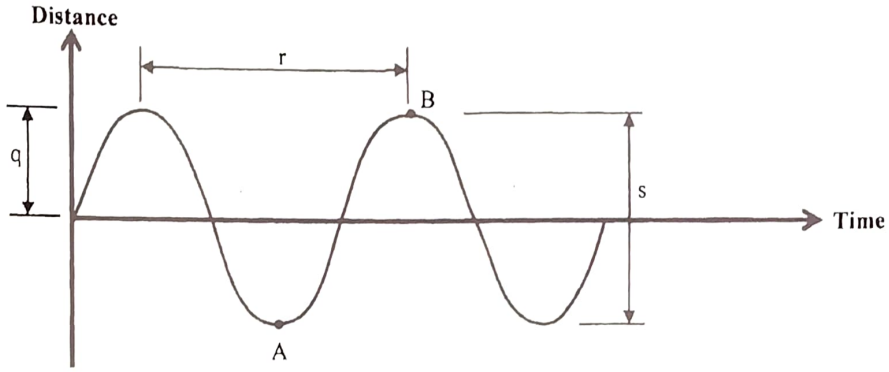

Fig. 1

(i) Name the points labelled A and B. (2 marks)

(ii) Identify the measurements represented as q, r and s. (3 marks)

(iii) Name the type of wave represented by the waveform. (1 mark)

(c) Figure **2** represents a waveform of a wave.

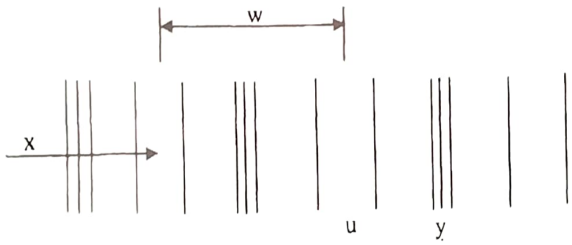

Fig. 2

(i) Name region denoted as u and v. (2 marks)

(ii) Describe the nature of regions u and v. (4 marks)

(iii) Identify the length denoted as w. (1 mark)

(iv) Name the type of wave represented by the waveform. (1 mark)

(v) Explain the arrow x drawn on the waveform. (2 marks)

3. (a) Figure **3** shows a high frequency wave transmission over a hill.

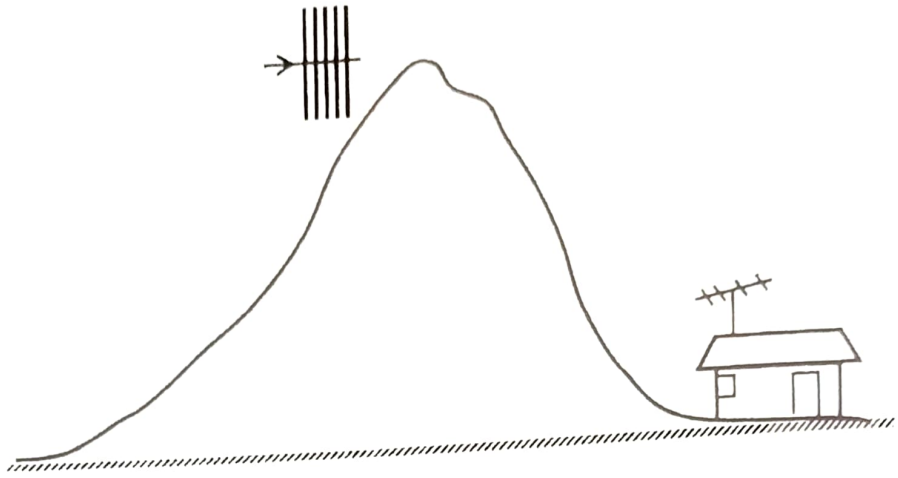

Fig. 3

(i) Copy the diagram and show the propagation of the waves over the hill. (3 marks)

(ii) Name the effect that occurs to the waves. (1 mark)

(iii) Repeat a (i) for low frequency waves. (3 marks)

(iv) Explain the most suitable wave for aerial reception in the valley. (3 marks)

(b) Describe the theory of plate tectonics. (5 marks)

(c) (i) Explain the geologic time scale. (2 marks)

(ii) Figure **4** represents geologic times.

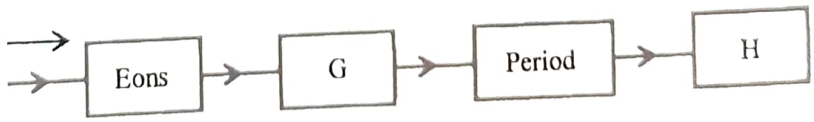

Fig. 4

(I) Identify the times represented by letters G and H. (2 marks)

(II) State the unit of measurement on the geologic timescale. (1 mark)

4. (a) Figure **5** shows two equal pulses moving in a wire fixed at both ends.

