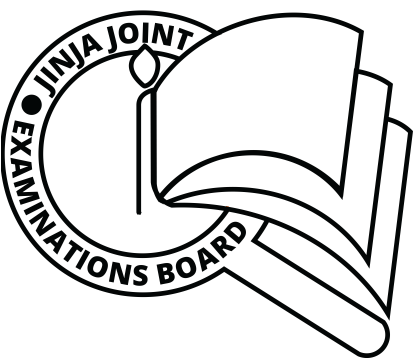
**P510/2**



**PHYSICS**

Paper 2

August, 2019

2½ hours

**JINJA JOINT EXAMINATIONS BOARD**

***Uganda Advanced Certificate of Education***

**MOCK EXAMINATIONS –AUGUST, 2019**

**PHYSICS**

**Paper 2**

(Principal Subject)

2 hours 30 minutes

**INSTRUCTIONS TO CANDIDATES:**

*Answer* **FIVE** *questions, taking at least* *one from each* *of the* Sections **A**, **B**, **C** *and* **D** **but not more than one question** *should be chosen from either* Section **A** or **B**.

*Any extra question shall* **not** *be assessed.*

*Non-programmable scientific electronic calculators may be used.*

*Assume where necessary*

*Acceleration due to gravity, g = 9.81 ms -2*

*Speed of light in a vacuum, c = 3 x 10 8 ms-1*

*Speed of sound in air = 330 ms-1*

*Electronic charge, e = 1.6 x 10 -19 C*

*Electron mass = 9.11 x 10 -31 kg*

*Permeability of free space, µ0= 4π x 10* ***-****7Hm -1*

*Permittivity of free space, ε0 = 8.85 x 10 -12 Fm -1*

*The constant 1 = 9.0 x 109 mF -1*

*4 πε0*

*One electron volt (eV) = 1.6 x 10 -19 J*

*Avogadro’s number NA = 6.02 x 1023 mol -1*

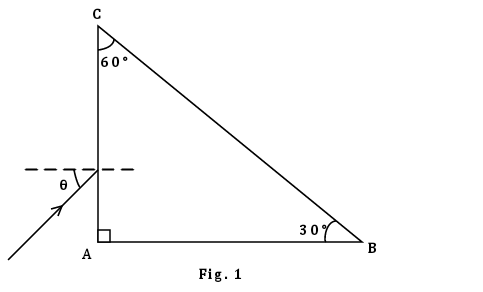
*Planck’s constant, h = 6.63 x 10 -34 Js*

*Specific heat capacity of water = 4.2 x 103JKg -1 K-*

SECTIONA

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

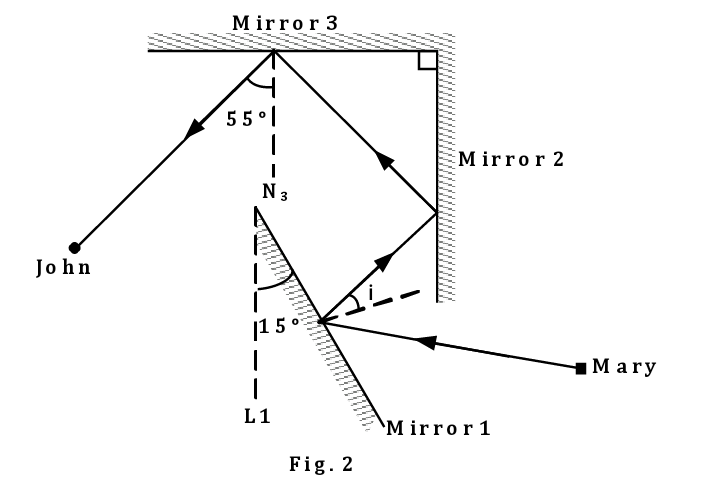
(ii)A ray of monochromatic light is incident from air onto a right angled prism of refractive index1.52at an angleθ as shown in figure1.



Determine the maximum value of angle θ for which the ray just emerges into air after refraction by the prism.(4marks)

(b)(i)Define the term reflection of light.(1mark)

(ii) In an amusement park all the walls are covered with plane Mirrors as shown in figure2.With normal and line L being Parallel to each other .John sees Mary’s image after three Successive reflections by the mirrors,M1,M2 andM3.



