REPUBLIC OF RWANDA

KAYONZA DISTRICT

PHYSICS II

2nd TERM EXAM

2023-2024

Time:9h00-12h00 (3 Hours)

ADVANCED LEVEL DISTRICT EXAMINATION OF PHYSICS 2023-2024

LEVEL: SENIOR FIVE

SUBJECT: PHYSICS THEORY

COMBINATIONS:

- ✓ **PHYSICS-CHEMISTRY-MATHEMATICS.** **(PCM)**
- ✓ **MATHEMATICS-PHYSICS-GEOGRAPHY.** **(MPG)**
- ✓ **MATHEMATICS-PHYSICS-COMPUTER SCIENCE.** **(MPC)**
- ✓ **PHYSICS-CHEMISTRY-BIOLOGY.** **(PCB)**
- ✓ **ASSOCIATE NURSING PROGRAM.** **(ANP)**

INSTRUCTIONS:

This paper consists of two sections: **A** and **B**

- **SECTION A:** ATTEMPT ALL QUESTIONS. **(70 Marks)**
- **SECTION B:** ATTEMPT ONLY THREE (3) QUESTIONS. **(30 Marks)**

Geometrical instruments and silent non-programmable calculators may be used.

SECTION A: ATTEMPT ALL QUESTIONS. **(70 Marks)**

1. (a) Explain Planck's quantum theory? **(2 Marks)**

(b) State any 2 postulates of Planck's quantum theory? **(2 Marks)**

2. (a)What is meant by:

(i) Simple harmonic Motion? **(2 Marks)**

(ii) A simple pendulum? **(2 Marks)**

(b) State the factors affecting the periodic time of the simple pendulum. **(2 Marks)**

3. State all types of damped oscillations, their equations and represent them clearly on the same figure. **(6 Marks)**

4. A travelling wave is described by the equation $y(x, t) = 0.003 \cos(20x + 200t)$ where y and x are measured in metres and t in seconds. What is the direction in which the wave is travelling? Calculate the following physical quantities:

(a) Angular wave number. **(1 Mark)**
(b) Wavelength. **(0.5 Mark)**
(c) Angular frequency. **(0.5 Mark)**
(d) Frequency. **(0.25 Mark)**
(e) Time period. **(0.25 Mark)**
f) The wave speed. **(1 Mark)**

g) The amplitude. **(0.5 Mark)**
h) The particle velocity when x=0.3m and t=0.02sec. **(1 Mark)**
i) The particle acceleration when x=0.3m and t=0.02sec. **(1 Mark)**

5. (i) Why Coal, oil and natural gas are called 'fossil fuels? **(2 Marks)**
(ii) Give at least 4 advantages and 4 disadvantages of coal? **(2 Marks)**

6. All fossil fuels are non-renewable but not all non-renewable energy sources are fossil fuels.

a) Differentiate between fossil fuel and renewable energy sources. **(2 Marks)**

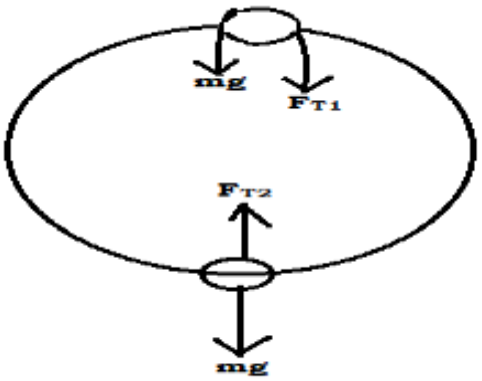
b) From the list of non-renewable energy sources, select one example which is not a fossil fuel. **(1 Mark)**

c) Give any one example of a renewable energy. **(1 Mark)**

d) Provide any one fossil fuel. **(1 Mark)**

7. A ball on the end of a string in revolved at a uniform rate in a vertical circle of radius 72.0 cm, as thrown in the figure below. If its speed is 4.00m/s and its mass is 0.300Kg. Calculate the tension in the string when the ball is

a) At the top of its path. **(2 Marks)**
b) At the bottom of its path. **(2 Marks)**