Fig. 5

Sketch the **two** equal pulses:

(i) Just after reflection at both ends; (2 marks)

(ii) On coinciding; (2 marks)

(iii) Just after coinciding. (2 marks)

(b) A wire of length 0.7 m and linear density 0.08 kg/m is tied to two fixed supports. The tension in the wire is 10 N. It is plucked repeatedly at one end.

(i) Explain the expected observations. (5 marks)

(ii) If a wave of wavelength equal to length of wire is formed:

(I) Sketch a labelled diagram to illustrate the wave; (3 marks)

(II) Calculate the velocity of wave; (3 marks)

(III) Determine frequency of wave. (3 marks)

5. (a) Figure **6** shows the bands of an electromagnetic spectrum. Study and use it to answer the questions that follow.

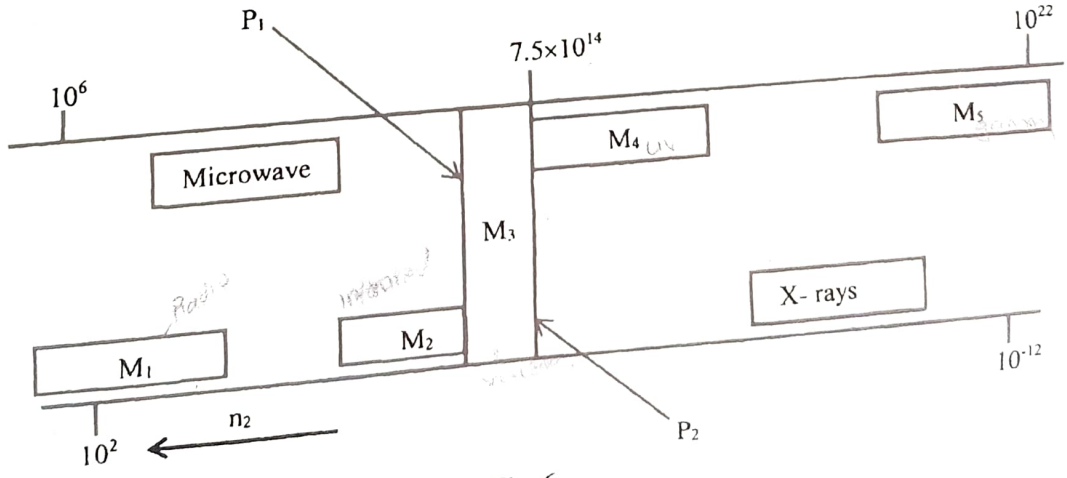

Fig. 6

(i) State the quantity increasing along n_1 and n_2. (2 marks)

(ii) Name the band of spectrum denoted as m_1, m_2, m_4 and m_5. (4 marks)

(iii) Identify the colours in band m_3 represented as p_1 and p_2. (2 marks)

(iv) Calculate the wavelength of the colour p_2. (3 marks)

(v) State **one** method each of producing waves in bands m_1 and m_5. (2 marks)

(vi) State **three** ways of detecting the waves in band m_3. (3 marks)

(b) State **four** properties of electromagnetic waves. (4 marks)

6. Figure 7 shows the waveform of two waves w_1 and w_2 between points Q and R on the surface of a lake. The points are 150 m apart. The waves were created by two speed boats within 5 seconds.

