P510/2
PHYSICS
PAPER 2
JULY 2014

UGANDA ADVANCED CERTIFICATE OF EDUCATION

S.6 MOCK EXAMINATIONS

PHYSICS PAPER 2 (P510/2)

TIME:2HRS 30MINUTES

INSTRUCTIONS TO CANDIDATES

Attempt five questions, including at least one from each section, A, B,C and D.
Do not attempt more than one question from section A or B and not more than two from section C or D.
Non programmable scientific electronic calculators may be used.
Assume where necessary;

Acceleration due to gravity; g	$=9.81ms^{-2}$
Speed of light in a vacuum , C	$=3.0x10^{8}ms^{-1}$
Electron charge, e	$=1.6x10^{-19}C$
Electron mass	$=9.11x10^{-31}kg$
Planck's constant, h	$=6.63x10^{-34}Js$
Permeability of free space,$\mu_{\circ}$	$=4.0\pi x10^{-7}Hm^{-1}$
Permeability of free space,$\varepsilon_{\circ}$	$=8.85x10^{-12}Fm^{-1}$
The constant $\frac{1}{4\pi\varepsilon_{\circ}}$	$=9.0x10^{9}F^{-1}m$

SECTION A

1.(a) Define ***lateral magnification.*** (1)

(b) Derive an expression for lateral magnification of a convex lens in terms of object and image distances. (4)

(c) If figure 1 below when an object is placed at O it forms an image at I with the lens in position A.The lens is then displaced to position B and still forms an image at I. Determine

(i) the focal length of the lens. (3)

(ii) the magnification of the image when the lens is in position A . (3)

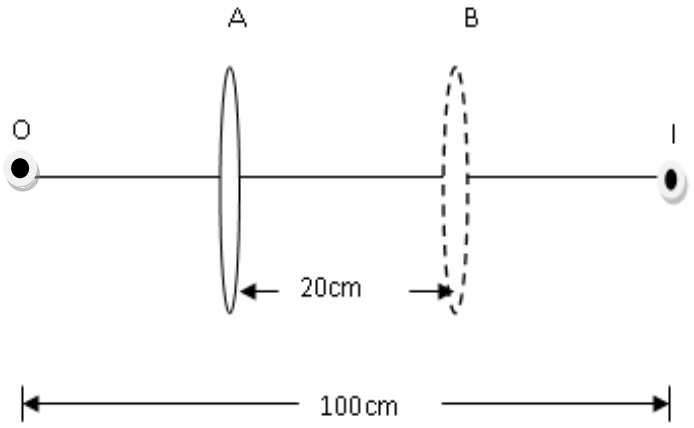


Figure 1

(d) Describe an experiment with the aid of a diagram to determine the focal length of a convex mirror by using a convex lens. (6)

(e) Discuss the relevance of a convex lens in the correction of eye sight. (3)

2.(a)(i) Distinguish between ***real*** and ***virtual images***. (2)

(ii) With reference to a plane mirror, draw ray diagrams to show the formation of the images in (i) above. (2)

(b) A point object is placed in front of a plane mirror, show that the image formed will be the same distance from the mirror as the object is in front. (4)

(c) A camera has focal length 50mm.If it can form images of objects from infinity down to 1.5m from the lens, calculate the distance through which it must be possible to move the lens. (4)

(d) Two equiconvex lenses of focal length 20cm are placed in contact and the space between them is filled with water.

Find the focal length of the combination $({}_a\cap_g = \frac{3}{2}, {}_a\cap_w = \frac{4}{3})$. (4)

(e) Draw a ray diagram of a Galilean telescope and derive the expression for its magnification when in normal adjustment. (4)

SECTION B

3.(a) Define a ***progressive wave***. (1)

(b) A plane progressive wave is represented by the equation $y = 0.8\sin\left(250\pi t - \frac{10\pi}{15}x\right)$ *where* y is the displacement in millimetres is in seconds and x is the distance from the origin in metres(m).Find

