Republic Rwanda

Ministry of education

Eastern province

Kirehe District

Exam: PHYSICS II

Maximum: 100 MARKS

Class: SENIOR SIX

Date: 14/03/2024

Duration: 3hours

SECOND TERM PHYSICS EXAMINATION /2023-2024

INSTRUCTION TO CANDIDATES:

-The test is composed of two sections A and B

-Attempt ALL questions for section A and any THREE for section B

COMBINATIONS:

PHYSICS-CHEMISTRY-MATHEMATICS (PCM)

MATHEMATICS- PHYSICS- COMPUTER SCIENCE (MPC)

PHYSICS –CHEMISTRY- BIOLOGY (PCB)

MATHEMATICS –PHYSICS- GEOGRAPHY (MPG)

PHYSICS-ECONOMICS-MATHEMATICS (PEM)

SECTION A: ATTEMPT ALL QUESTIONS (55 MARKS)

1) What occurs when a body is made to vibrate with its natural frequency due to external vibration

A. Echo B. Resonance C. refraction **(2marks)**

2) Choose the choice that best answers the question

a) The angular momentum of hydrogen electron in n^{th} orbit is given by

(i) nh

(ii) h / 2nπ

(iii) nh/ 2π

(iv) n^2 h/ 2π (**2marks)**

3)Indicate T (TRUE) if the statement is correct or F (FALSE) if the statement is wrong.

(a) A wave is a theoretical object that absorbs 100% of the radiation that hits it. **(1mark)**

(b) A wave is any disturbance that results into the transfer of energy from one point to another point. **(1mark)**

4)Electric current may be expressed in which one of the following units? **(1mark)**

a) coulombs/volt b) joules/coulomb

c) coulombs/second d) ohms/second

5) When charged particle is projected perpendicular to the magnetic field , its path will be circular. Give the formula illustrating the radius of path. (**2marks)**

6)For an object moving in uniform circular motion, the direction of the instantaneous acceleration vector is: **(1mark)**

a) tangent to the path of motion b) equal to zero

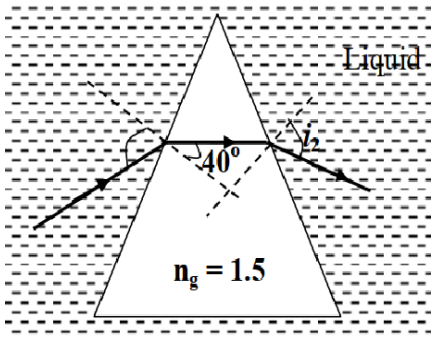
c) directed radially outward d) directed radially inward

7) a) What is Sankey diagram? (**1 mark**

b) In a thermal power station, 55% of input energy is wasted and the remaining is what is used to do work.

Draw an energy flow diagram illustrating this energy degradation. (**2 marks)**

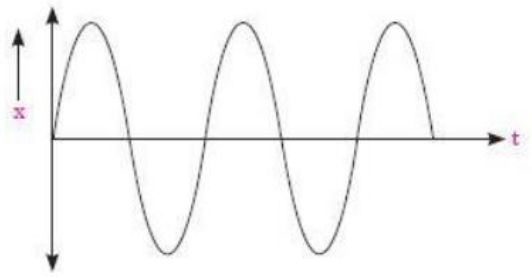
8)The figure shows a ray of light incident at an angle of 46.46^0 on one side of equilateral triangular prism immersed in a liquid of refractive index n_l. Given that the refractive index of the glass is 1.5, and its angle of refraction on the first face is 40^0,



calculate;

a) the refractive index of liquid (n_l). **(2 marks)**
b) Emerging angle on the second interface (i_2). **(2 marks)**
c) the angle of deviation (d). **(2 marks)**

9)(a) Analyze the graph in Figure and describe briefly the type of motion that it represents. X is the displacement and t is the time. **(2marks)**



(b) What happens to the period of a simple pendulum if the pendulum's length is doubled?

