RESOURCEFUL MOCK 2017

Uganda Advanced Certificate of Education

PHYSICS PAPER 2

TIME: 2½ HOURS

- *Answer **five** questions taking **one** question from each of the sections **A** and **B** and at least **one** but not more than **two** from each of the sections **A** and **D***
- *Any additional question(s) answered will not be marked*
- Assume where necessary
- *Acceleration due to gravity g = 9.81m/s²*
- *Speed of sound in air = 330m/s*
- *Speed of light in vacuum C = $3.0 \times 10^{8} m/s$*
- *Electronic charge e = $1.6 \times 10^{-19} C$*
- *Electron mass = $9.11 \times 10^{-31} Kg$*
- *Permeability of free space μ_0 = $4.0\pi \times 10^{-7} Hm^{-1}$*
- *Permittivity of free space ε_0 = $8.85 \times 10^{-12} Fm^{-1}$*
- *The constant $^{1}/_{4\pi\varepsilon_0}$ = $9 \times 10^{9} F^{-1}m$*
- *Plank's constant h = $6.63 \times 10^{-34} JS$*
- *One electron volt ev = $1.6 \times 10^{-19} J$*
- *Avogadro's number NA = $6.02 \times 10^{23} mol^{-1}$*

SECTION A

1. a) i. Define the terms real and virtual image. [2mks]

   ii. Distinguish between regular and diffuse reflection. [4mks]

   b) Describe how the focal length of a convex mirror can be obtained using a plane mirror. [5mks]

   c) A linear object of length 10cm lies along the axis of a concave mirror whose radius of curvature is 30cm. If the far end of the object 28cm from the mirror, find the magnification of the image. [4mks]

   d) A vessel of depth 2t is half filled with a liquid of refractive index n_1, and the upper half is occupied by a liquid of refractive index n_2. Show that apparent

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depth of a small stone at the bottom of vessel, viewed from vertically above is $t\left(\frac{1}{n_1}+\frac{1}{n_2}\right)$ [3mks]

e) Explain dispersion of white light by a glass prism. [2mks]

2. a) i. Define the term refraction. [1mk]

ii. Explain the occurrence of total internal reflection. [3mks]

b) Describe how refractive index of a small quantity of a liquid can be obtained by use of an equi convex lens. [5mks]

c) A converging lens of focal length 1.5cm is placed 29.0cm infront of another converging lens of focal length 6.25cm. An object of height 0.1cm is placed 1.6cm away from the first lens on the side remote to the second lens at right angles to the principle axis of the two lenses.

i) Draw a ray diagram to show the formation of the final image by the lens system. [2mks]

ii) Determine the size of the final image of the object. [5mks]

a) Explain why the image seen in a simple magnifying glass is almost free from chromatic aberration when the eye is very close to the lens. [4mks]

SECTION B

3. a) Distinguish between progressive and stationary waves. [3mks]

b) i. What are overtones? [1mk]

ii. Explain why a musical note played on one instrument sounds different from the same note played on another instrument. [3mks]

c) A stretched string of length ***l***, is fixed at both ends and then set to vibrate in its allowed modes.

Derive an expression for frequency of the second overtone in terms of the fundamental frequency. [4mks]

d) A wire of length 0.60m and mass 9×10^{-4}Kg is under tension of 135N. The wire is plucked such that it vibrates in its third harmonic. Calculate the frequency of the third harmonic. [5mks]

e) Describe the variation of pressure with displacement of air in a closed pipe vibrating with fundamental frequency [4mks]

4. a) i. Distinguish between free oscillations and damped oscillation. [2mks]

ii. What is meant by resonance as applied to sound? [3mks]

b) Describe an experiment to determine the velocity of sound in air using tuning forks of different frequencies and a resonance tube. [4mks]

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c) A uniform tube 80cm long is filled with water and a small loud speaker connected to a signal. Generator set at 600Hz, the water level in the tube is lowered until resonance is first obtained when the length of air column is 13cm. If the third resonance is obtained when the air column is 69.8cm long, calculate the;

i. Velocity of sound in air [2mks]

ii. Fundamental frequency for the tube if it were open at both ends [2mks]

d) i. What is meant by Doppler effect? [1mk]

ii. A motor cyclist and a police car are approaching each other. The motor cyclist is moving at $10ms^{-1}$ and the police car at $20ms^{-1}$. If the police siren is sounded at 480Hz. Calculate the frequency of the note heard by the cyclist after the police car passes by

iii. Give two applications of the Doppler effect. [1mk]