8. a) Determine the wavelength of the second Balmer line (n = 4 to n = 2 transition). **(2 Marks)**

b) Determine likewise the wavelength of the second Lyman line, and **(2 Marks)**

c) The wavelength of the third Balmer line. **(2 Marks)**

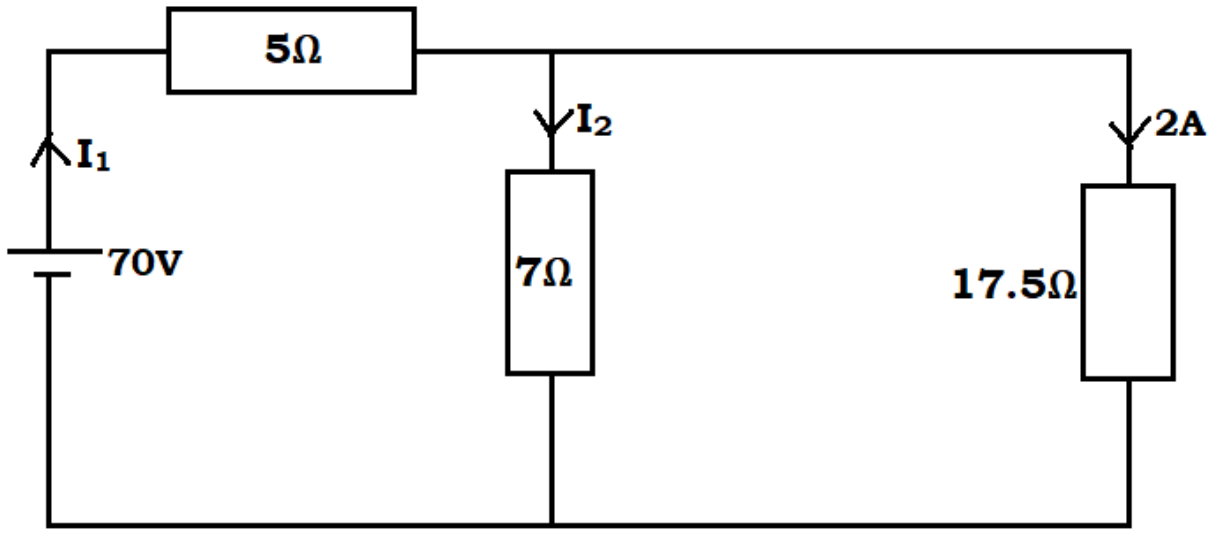
9. A certain traverse wave is described by:

$\mathbf{Y_{(x,t)} = (6.50\ mm)\ \cos 2\pi\left(\frac{x}{28.0\ cm} - \frac{t}{0.0360\ sec}\right)}$ Determine the wave's

a) The amplitude. **(0.5 Mark)**
b) The wavelength. **(0.5 Mark)**
c) The frequency. **(0.5 Mark)**
d) The speed of propagation. **(1 Mark)**
e) The direction of propagation. **(0.5 Mark)**

10. Analyse the given electrical circuit and determine the currents I_1 and I_2

(4 Marks)



11. A sonometer wire of length 0.5m is stretched by a weight of 5Kg. The fundamental frequency of vibration is 100Hz. Determine the linear density or linear mass of material of wire. **(4 Marks)**

12. a) Define the following terms:
i) Electric field. **(1 Mark)**
ii) Electric potential. **(1 Mark)**

b) Two parallel plates have a potential difference between them of 12V. The distance between the plates is 1.0mm. Find:
i) The electric field strength between the plates. **(1 Mark)**

ii) The work done on a charge of+2.50μC to move the charge from the negative plate to positive plate. **(1 Mark)**

13. Match elements from **Column A** with their corresponding elements in **Column B.** **(4 Marks)**

Column A	**Column B**
a) Telephone call	i) Simplex communication
b) Radio broadcasting	ii) Continuous electrical signals that vary with time
c) Analog signal	iii) Signal that represents data as a sequence of a discrete values.
d) Digital signal	iv) Full duplex communication.