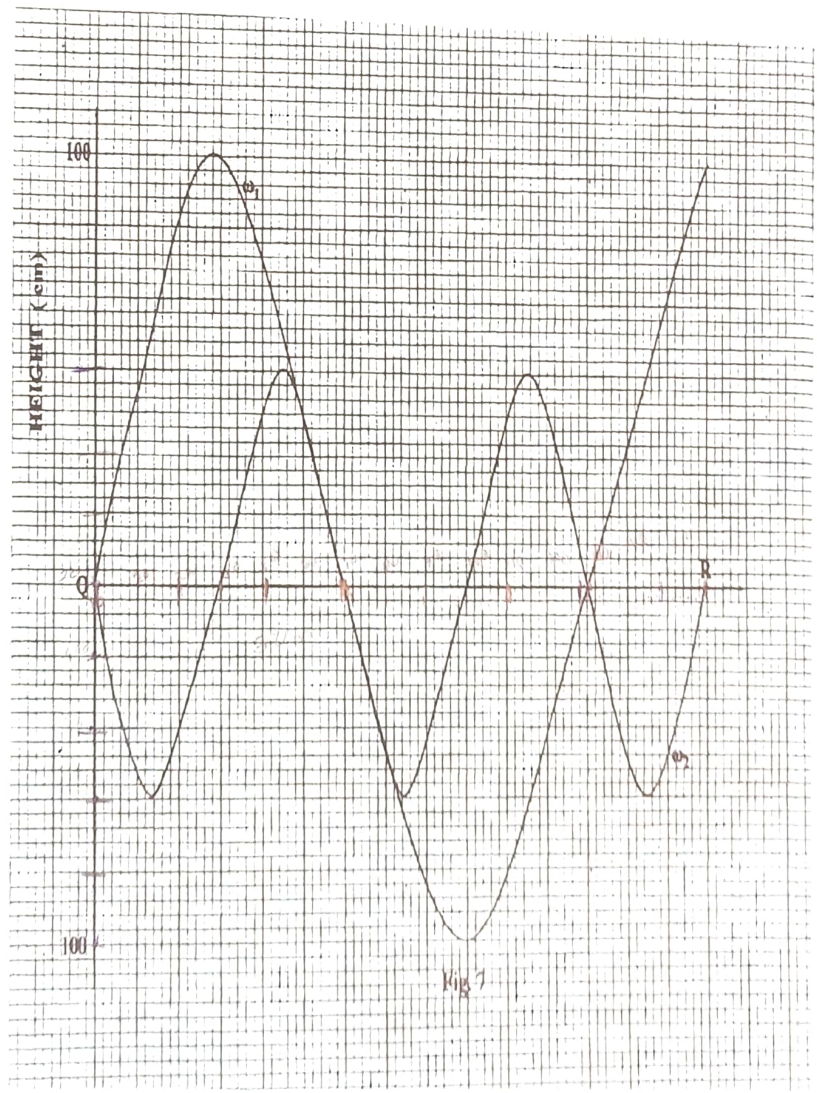

Fig 7

(a) For each wave, determine its:

(i) amplitude; (2 marks)

(ii) periodic time; (2 marks)

(iii) frequency; (4 marks)

(iv) wavelength; (2 marks)

(v) speed. (4 marks)

(b) Determine the displacement of a particle:

(i) 54 m front point Q; (3 marks)

(ii) 40 m from point R. (3 marks)

7. (a) State the effect on a pulse at:

(i) a closed end pipe; (1 mark)

(ii) an open end pipe. (2 marks)

(b) Two pipes are of equal length, 0.5 m. One is closed at one end and the other is open at both ends.

(i) Draw diagrams of the wave vibrations in the two pipes at the fundamental frequency. (4 marks)

(ii) Derive the formula for the fundamental frequency in each tube in terms of velocity (v) of wave and length of tube (l). (5 marks)

(iii) The velocity of wave in each tube is 340 m/s. Calculate the fundamental frequency for each tube. (4 marks)

(c) Differentiate standing waves from travelling waves in terms of:

(i) propagation;

(ii) energy. (4 marks)

Turn over

8. (a) Figure **8** shows a set-up of a radioactive material in an electric field.

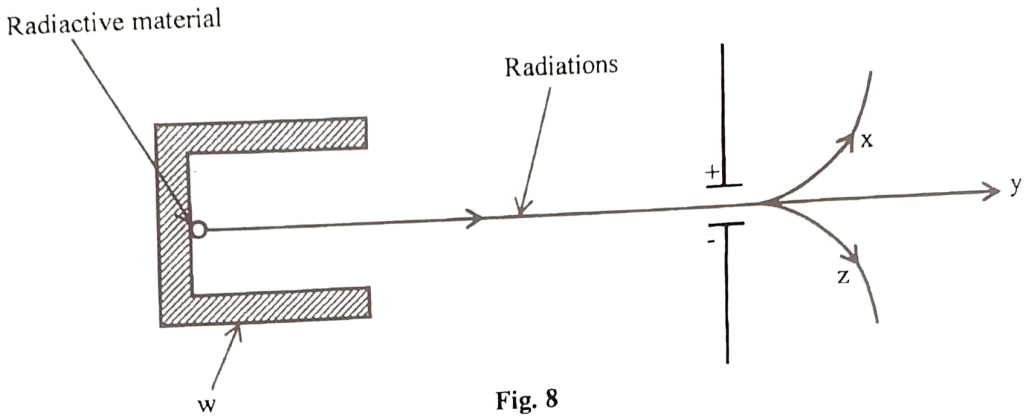

Fig. 8

(i) Identify the **three** radiations labelled x, y and z produced by the radioactive material. (3 marks)

(ii) Give **two** reasons for each answer in a (i). (6 marks)

(iii) Name the part labelled w and state its function. (2 marks)

(b) Differentiate between radiometric dating and radiocarbon dating. (4 marks)

(c) (i) Explain the term half life as used in radioactivity. (2 marks)

(ii) A radioactive lead isotope, $^{214}_{86}Pb$, has a half-life of 26.8 minutes. Determine time taken for a mass of 160 g of the isotope to disintegrate to 20 g. (2 marks)

(iii) State **one** danger of radioactivity. (1 mark)

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