(2marks)

(c) What happens to the period of a simple pendulum if the mass of the suspended bob is doubled?
(2marks)

10) State the laws of blackbody radiation **(4 marks)**

11) Estimate the temperature of the surface of the sun, given that the sun emits light whose peak intensity occurs in the visible spectrum at around 500 nm b=2.9X10^{-3} mK (**2 marks**)

12)a) Sketch the electric field lines for

i) two equal and positive point charges**.** **(1mark)**

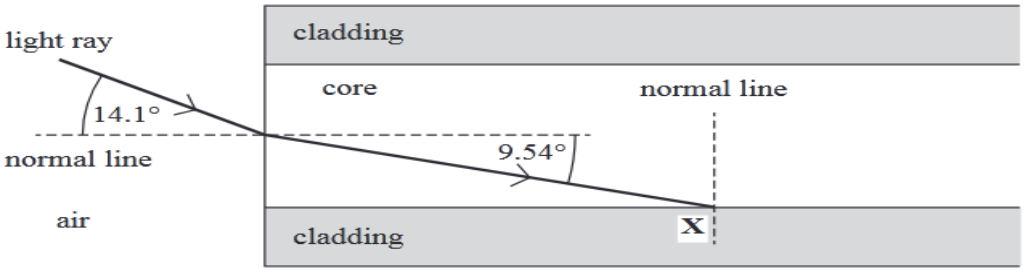
ii) two equal and opposite point charges**.** **(1mark)**

b)Two coins lie 1.5m apart on a table. They carry identical charges. Approximately how large is the charge on each if a coin experiences a force of 2N? **k=9x10^{9}Nm^2/C^2**
(3marks)

13)(a) Give any three causes of optical power loss. **(3marks)**

(b) Explain why cladding should have a higher refractive index than that of core. **(1mark)**

c)Figure below shows a section of a typical glass step-index optical fibre used for communications.



Show that the refractive index of the core is 1.47. **(2marks)**

(d) The refracted ray meets the core-cladding boundary at an angle exactly equal to the critical angle.
(i) Complete the Figure to show what happens to the ray after it strikes the boundary at X. **(3marks)**
(ii) Calculate the critical angle. **(2marks)**

(iii) Calculate the refractive index of the cladding. **(2marks)**

(e) Give two reasons why optical fibres used for communications have a cladding. **(2marks)**

14) (a)What do you understand by the term "greenhouse effect"? **(2 marks)**

(b)Give any three greenhouse gases **(3 marks)**

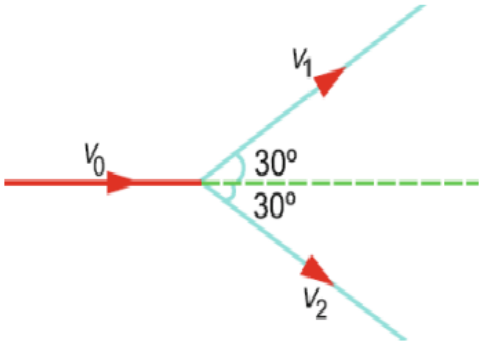
15) Give any two measures that the government of Rwanda has taken to minimize the effect of greenhouse effect **(2 marks)**

SECTION B ATTEMPT ANY THREE QUESTIONS (45 MARKS)

16)a) Define,the term linear momentum, give its unit and dimensions. **(3 marks)**

b) A ball moving with a speed of 9m/s strikes an identical stationary ball such that after collision, the direction of each ball makes an angle 300 with the original line of motion (see Fig below). Find the speeds of the two balls after the collision. Is the kinetic energy conserved in the collision process?

(7 marks)



c) A bullet of mass 10g travelling horizontally at 100ms-1 embeds itself in a block of mass 990g suspended by a massless string of length 2m, so that it can swing vertically. Calculate the angle through which the block is displaced.

(5 marks)

17)(a) To you, what do you understand by Thermionic emission? **(3marks)**

(b) Suggest and explain at least three applications of photoelectric effect in our everyday life. **(3marks)**

(c) Discuss fully about how a Cathode Ray Tube, TV and Computer monitor work. **(9marks)**

18) a) what is equipotential surface ?
(1mark)

b) Differentiate electric potential and gravitational potential.
(2marks)

