**P510/2**

**Physics**

**Paper 2**

**June. July, 2022**

**2½hours**

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**Community**

UNNASE MOCK EXAMINATIONS 2O22

***Uganda Advanced Certificate of Education***

**PHYSICS**

**PAPER 2**

2 hour 30 minutes

**INSTRUCTIONS TO CANDIDATES:**

Attempt only **Five** questions with at least **one** question from each of the four sections **A**, **B**, **C** and **D**. Do not attempt more than one question from each of the sections **A** and **B**.

Silent Non – programmable electronic scientific calculators may be used.

**Where necessary assume the following constants;**

*Acceleration due gravity, g = 9.81 m s–* ***2***

*Speed of light in vacuum, c = 3.0 × 10 8 m s* ***– 1***

*Speed of sound in air = 330 m s* ***– 1***

Electronic charge, e = 1.6 × 10 – 19 C

Electronic mass, me = 9.11 × 10 – 31 kg

Permeability of free space, µo = 4.0π × 10 – 7 H m– 1

Permittivity of free space,  = 8.85 × 10 – 12 Fm – 1

The Constant,  = 9.0 × 10 9 F – 1 m

SECTION A

1. (a) (i) Draw a ray diagram to show how a concave mirror forms

a real image of a finite size object. (01 mark)

(ii) From the diagram in (a) (i) derive the relation

where are object distance, image

distance and focal length of the mirror. (04 marks)

(b) Describe an experiment to determine the focal length of a

convex mirror using the parallax method. (05 marks)

(c) A convex lens of focal length is arranged co-axially with

a convex mirror of focal length such that they are 4cm

apart. An object is placed infront of the lens.

(i) Find the position of the final image. (04 marks)

(ii) Using a point object sketch a ray diagram showing the

image formation. (02 marks)

(d) (i) Distinguish between real and virtual images.

(02 marks)

(ii) With reference to a plane mirror, draw ray diagrams to

show the formation of the images in (d) (i) above.

(02 marks)

2. (a) Derive an expression of effective focal length of two thin

bincovex lenses of focal length placed in contact with

each other with a ray diagram. (03 marks)

(b) (i) Describe an experiment to determine the focal length of a

concave lens using a convex lens. (04 marks)

(ii) State the possible causes of failure to receive a real image

on the screen in lenses. (02 marks)

(c) The curved face of a plano mirror convex lens of refractive

index is placed in contact with a plane mirror. An object at

distance coincides with the image produced by the lens

and reflection by the mirror. A film of a liquid is now placed

between the lens and the mirror and the coincident object and

image are at distance.

Find the index of refraction of the liquid. (04 marks)

(d) (i) Define angular magnification of an optical instrument.

(01 mark)

(ii) What is meant by an exit pupil of a compound

Microscope? (02 marks)

(iii) Describe with the aid of a ray diagram, the structure and

action of a compound microscope in normal adjustment.

(04 marks)

SECTION B

3. (a) (i) Distinguish between free and damped oscillations.

(02 marks)

(ii) Describe how the amplitude of a forced oscillation builds

up to a constant value. (03 marks)

(b) The displacement in meters of a plane progressive wave is

given by the equation

Find;

(i) wavelength and (02 marks)

(ii) speed, of the wave (02 marks)

(c) (i) Explain the occurrence of beats in sound. (03 marks)

(ii) Two tuning forks are sounded together to

produce beats of frequency . Fork has a known

frequency of .

When is loaded with a small plasticine beats at a

frequency of are heard when the two tuning forks are

sounded together.

Calculate the frequency of when unloaded.

(03 marks)

(d) (i) What is meant by Doppler effect? (01 mark)

(ii) A car sounds its horn as it travels at a steady speed of

along a straight road between two stationary

observers . The observer hears a frequency of

hears a frequency of while hears a lower

frequency.

Calculate he frequency heard by , assuming the speed

of sound in air is . (04 marks)

4. (a) What is meant by the following terms;

(i) unpolarised light, (01 mark)

(ii) plane polarized light? (01 mark)

(b) (i) Describe briefly how plane polarized light is produced by

double refraction. (03 marks)

(ii) Explain briefly one application of polarized light.

(02 marks)

(c) Explain;

(i) how two coherent sources are obtained using a biprism.

(03 marks)

(ii) why interference effects are not observed in thick films?

(03 marks)

(d) In Young’s double slit experiment, the slits are separated by

and the screen is away. The distance between the

fourth bright fringe and the central fringe is . Determine

the wavelength of light used in this experiment.

(04 marks)

(e) Explain the effect of increasing the number of narrow slits in

diffraction grating on the intensity of diffraction fringes.

(03 marks)

SECTION C

5. (a) Define the following terms as applied to alternating voltage:

(i) root – mean –square value. (01 mark)

(ii) peak value. (01 mark)

(b) (i) An alternating voltage is applied across a capacitor of

capacitance, . Show that the current in the circuit leads

the voltage by . (03 marks)

(ii) Find the expression for the capacitive reactance in terms

of frequency, and capacitance, C. (02 marks)

(iii) A capacitor of is in series with an source of

frequency . If the value of the current flowing

is , calculate the voltage across the capacitor.

(03 marks)

(c) Explain why a capacitor in a circuit blocks the flow of direct

currents but allows the flow of alternating current.

