P510/2
PHYSICS
Paper 2
2 hours

Uganda Advanced certificate of Education
Pre-Registration Examinations 2016
PHYSICS
PAPER 2
2 HOURS

INSTRUCTIONS TO CANDIDATES:

*Answer **Five** questions, taking only **One questions** from each of the sections **A** , **B and C**.*
Any additional questions answered will not be marked.

Assume where necessary:

Acceleration due to gravity, g	=	$9.81\ m\ s^{-2}$
Speed of light in Vacuum, c	=	$3.0 \times 10^{8}\ m\ s^{-1}$
Electronic charge, e	=	$1.6 \times 10^{-19}\ C$
Electronic mass, m_e	=	$9.11 \times 10^{-31}\ kg$
Permeability of free space, μ_o	=	$4.0\pi \times 10^{-7}\ H\ m^{-1}$
Permittivity of free space, ε_0	=	$8.85 \times 10^{-12}\ Fm^{-1}$
The Constant, $\frac{1}{4\pi\varepsilon_o}$	=	$9.0 \times 10^{9}\ F^{-1}\ m$

SECTION A

1. a) State the laws of refraction of light. (2marks)

b) i) Derive an expression for the refractive index of a prism in terms of the refracting angle, A, and the angle of minimum deviation, D. (5marks)

ii) Monochromatic light is incident on a refracting face of a prism of refracting angle 60^0, made of glass of refractive index 1.50. Calculate the least angle of incident for the ray to emerge through the second refracting face. (5marks)

c) i) Show that the effective focal length, f, if two thin lenses in contact is give by $\frac{1}{f} = \frac{1}{f_1} + \frac{1}{f_2}$ where f_1 and f_2 are the focal lengths of the individual lenses.

(5marks)

ii) A compound lens consists of two lenses in contact having powers of +12.5D and -2.5D. Find the position and nature of the image of an object placed 15.0cm from the compound lens. (3marks)

2. a) i) What is meant by radius of curvature of a concave mirror? (1mark)

ii) Show that the radius of curvature, r, of a concave mirror is given by the expression r = 2f, where f is the focal length of the mirror. (5marks)

b) Describe how the refractive index of a liquid can be determined using a concave mirror. (5marks)

c) i) Define linear magnification of an optical instrument. (1mark)

ii) Explain why the farthest vertical pole in line with others of equal height looks shorter. (2marks)

d) i) Explain, with the aid of a diagram, why a thick plane mirror forms multiple images. (4marks)

ii) Explain how image is formed. (2marks)

SECTION B

3. a) State three differences between sound and light waves. (3marks)

b) Distinguish between free and damped oscillations. (2marks)

c) i) What is meant by resonance? (2marks)

ii) Describe with the aid of a diagram, an experiment to investigate the variation of frequency of a stretched string with length. (6marks)

d)i) Calculate the frequency of beats heard by a stationary observer when a source of sound of frequency 80Hz is receding with a speed of 5.0ms^{-1} towards a vertical wall. (Speed of sound in air = 340ms^{-1}). (5marks)

ii) State two uses of beats. (2marks)

4. a) Define the terms frequency and amplitude. (2marks)

b) Give two examples of wave form motion. (2marks)

c) A wave of amplitude 20cm, wavelength 2.0m and frequency 50Hz propagates in the positive x-direction. If the initial displacement is zero at point $x = 0$,

i) Write the expression for the displacement of the wave at any time t. (2marks)

ii) Find the speed of the wave. (2marks)

d) Two waves of frequencies 256Hz and 280Hz respectively. Travel with a speed of 340ms^{-1} through a medium. Find the phase difference at a point 2.0m from where they were initially in phase. (4marks)

e) Explain how energy is transmitted in a progressive wave in a gas. (3marks)

f) Describe how you can determine the speed of sound in air using Kundt's tube method. (5marks)

SECTION C

5. a) Define the following terms as applied to alternating voltage.
i) Root-mean-square value (1 mark)
ii) Peak value (1 mark)

b. i) With the aid of a labeled diagram, explain how the repulsion type moving iron ammeter can be used to measure alternating current. (6 marks)
ii) A resister of 4000Ω is connected to a 240V a.c supply. What is the peak value of the current flowing through the resistor? (2 marks)

c. Define the following as applied to Terrestrial magnetism.
i) magnetic meridian (1 mark)
ii) angle of dip (1 mark)

d. i) With the aid of diagrams, explain what happens when two straight conductors carrying current in opposite directions are brought near each other. (5 marks)
ii) Draw the magnetic field pattern for a conductor carrying current (out of paper) under influence of earth's magnetic field.