If the angle of reflection in mirror 3 is 55°for the mirror arrangement, determine the angle of incidence.i in mirror1. (3marks) (c)(i)Derive an expression relating ,the focal length and the radius of Curvature of a concave mirror. (3marks)

(ii)Areal finite object is placed in front of a concave mirror of focal length ,f and produces a real magnified image of magnification m. When the object is displaced towards the mirror, a virtual image of the same magnification, m is obtained. Show that the displacement of the object, d= 2f (4marks)

(d)Explain why some Stars twinkle at night, when observed from the Earth’s surface.(3marks)

2.(a)Define the following terms as applied to convex lenses.

(i)optical centre.(1mark)

(ii) focal plane.(1mark)

(b)Wild daisy having a radius of 0.6 m is at a distance of 90.0cm from

the camera’s zoomlens.Thefocallengthofthelensis15.0cm.

Determine the;

1. distance from the lens to the film of the camera.(3marks)
2. size of the image of the daisy on the film.(2marks)

(c)(i)Describe the structure and mode of operation of a compound Microscope in normal adjustment.(5marks)

1. Derive an expression for the angular magnification of the Microscope in (i) above.(3marks)

(d)(i)Distinguish between compound microscopes and astronomical telescopes when both are in normal use.(3marks)

(ii) Explain the significance of the Eye-ring in an optical instrument.(2marks)

**SECTIONB**

3.(a)Distinguish between;

1. Electromagnetic waves and Mechanical waves.(2marks)
2. Light waves and Sound waves.(2marks)

(b)Describe an experiment to demonstrate the interference effect of Sound waves, using two coherent sources of sound, a microphone and other essential apparatus.(5marks)

(c)(i) State the laws of vibration of stringed instrument. (3marks)

(ii)A guitar wire ofthickness0.30mm made of a metal of density

780kg/m3 and held under a tension of 100N is plucked in the Middle so as to vibrate at its first harmonic of frequency 842Hz.Determine the length of the wire used. (4marks)

(d)(i)Define the term Doppler effect.(1mark)

(ii)A referee blowing a whistle sounding at a frequency 600Hz is Running at a steady speed of 4.0ms-1 towards an injured groaning player limping towards the referee at 0.5ms.

Calculate the apparent frequency of sound heard by the injured player, given that speed of sound in air is 340ms-1.(3marks)

4.(a)(i) Define the term interference of light waves.(1mark)

(ii)State three conditions necessary for the occurrence of Interference of light by division of wave front.(3marks)

(b)(i)Derive using well defined symbols an expression for the fringe Separation in Young’s double slit experiment.(4marks)

(ii)In Young’s double slit experiment , the separation between the two slits is a distance of 0.127mm while the screen is3.30m from the common plane of the slits. Calculate the distance of Separation between the third and fifth bright fringes formed on the screen, when the slits are illuminated with light of Wave length of 6.34×10-7m.. (3marks)

(c)(i) Distinguish between plane polarized light and un–polarized light.(2marks)

(ii) Explain how sun glasses help to reduce glare in the eyes of a person observing a bright object.(3marks)

(d)Explain why the Sky appears blue on the Earth and Dark on the Moon (4mark)

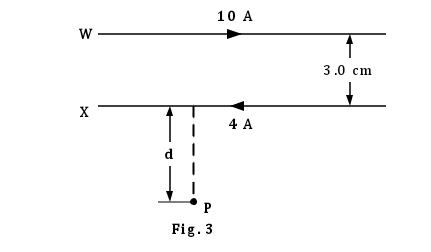
**SECTIONC**

5.(a)Define the terms:

1. tesla.(1mark)
2. Weber .(1mark)

(b)Figure3 shows two straight and parallel copper wires W and X, placed 3.0cm apart in air and carrying currents of 10A and 4A respectively.