Explain one application [3mks]

SECTION C

5. a) i. Write down the expression for the force exerted on a straight wire of length ***L*** metres carrying a current ***I*** amperes at right angles to the magnetic field of flux density B teslas. [1mk]

ii. A rectangular coil of N turns and area Am^2 is suspended in a uniform magnetic field of flux density B teslas. Initially the plane of the coil is at right angle to the magnetic field. Derive the expression for the initial couple on the coil when a current I amperes flows through the coil. [5mks]

b) Draw a labeled diagram of a moving coil galvanometer and explain how it works. [6mks]

c) A small circular coil of 10 turns and mean radius 2.5cm is mounted at the centre of a long solenoid of 750 turns per meter with its axis at right angles to the axis of the solenoid. If the current in the solenoid is 2.0A, calculate the initial torque on the circular coil when a current of 1.0A is passed through it. [5mks]

d) Explain why a current – carrying conductor in a magnetic field experiences a force. [3mks]

6. a) i. What is meant by Peak value of sinusoidal current? [1mk]

ii. A source of sinusoidal voltage of amplitude V_0 and frequency F is connected across a capacitor of capacitance C. Derive an expression for the instantaneous current which flows. [3mks]

iii. With reference to the circuit in a (ii), sketch using the same axes, graphs to show the variation of voltage V and current I with time. [2mks]

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b) i. Explain why an alternating current apparently flows through a capacitor whereas a direct current does not. [3mks]

ii. Explain the advantages of a.c over d.c in power transmission. [2mks]

c) With the aid of a diagram, describe how a half wave rectifier type of meter works. [4mks]

d) A sinusoidal voltage V – 339 Sin (100πt) is connected across a 40Ω resistor. Find the

i) Amplitude of the current through the resistor. [2mks]

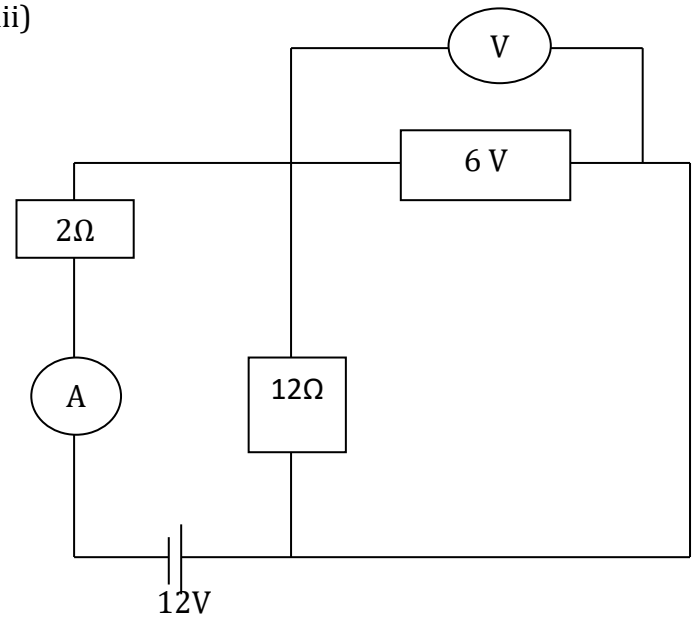
ii) Average power developed in the resistor. [2mks]

SECTION D

7. a) i. Define a volt. [1mk]

ii) Derive the formula for the combined resistance of three resistors in parallel. [4mks]

iii)



In the circuit above, the battery as negligible internal resistance. Find the ammeter and voltmeter readings. [4mks]

b) i. A coil of wire has resistance of 3Ω at 20^0C and 34.5Ω at 60^0C. Calculate its temperature coefficient of resistance. [4mks]

ii. Define the term electrical resistivity. [1mk]

c) An 80.0cm copper wire of diameter 1.0mm is joined end for end with a 50.0cm iron wire of the same diameter as shown below.