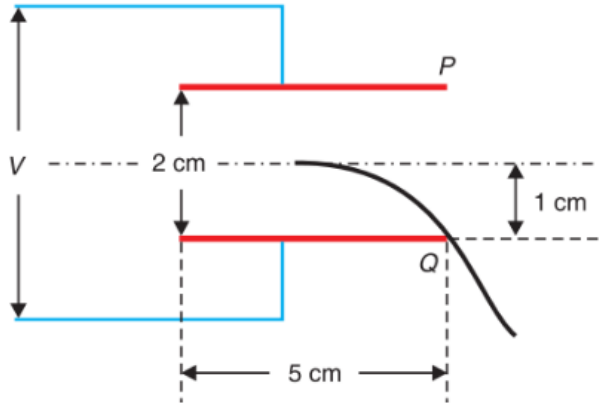
c) i) For a charged particle with charge q, which create electric field E around it at distance r in vacuum. Show that the electric potential is equal to

$$V = -\frac{Q}{4\pi\varepsilon_0 r}$$ **(4marks)**

ii) why this potential field at distance r is negative?
(2marks)

iii) plot the curve of Variation of electric potential with distance from a point charge.
(2marks)

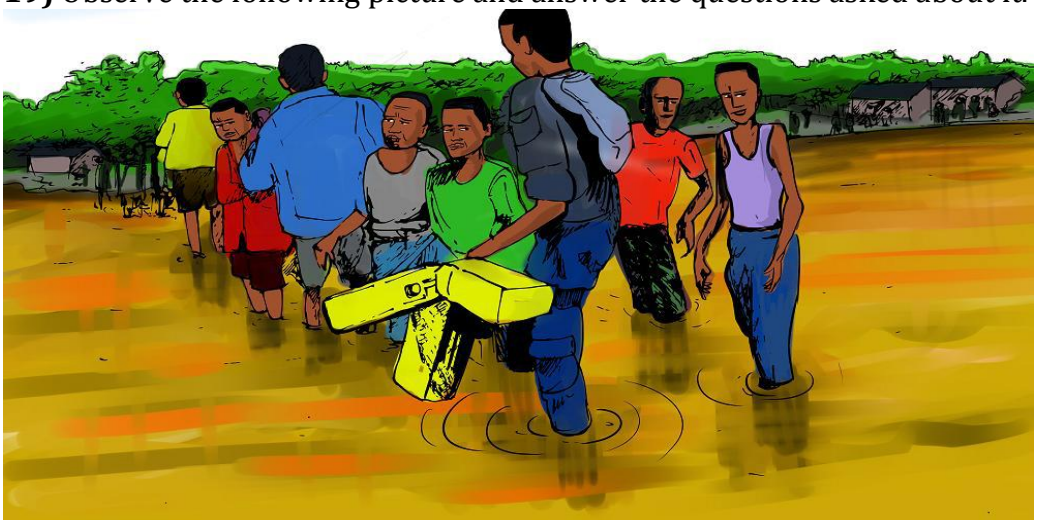
d)A beam of electrons moving with velocity 1×10^7 m/s enters mid-way between two horizontal parallel plates P and Q in a direction parallel to the plates as shown on Figure below P and Q are 5 cm long and 2 cm apart, and have a p.d V applied between them.



Calculate V if the beam is deflected so that it just grazes the edge of the lower plate Q. Assume that e/m =1.6x10^{11}c/kg

(4marks)

19) Observe the following picture and answer the questions asked about it.



a) What do you observe from the picture above? **(2marks)**

b) What could be the major causes (**any three**) of such situation in most of the communities especially in Rwanda? **(3marks)**

c) How does this situation affect the welfare of the people in a given community? **(3marks)**

d) In your view, suggest the preventive practices (**any three**) people should do to avoid such situations. **(3marks)**

e) Suggest **any four** ways that the government of Rwanda has taken to reduce global warming **(4marks)**

20 a) what is antiparticle? **(2marks)**

b) The first antiparticle found was the **(1mark)**

A. Positron B. Quark C. Hyperons

D. baryon

c) The process in which a particle and antiparticle unite annihilate each other and produce one or more photons is called……. **(1mark)**

d) Using the elementary particles, Complete the following sentences

i) One family of spin1 bosons called_____which act as 'force carriers' in the theory **(1mark)**

ii) Two spin 1/ 2 families of fermions called_____ and _____ **(2marks)**

e) Name the four fundamental interaction and their particle carries **(4marks)**

f) The 2 up quarks (u) in a proton are separated by a distance$r = 1x10{-}15m$.
These quarks each have an electric charge+ 2 3 , and mass of $mu = 7x10{-}30kg$ so they repel each other through an electric force obeying Coulomb's law. They also attract each other through a gravitational force. What is the ratio of the magnitude of the electric and gravitational forces between these 2 quarks? **(4marks)**

END