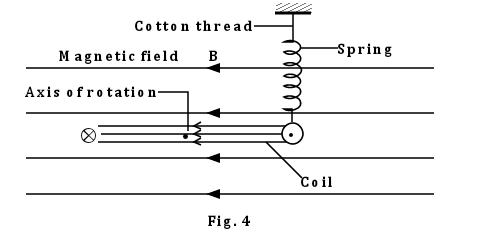
(i)Determine the value of the distance, d, from wire X for which the Resultant magnetic flux density at point P ,is zero.(3marks)



(ii)Calculate the force per meter exerted on wire W.(2marks)

(c)Derive an expression for the magnetic torque experienced by a Rectangular coil of N turns each of area A ,and carrying a current I, When its plane is parallel to a uniform magnetic field of flux density B tesla.(4marks)

(d)Figure4 shows a plane square coil of wire of side 0.060m having 10 turns of wire each carrying a current of 0.90Aasindicated.



When a magnetic field of flux density1.30T is applied from right to left Parallel to the plane of the coil turns about the axis through a small angle θ while the spring of force constant 550Nm remains vertical.

Determine the;

(i)Extension produced in the spring.(3marks)

(ii)State two ways in which the deflection torque of the coil above Can be increased.(2marks)

(e)Explain the origin of Hall voltage across a metal conduct or placed A cross a uniform magnetic field when a current flows through the conductor and derive its expression. (4marks)

6.(a)(i)What is electromagnetic induction? (1mark)

(ii)State the laws of electromagnetic induction.(2marks)

(b)Acoil of 100 turns is wound tightly round the middle of a long solenoid

Of 500turns per meter and of radius8.0cm. A sinusoidal current I=10 sin120πtamperes is passed through the solenoid winding. Find the amplitude of the e.m.f induced across the terminals of the coil. (4marks)

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

1. State three uses of Eddy currents.(3marks)

(d) (i) Describe the structure and mode of operation of an a.c.transformer. (5marks)

1. What are the energy losses in a transformer?(4marks)

7.(a)(i) Define the term inductive reactance.(1mark)

(ii)Derive an expression for the reactance of a pure inductor when a Sinusoidal current is passed through it. (3marks)

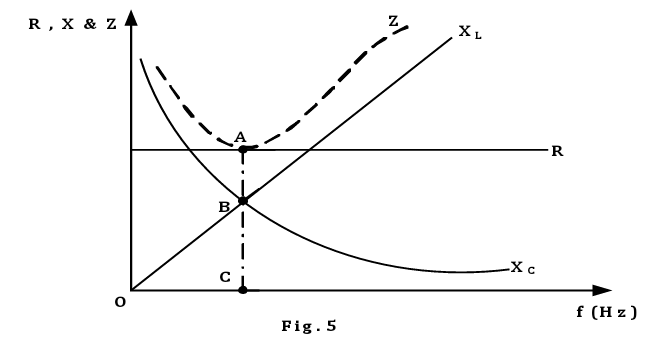
(b)(i) Sketch using the same axes graphs of current and voltage against time for an inductor having a current, I= Iosin 2πft amperes flowing through it and comment on the phase relationship. (3marks)

(ii)Explain why voltage leads current in an inductor.(3marks)

(c)(i)An alternating voltage V=340 sin 100πt is connected across a Capacitor of 10µF. Determine the peak value of the current Flowing in the circuit.(3marks)

(ii)Draw a phasor diagram for the capacitor in (i)above. (1 mark)

(d)Figure5 shows graphs of resistance ,R, reactance X and impedance Z of a series circuit containing a capacitor a pure inductor and a resistor.



(i) Identify the significance of points A ,B and C.(3marks)

(ii)A variable air capacitor used in a reactive circuit having a pure Inductor of self-inductance5.0mH connected in series with is tuned to receive a resonant signal of frequency 60.0Hz. Determine the capacitance of the capacitor.(3marks)

**SECTIOND**

8.(a)(i)Define the term volt and electro motive force of a battery. (2marks)

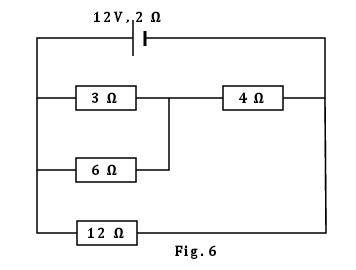
ii)Explain why the temperature of a metal conductor increases when a potential difference is applied across its ends. (3 marks)

(b)(i) What is meant by temperature coefficient of resistance of a material?(1mark)

(ii)Describe an accurate experiment to determine the temperature Coefficient of resistance of copper. (6marks)

(c)(i)Derive an expression for the effective resistance of three resistors arranged in parallel.(3marks)

(ii)Figure6 shows a network of four external resistors of resistances 3Ω, 4Ω, 6Ωand 12Ω connected to a 12V supply of internal resistance2Ω.



