ADVANCED PHYSICS
SENIOR SIX
DURATION: 3hours

MUSANZE DISTRICT
ACADEMIC YEAR: 2023-2024
SECOND TERM

DISTRICT COMPREHENSIVE ASSESSMENT, 2023-2024

SUBJECT: PHYSICS THEORY EXAM/100marks

COMBINATIONS:
PHYSICS-CHEMISTRY MATHEMATICS (PCM), MATH-PHYSICS-COMPUTER SCIENCE (MPC)
PHYSICS-CHEMISTRY-BIOLOGY (PCB), MATH- PHYSICS- GEOGRAPHY (MPG)
PHYSICS- ECONOMICS- MATH (PEM)

INSTRUCTIONS

- ✓ This paper consists of two sections:

SECTION A: Attempt all questions **(70marks)**
SECTION B: Attempt only three (3) questions of your choice **(30marks)**

- ✓ Non programmable scientific calculators and mathematical sets may be used where appropriate
- ✓ Use only a blue or black pen

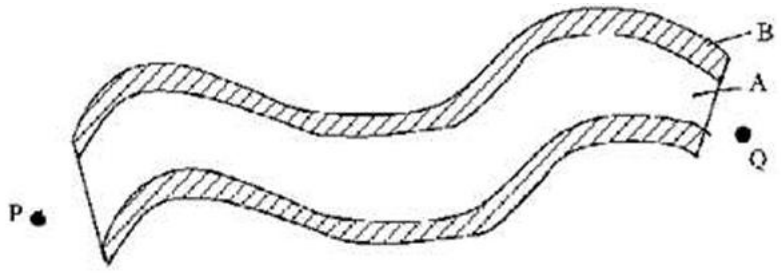
ADVICE

- ✓ Read every question carefully before you start to answer it.
- ✓ Try to answer every question.
- ✓ Check your answers if you have time at the end.
- ✓ Look at the marks as a guide to how much time to spend on each question.

1. Optical fibers can be used in and why: **(2Marks)**
   A. CAT Scans
   B. X-rays photos
   C. Ultrasound scans
   D. Endoscopy
2.
   a) What does Agrophysics mean? **(2Marks)**
   b) Which atmospheric layer contains the weather, most farmers are concerned with? **(2Marks)**
3.
   a) Complete the following sentences. Increasing the amplitude of a sound wave will increase the..... of the sound. **(2Marks)**
   b) A physics teacher uses a signal generator and a loudspeaker to demonstrate the range of hearing of a group of students. What is the range of frequencies most humans can hear? **(2Marks)**
4. Pion radiotherapy is a new form of cancer treatment that has been extensively investigated for tumours of the brain. Pions are short lived sub-atomic particles and belong to a group called mesons.The following table lists some quarks and their charge.

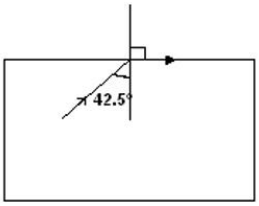
Quak	Up (u)	Doun(d)	Strange (s)	Charm (c)
Charge/e	$+\frac{2}{3}$	$-\frac{1}{3}$	$-\frac{1}{3}$	$+\frac{2}{3}$

a. State the quarks composing of proton and neutron **(2Marks)**
b. Use the information in the table to show how the charge of the proton and the neutron are arrived at. **(2Marks)**
5. Figure below shows a cross-section of an optical fibre made of two types of glass A and B. The refractive index of B is lower than that of A. A ray of light enters the optical fibre at P and emerges from Q.



a. Sketch the path of the ray through the fibre. **(1mark)**
b. State the reason why light travels through the fibre as in (a) above**(1mark)**

c. The figure below shows a path of a ray of light through a rectangular block of Perspex placed in air. Calculate the refractive index of Perspex. **(2marks)**