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A current of 4.0A is fed into the loop as shown.

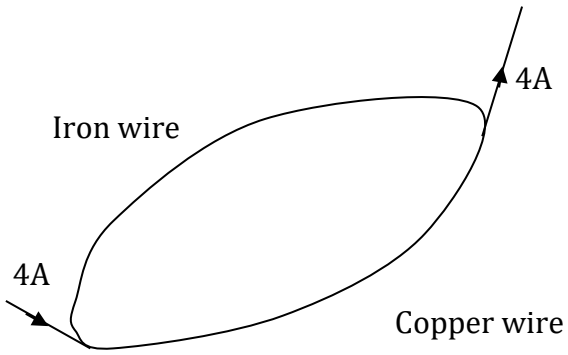
Find

i) the effective resistance of the loop [2mks]

ii) the electric field intensity in the copper wire [3mks]

iii) the current through the copper wire [Resistivity of copper] [2mks]

$\delta = 1.7\ x\ 10^{-8}\Omega m$, and that of iron = 10 x $10^{-8}\Omega$ m)



8. a) i. Define capacitance of a capacitor. [1mk]

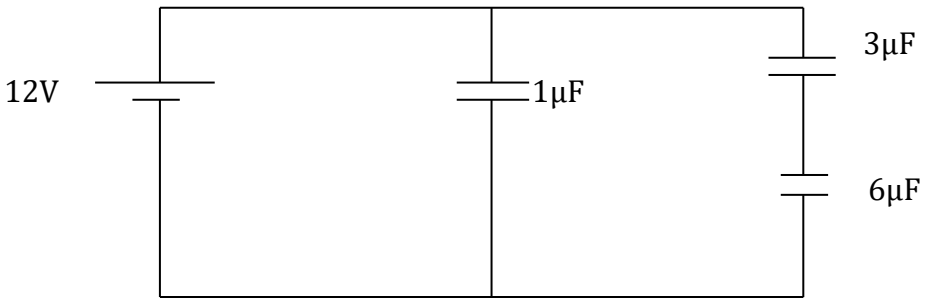
ii. Describe briefly an experiment to show the effect of placing a sheet of glass or mica between the plates of a capacitor on capacitor on capacitance. [5mks]

b) Describe how the unknown capacitance of a capacitor can be determined using ballistic galvanometer. [4mks]

c) Explain briefly how a charged capacitor can be fully discharged. [2mks]

d) A 3μF capacitor is connected in series with a 6μF capacitor.

The combination is the connected in parallel with a 1μf capacitor to 12V battery as shown in figure below.



Calculate the;

i) Charge stored by each capacitor [5mks]

ii) Energy stored in the 6μF capacitor when fully charged [3mks]

9. a) i. Define electric potential. [1mk]

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ii. Derive an expression for the electric potential at a point of a distance ***r*** from a fixed charge. [4mks]

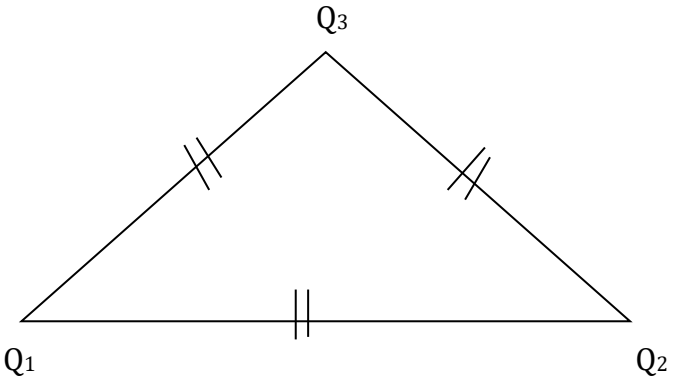
b) With reference to a charged pear –shaped conductor,

i. Describe an experiment to show the distribution of charge on it. [3mks]

ii. Show that the surface of the conductor is an equipotential surface. [3mks]

c) Explain how a lighting conductor protects a house from lightning. [4mks]

d) Three charges Q_1, Q_2 and Q_3 of magnitude 2μC, -3μC and 5μC respectively are situated at corners of an equilateral triangle of sides 15cm as shown



Calculate the net force on Q_3

END

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