(i) the frequency of the wave (2)
(ii) its wavelength (2)
(iii) speed (1)
(iv) phase difference in radians between a point $0.25m$ from the origin and a point $1.35m$ from the origin. (2)

(b) A wire of length l, tension T, and mass per unit length m fixed at both ends is plucked in the middle and a transverse wave travels along it. Derive an expression for the fundamental note produced in terms of those quantities. (4)

(c) A uniform tube ,60.0cm long stands vertically with its lower end dipping into water. When the length above water is 14.8cm and again when it is 48.0cm the tube resounds to a vibrating tuning fork of frequency 512Hz.Find the lowest frequency to which the tube will resound when it open at both ends. (4)

(d) Explain why sounds are easier to hear at night than during day time. (4)

4.(a) Define ***plane polarised light.*** (1)

(b)(i) Explain how you can produce polarised light using a *nicol prism*. (4)

(ii) Calculate the polarising angle for light travelling from water of refractive index $\frac{4}{3}$,to glass of refractive index $\frac{3}{2}$. (3)

(ii) State *four differences* between ***light waves*** and ***sound waves***. (4)

(c) List 3 applications of polarised light. (3)

(d) Explain how a thin wedge can produce an interference pattern. (5)

SECTION C

5.(a)(i) What is a **Tesla**? (1)

(b) Draw magnetic field patterns of the following;

(i) two wires carrying current in opposite directions. (2)

(ii) a wire carrying current in the earth's magnetic field. (2)

(c) A narrow vertical rectangular coil is suspended from the middle of its upper side with its plane parallel to a uniform horizontal magnetic field of 0.02.The coil has 10turns and the lengths of its vertical and horizontal sides are 0.1m and 0.05m respectively. Calculate the torque on the coil when a current of 5A is passed into it.
What would be the value of the torque if the plane of the vertical coil was initially at 60^{o} to the magnetic field and current of 5Awas passed into the coil? (5)

(d) Describe with the aid of a diagram an experiment to investigate how the magnitude of the force on a conductor situated in a magnetic field depends on the current and the length of a conductor. (7)

(e) Explain why a conductor carrying current and placed between poles of a bar magnet experiences a force. (3)

6.(a).With the aid of a diagram ,describe how a simple d.c motor works. (6)

(b) A motor of armature resistance 0.75Ω is operated from a 240V d.c supply. When the motor turns freely without a load, the current in the armature is 4.00A and the motor makes 200 revolutions per minute. Calculate the back emf. (2)

(c)(i) What are eddy currents? (1)

(ii) State and explain one application of eddy currents. (3)

(iii) Derive an expression for the emf induced in a coil rotating in a magnetic field.(4)

(d) A search coil has 5000 turns and an area of $1.0\times10^{-4}m^{2}$.It is placed in a long current carrying coil so that its face is at 90^{0} to the lines of magnetic flux inside the coil. What emf is induced across the coil when the flux density inside it changes from $2.5\times10^{-3}T$ to $1.3\times10^{-3}T$ in 0.4s? (4)

7.(a) What do you understand by the following terms as applied to an alternating current.

(i) ***root-mean –square value***. (1)

(ii) ***peak value.*** (1)

(b) An alternating voltage of 10Vr.m.s and frequency 50Hz is applied to an inductor of 2H,determine the r.m.s current flowing in the inductor and draw a phasor diagram of the current and voltage. (4)

(c)(i) A coil of inductance L is connected to a source of alternating current .If the current in the coil is given by $I = I_O \sin \omega t$.