SECTION D

6. a) i) State Coulomb's law of electrostatics. (1mark)

ii) Define the terms electric field intensity and electric potential at a point. (2marks)

b) Sketch graphs of the variation of electric potential and electric field intensity with distance from the centre of a charged conducting sphere. (2marks)

c) Charges q_1 and q_2 of -5.0μC and +2.0μC respectively are placed at two opposite corners of a rectangle of side 5cm and 10cm as shown in figure below.

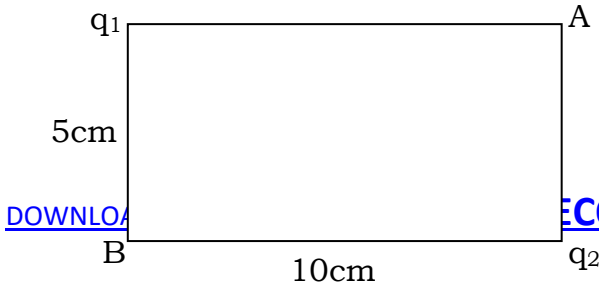

Fig. 1

Calculate the;

i) Electric potential at A (4marks)
ii) Electric field intensity at A. (5marks)

7. a) Define the terms electrical resistivity and temperature coefficient of resistance. (2marks)

b) i) Explain why the temperature coefficient of resistance is positive for metals. (3marks)

ii) What are super conductors? (1mark)

c) The temperature coefficient of resistance of two wires A and B of diameters 1.20mm and 0.80mm are $0.0004k^{-1}$ and $0.0003k^{-1}$ respectively. If the ratio of their resistances at 0^0C is 1.5, calculate;

i) The ratio of the resistances at 100^0C. (3marks)

ii) Their electrical resisitivities at 100^0C given that they have the same length. (3marks)

d) i) Derive the balance condition for a whatstone bridge. (4marks)

ii) Explain why the whatstone bridge is not suitable for measuring very low or very high resistances. (4marks)

8. a) define the following terms.

i) Capacitance of a capacitor. (1mark)

ii) Dielectric constant. (1mark)

b) Explain the effects of a dielectric on the capacitance of a capacitor.

(4marks)

c) Derive an expression for the energy stored in the capacitor of capacitance, C, changed to a voltage, V.

d

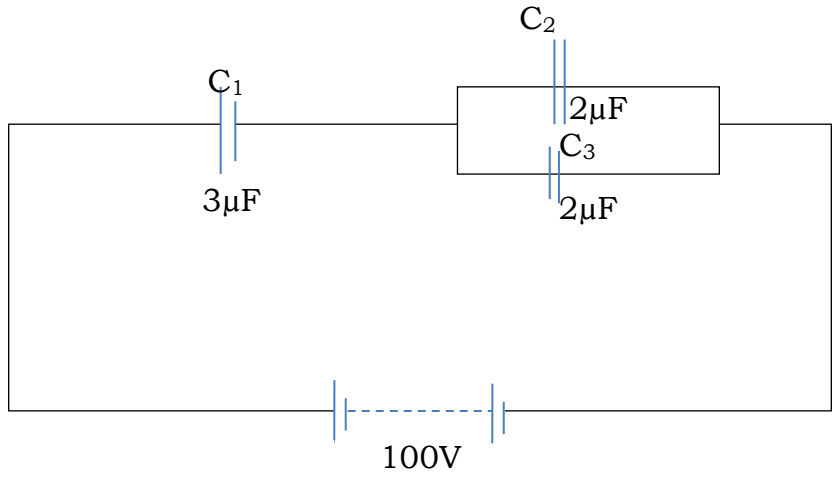

Fig. 2

In figure 2, C_1, C_2 and C_3 are capacitors of capacitances 3μF, 2μF and 2μF respectively, connected to a battery of e.m.f 100V.

i) Calculate the energy stored in the system of the capacitors if the space between the plates of C_1 is filled with an insulator of dielectric constant 3, and the capacitors are fully charged. (6marks)

ii) Account for the change in energy stored by an insulated parallel plate capacitor when the plate separation is doubled. (3marks)

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