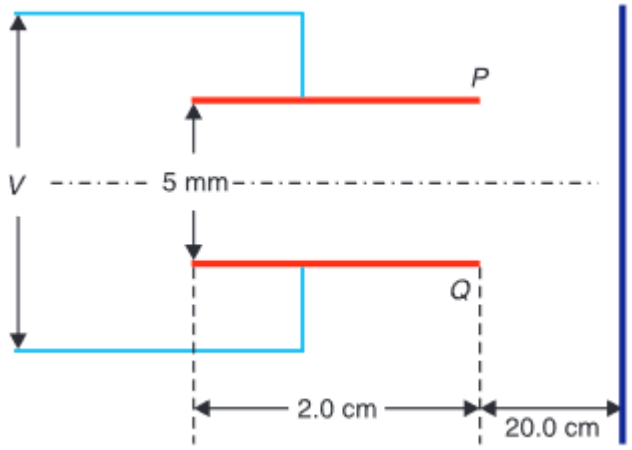
14. A satellite orbits at a height of 700 Km above the earth's surface. Assume the orbit to be circular, Re=6400Km, M=5.97x10^{24}Kg and G=6.67x10^{-11}Nm^2/kg. Calculate:

a) The radius of the orbit. **(2 Marks)**

b) The speed of the satellite. **(2 Marks)**

15. a) Define the term "Cathode Ray tube (CRT)." **(2 Marks)**

b) two metal plates 2.0 cm long placed 5 mm apart. A fluorescent screen is placed 20.0 cm from one of the plates. An electron of kinetic energy 3.2 × 10^{-6}J is incident mid-way between the plates. Calculate the voltage applied across the plates to deflect the electron 2.1 cm on the screen. Assume that the electron moves through vacuum. **(4 Marks)**



SECTION B: ATTEMPT ONLY THREE (3) QUESTIONS. (30 Marks)

16. a) In a photoelectric effect experiment, which of the following will **increase**, **decrease** or will **not affect** the maximum kinetic energy of the photoelectrons? In each case justify your answer on the basis of Einstein's equation: $\frac{mv_{max}^2}{2}$ **=hf-Φ**

(i) Use light of greater intensity. **(1 Mark)**
(ii) Use light of higher frequency. **(1 Mark)**
(iii) Use of light longer wavelength. **(1 Mark)**
(iv) Use a metal surface with a larger with work function. **(1 Mark)**
b) The photoelectric work function of potassium is 2.3eV. The light having the wavelength of 250nm falls on potassium.
(i) Convert 2.3eV in joules. **(1 Mark)**
(ii) Find the frequency of this light. **(3 Marks)**
(iii) Calculate the maximum kinetic energy of the photoelectrons. **(2 Marks)**

17. a) Differentiate between Rutherford's atomic model and Bohr's atomic model. **(4 Marks)**
b) State Bohr's postulates of a hydrogen atom. **(3 Marks)**
c) Propose any three (3) deficiencies of the Bohr model of a hydrogen. **(3 Marks)**

18. a) Define the following terms:

(i) Work function. **(2 Marks)**

(ii) Stopping potential. **(2 Marks)**

(iii) Threshold frequency. **(2 Marks)**

b) Two different monochromatic light sources, one yellow (580 nm) and one violet (425 nm), are used in a photoelectric effect experiment. The metal surface has a photoelectric threshold frequency of 6.20×10^{14}Hz.

(i) Are both sources able to eject photoelectrons from the metal? Explain.

(2 Marks)

(ii) How much energy is required to eject an electron from the metal? **(2 Marks)**

19. a) What is meant by the term "Resonance of a system?" **(2 Marks)**

b) Distinguish between damped and forced oscillations. **(4 Marks)**

c) For damped oscillation shows that the mass damping m=200g of the back tough K=90N/m and damping constant b=40g/s. Calculate the period of the oscillation. **(4 Marks)**

20. a) Differentiate the following concept used in propagation of mechanical waves.

(i) Crest and trough. **(2 Marks)**

(ii) Longitudinal and transverse waves. **(2 Marks)**

(ii) Sound waves and Light waves. **(2 Marks)**

b) The frequency of a wave is 600Hz and is travelling at a speed of 340 m/s. Find the phase difference between two points which are

(i) 0.17m apart. **(2 Marks)**

(ii) 1.7m apart. **(2 Marks)**

END!!!!!!!!!!!!!!!!!!!!!