Find the expression for the voltage and also the reactance of the inductor. (5)

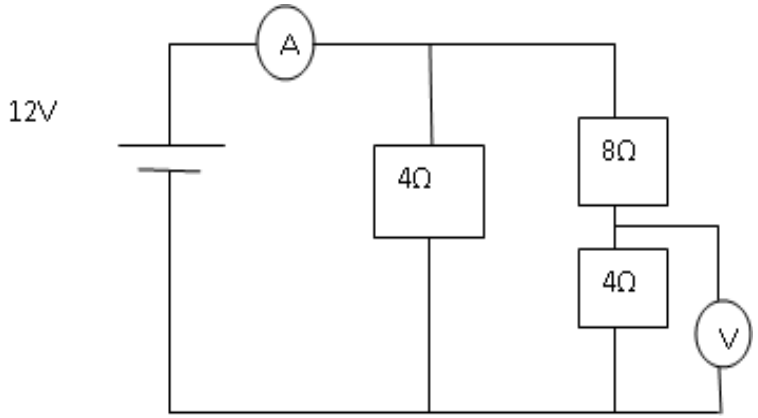
(ii) Explain why no power is absorbed in a pure inductance. (4)

(d) With the aid of a diagram explain how a hot wire instrument works. (5)

SECTION D

8.(a) Distinguish between *electromotive force* and *terminal p.d* of cell. (2)

(b)



Find the values of the ammeter and voltmeter readings in the circuit shown. Assume that the ammeter and cell have negligible resistance. (5)

(b) You are provided with a switch, an ammeter, a voltmeter, a rheostat ,connecting wires and a resistor of unknown resistance. Draw a circuit diagram and use it to explain how you can determine the resistance of the resistor by graphical analysis of the observations made. (6)

(c)(i) State **Ohm's law.** (1)

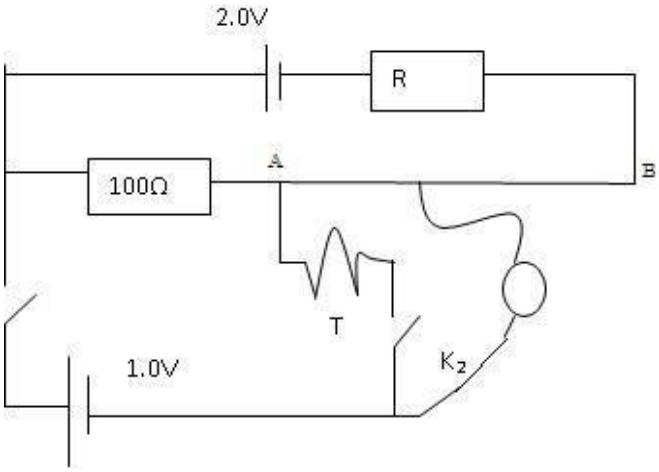
(ii) Draw a current –voltage graph for a thermistor. Explain the shape of the graph drawn. (3)

(d) Explain why the temperature of a metal rises when a current passes through it.(3)

9.(a) Explain the ***principle of a slide wire potentiometer.*** ***(4)***

(b) With the aid of a diagram describe how you can determine the internal resistance of a cell using a potentiometer wire. (6)

(c) The circuit in fig is being used to measure the emf of a thermocouple T.AB is a uniform wire of length 1.00m and resistance 2.0Ω.With K_1 closed and K_2 open ,the balance length is 90.0cm ,with K_2 closed and K_1 open the balance length is 45cm.What is the emf of the thermocouple?
What is the value of R if the resistance of the driver cell is negligible? (6)



(d) Discuss the ***advantages*** and ***disadvantages*** of using a potentiometer over a voltmeter for determining the emf of a cell. (4)

10.(a) Define the terms
(i) ***Capacitance*** (1)
(i) Dielectric strength and (1)
(ii) Dielectric constant (1)

(b) Explain why water is not suitable for a dielectric. (2)

(c) A $2.5\mu F$ capacitor is charged to a potential difference of 100volts and is disconnected from the supply. Its terminals are then connected to those of un charged $10\mu F$ capacitor. Find

(i) the resulting potential difference across the two capacitors and

(ii) the total energy stored in them. Compare the result in (ii) with the energy originally stored in the $2.5\mu F$ and comment on the difference. (5)

(d) Explain, with the aid of a diagram, how you can determine the capacitance of a capacitor when you have another capacitor of known capacitance, a battery and a ballistic galvanometer. (6)

(e) Draw separate graphs to show variation of potential difference with time for a capacitor which is

(i) Charging using a battery of emf V_O, (2)

(ii) discharging. (2)

End