(03 marks)

(d) (i) Draw a well labelled diagram to show that the structure

of the repulsion type moving iron ammeter.

(02 marks)

(ii) Explain how the ammeter in (d) (i) above is able to

measure alternating current. (05 marks)

6. (a) Define the following terms in magnetism.

(i) Magnetic flux density,

(ii) A tesla,

(iii) Electromagnetic moment of coil. (03 marks)

(b) The figure1 below shows a horizontal straight wire with current

into the page placed between two poles of a magnet.

**S**

**N**

Figure 1

Wire

Use the above resultant flux pattern round the wire to explain

why the wire experiences a force. (02 marks)

(c) (i) With the aid of a well labelled diagram explain the mode

of action of a moving coil galvanometer. (05 marks)

(ii) Derive the expression of magnetic torque of a couple

experienced by a coil of N turns and area, A, carrying a

current, I, when its plane is parallel to a uniform

magnetic field of flux density, B. (03 marks)

(d) Two long straight wires carrying currents in opposite directions are placed at a distance, , in

vacuum.

(i) Derive an expression for the force per meter between the

wires. (03 marks)

(ii) Use the above expression define and deduce the

definition of an ampere. (02 marks)

(iii) Find the flux density midway between the wires.

(02 marks)

7. (a) (i) State the laws of electromagnetic induction.

(02 marks)

(ii) Explain how Lenz’s law is consistent with the law of

conservation of energy. (03 marks)

(b) Describe the experimental determination of the flux density of

the field between poles of a strong magnet using calibrated

ballistic galvanometer. (05 marks)

S

(c)

A

P

X

B

Q

R

X

**Figure 2**

In a circuit of figure 2 above, coil A is a coil with resistance equal to the resistance of B and B is a resistor with no inductance. P and Q are identical lamps and a battery is applied across them.

State and explain what happens

(i) when switch S is closed. (03 marks)

(ii) source is replaced with an source and switch is S

closed. (03 marks)

(d) A circular coil of radius and is of 30 turns is tightly wound

round the middle of a solenoid of 600 turns per meter. The current through the solenoid is . Find the induced in the coil when the current in the solenoid is reversed in .

(03 marks)

(e) Derive the expression for the induced in a straight

conductor of length, , moving at a velocity, , across a field of

flux density, . (03 marks)

SECTION D

8. (a) (i) Define the terms super conductor and short – circuit as

used in electricity. (02 marks)

(ii) State two uses of super conductors. (01 mark)

(b) (i) Explain the effect of temperature rise to resistance of

pure conductors. (03 marks)

(ii)

V

**Fig.3**

In the figure 3 above, the batteries have negligible internal

resistance and the voltmeter V has a high resistance. Find the

voltmeter reading. (03 marks)

(c) Describe an experiment used to determine temperature coefficient of resistance of copper wire in the laboratory.

(05 marks)

(d) Figure 4 shows a simple potentiometer circuit set using a uniform wire AB, 1.0m long, which has a resistance of . The resistance of the 4V battery is negligible. If the variable resistor R were given a value of and switch K is closed.

**K**

**R**

**B**

**C**

**A**

**G**

**Slide wire**

**1.5V**

**Fig.4**

(i) Find the balance length AC of the wire. (03 marks)

(ii) If R were made and the 1.5V cell and galvanometer

were replaced by a voltmeter of resistance , find the

voltmeter reading if the contact C were placed at the

mid-point of AB. (03 marks)

9. (a) (i) Define terms dielectric constant and dielectric

strength. (02 marks)

(ii) Explain what happens when a conductor instead of a

dielectric material is placed between the plates of a

charged capacitor. (02 marks)

(b) (i) Define a Farad. (01 mark)

(ii) A capacitor is used to power the flash gun of a

camera. The average power output of the flash gun is

for the duration of the flash which is .

Find the average current provided by the capacitor

during the flash. (04 marks)

(c) (i) Describe an experiment to determine the relative

permittivity of the dielectric material between the plates

of a parallel plate capacitor using ballistic galvanometer.

(05 marks)

(ii) Derive the total capacitance of any three capacitors in

series. (03 marks)

(d) Figure5 shows a battery of e.m.f 100V is connected across a network of capacitors.

**100V**

**Fig.5**

Calculate the energy stored in the above network of

capacitors. (04 marks)

10. (a) (i) State the characteristics of the equipotential surface.

(02 marks)

(ii) Explain why the electric field intensity is always normal

to the equipotential surface. (03 marks)

**+1nc B**

(b)

**C +1nc**

**+1nc A**

**O**

**+1nc C**

**Fig.6**

Figure 6 shows, Charges of +1nc situated at each of the points A, B, C and D.

Given that AOC=6m, calculate the work done in bringing a

charge of +5nc from a distance point to the centre O.

(04 marks)

(c) Sketch the following graphs

(i) Potential against distance when a charged body is near a

neutral metal rod. (02 marks)

(ii) electric field intensity against distance when a charged

body is near an earthed neutral metal rod.(02 marks)

(d) (i) Explain why the live terminal of Van de Graff generator is

in form of a hollow sphere. (02 marks)

(ii) Two like charges are brought close to each other. Explain

what would happen to their electrostatic potential energy.

(02 marks)

(iii) A capacitor of capacitance, C is charged by a battery and

then isolated. When the plates of separation is doubled,

deduce what happens to the p.d between the plates.

(03 marks)

**END**