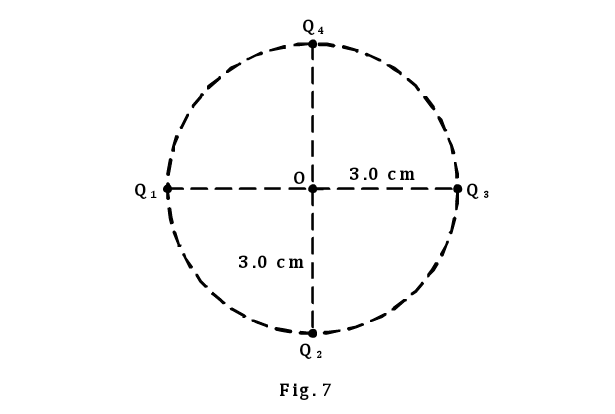
Determine the value of the current supplied by the battery. (4marks)

(d) Give one application of Super conductors.(1mark)

9.(a)(i) Define the term electric potential at a point.(1mark)

(ii)Sketch a graph showing the variation of electric potential with distance from the centre of a negatively charged metal sphere. (2 marks)

(b)FourpointchargesQ1,Q2,Q3andQ4 of +1.5µC,–3.0µC,+6.0µC and –1.8µC respectively ,lie at the extremes of two perpendicular diameters of a circle of radius3.0cm,along the x–axis and y–axis as shown in figure7.



Determine the resultant electric potential energy at point O when a Charge of +2.0µC is placed at O.(5marks)

(c) Explain how a gold leaf electroscope can be;

i)Charged positively by induction at zero potential.(3marks)

(ii)used to distinguish between a neutral copper rod and a neutral Glass rod.(4marks)

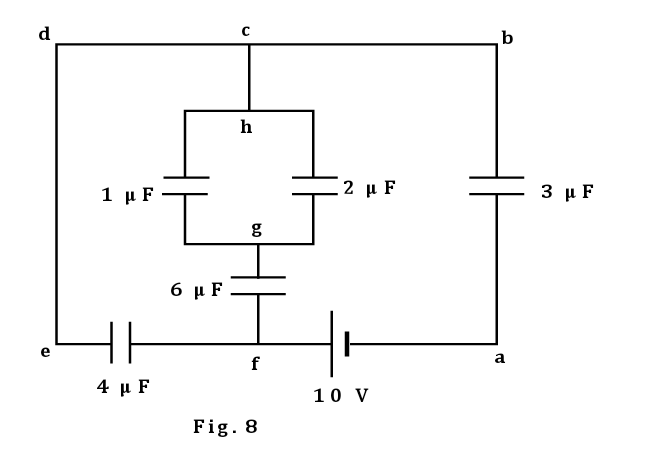
(d)(i)Describe with the aid of a diagram the essential parts and the Mode of operation of a photocopying machine. (5marks)

10.(a)(i) Define the term capacitance of a capacitor.(1mark)

(ii) A capacitor has the space between its plates filled with an Insulator of dielectric constant εr. It’s connected to a d.c source and charged fully. It’s then disconnected and isolated and the dielectric is removed. Show that the fractional change in the potential difference across the capacitor is 1- εr. (4marks)

(b)(i) Derive an expression for the effective capacitance of three Capacitors arranged in series.(4marks)

(ii) The circuit in figure 8 shows a network of five capacitors of 1.0µF ,2.0µF ,3.0µF, 4.0µF and6.0µF connected to a 10V d.c supply.



Determine the total energy stored in the network.(4marks)

(c) Describe an experiment to show the effect of inserting an insulator between the plates of a charged parallel plate capacitor.(5marks)

(d) Apart from storing charge give two industrial uses of a capacitor. (2 marks

**=END=**