6. Many radio stations now broadcast on FM rather than on AM.in general, FM is broadcast at much higher frequencies than AM
   a. Explain what is meant by FM(frequency modulation) **(2marks)**
   b. State two advantages and two disadvantages of FM transmission when compared with AM transmissions **(4marks)**
7. The half-life of a ${}^{22}_{11}N_a$ is 2.60years. If 25.0grams of a ${}^{22}_{11}N_a$ is given to you today and after many years would have 0.391grams remaining. Show that the number of half-lives is 6 and the time required is 15.6years.**4pt**
8. Draw a circuit diagram of a simple radio receiver **/6 marks**
9. The half-life of carbon14 is 5730 years the mass of certain sample of this isotope is g= 800mg .Graph the activity for the first 5 half-lives. **(4Marks)**
10. Various phenomena like earthquakes, landslides, volcanic eruptions, floods, hurricanes, tornadoes, blizzards, tsunamis, cyclones, wildfires, and pandemics are all natural hazards that kill thousands of people and destroy billions of dollars of habitat and property each year. But there are some positive effect some natural disasters have. Enumerates 4 positive effect of Landslide. **(4Marks)**
11. How is weathering different from erosion? **(4Marks)**
12. **(4Marks)**
    a. what is meant by Albedo
    b. What do you think are major factors that influence the insolation at a particular location on a particular day?
13. A sound source on a car produces sound waves of frequency 850 Hz. A stationary observer measures the emitted frequency using a detector which can measure a maximum frequency of 800 Hz. He finds that the detector only registers a reading whilst the car is moving. (Ignore the effects of wind.)
    a. State Doppler effect in words **(2Marks)**
    b. Must the car move TOWARDS or AWAY from the observer for the detector to register a reading? Explain the answer by referring to frequency or wavelength. **(2Marks)**

c. Calculate the minimum speed at which the car must move for the detector to register the maximum reading. Take the speed of sound in air as 340 m·s-1 . **(2Marks)**

d. State ONE use of the Doppler effect in medicine. **(1Mark)**

14. **(6Marks)**

a. Does all the light from the source getting to the destination?

b. What do you think is causing the loss in light transmission?

c. What can be done to minimize that loss in the optical fibers above?

15.

a. What do you understand by the term greenhouse? **(2marks)**

b. Enumerate four greenhouse gases **(2marks)**

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

SECTION B

16. (a) The figure 1 represents the waveform of a sound wave. The wave is travelling at constant speed in x-direction.

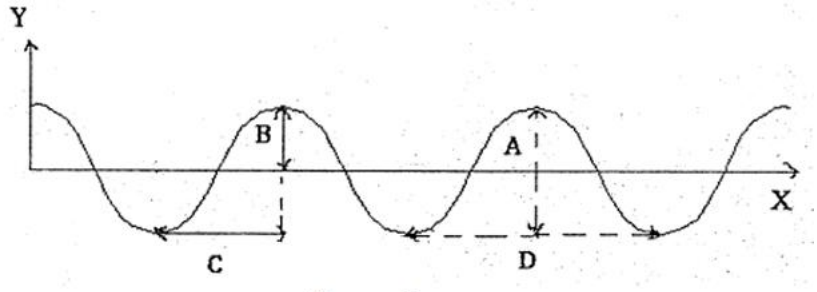


figure 1

(i) From the graph, determine the marked distance labelled with one of the letters A,B,C and D corresponding to the:

1) Wavelength of the wave **(1mark)**

2) Amplitude of the wave **(1mark)**

(ii) What happens to the loudness and the pitch of the sound wave if the following changes occur?

1) The amplitude of the sound is increased at constant wavelength. **(1marks)**

2) The wavelength of the sound is increased at constant amplitude. **(1marks)**

iii. How are sound waves produced? **(1mark)**

(b) (i) How are stationary waves formed? **(1mark)**

(ii) What is the importance of resonance in musical instrument? **(1 mark)**

(iii) A stretched string of a guitar has a length of 791 mm. The string emits a note of 256 Hz when it vibrates at its fundamental frequency.

1) Draw a diagram to represent the fundamental frequency of a stationary wave in a string. **(1mark)**

2) Calculate the speed of waves in this stretched string of a guitar **(1marks)**

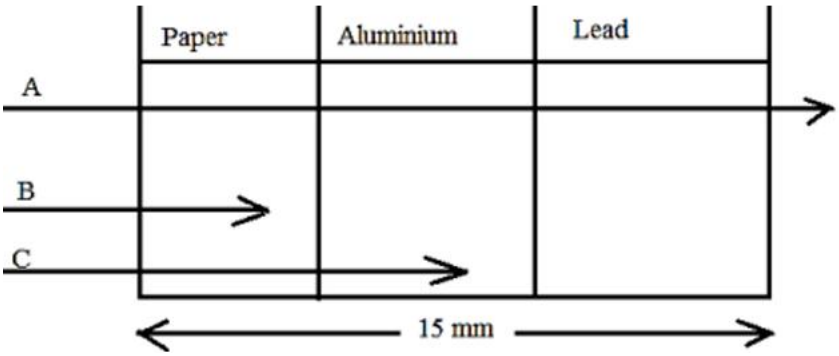
(c) An ambulance siren emits a sound of frequency 750 Hz. When the ambulance is travelling towards a stationary observer, the frequency detected by the observer is 820 Hz. The speed of sound in air is 340 m/s

(i) What is the speed of the ambulance? **(1marks)**

(ii) How is Doppler Effect used in everyday life? **(1mark)**

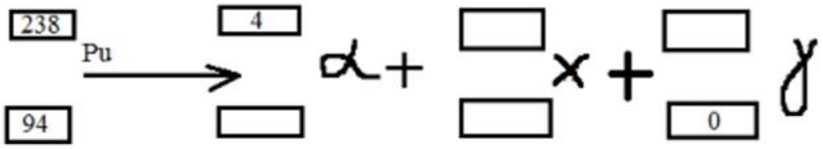
17.a. The following arrows (figure) show how far different types of nuclear radiations penetrates different materials. Identify the radiations A, B and C **(3 marks)**

b.



b) When plutonium-238 decays, it emits an alpha and a gamma particle

i) Complete the decay equation below for plutonium-238 **(2 marks)**



ii) Identify the element X **(1mark)**

c) The mass of proton m_p is 1.007825 a.m.u and the mass of a neutron m_n is equal to 1.008665 a.m.u. The mass of $^{14}_{6}C$ is 14.003242 a.m.u and 1 amu= 931.5 MeV/c^2 find the:

i. mass defect $^{14}_{6}C$ **(2mark)**

ii.The binding energy of $^{14}_{6}C$ **(1mark)**

iii. The binding energy per nucleon of $^{14}_{6}C$ **(1mark)**

18. Three successive resonance frequencies for a certain string are 175, 245, and 315 Hz.

(a) Find the ratio of these three modes. **/1marks**

(b) How can you tell that this sting has an antinode at one end? **/2marks**

(c) What is the fundamental frequency? **/1mark**

(d) Which harmonics are these resonance frequencies? Sketch each wave. **/4marks**

(e) If the speed of transverse waves on this string is 125 m/s, find the length of the string? **/2marks**

19.a) Considering that the Earth has always warmed and cooled naturally, people believe that human activities are mainly responsible for present day accelerated global warming. Evaluate the validity of this statement **/10 marks**

20. Match column **I** with column **II**
/6marks

Column I	**Column II**
1. Tsunamis cause damage by two mechanisms	**A**. Indicate that the energy of the explosion does not easily generate the kind of deep, all ocean waveform. Most of energy creates steam and compression waveforms.**(2mark)**
2. Tidal waves	**B**. The smashing force of a wall of water travelling at high speed, and the destructive power of a large volume of water draining off the land and transport a large amount of debris or fragment with it, even with waves that do not appear to be large.**(2marks)**
3. The analysis of the effect of tsunami	**C**. displacement of volume of water or perturbation of the sea usually attributed to either Earthquake, landslide, volcanic eruption, etc **(2marks)**
4. Impacts of tsunami	**D**. a series of waves in a water body caused by the displacement of a large

	volume of water with a very long wavelength hundreds of kilometers.**(1mark)**
5. causes	**E**. are produced by the gravitational pull of the moon and sun rather than the displacement of water.**(1mark)**
6. Tsunami's definition	**F**. Unfortunately the end products of this are: displacement of people, structural damage through destruction of people's properties **(2mark)**

END