P510/2
PHYSICS
Paper 2
July-August , 2019
2½ hours

KAMSSA JOINT MOCK EXAMINATIONS

Uganda Advanced Certificate Of Education

PHYSICS

(Principal Subject)

PAPER 2

TIME: 2½ HOURS

INSTRUCTIONS TO CANDIDATES:

*Answer only **five** questions, taking at least **one** question from each of the sections **A**, **B**, **C** and **D**, but **not** more than **one** question should be chosen from **either** section **A** or section **B**.*
*Any additional question(s) answered will **not** be marked.*
Mathematical tables and squared paper will be provided.
Non-programmable Silent Scientific Calculators may be used.

Assume where necessary:

Acceleration due to gravity,	g	=	9.81m s^{-2}
Speed of light in Vacuum,	c	=	$3.0 \times 10^{8} \text{m s}^{-1}$
Speed of sound in air,	*v*	=	$3.40 \times 10^{2} \text{m s}^{-1}$
Electronic charge,	e	=	$1.60 \times 10^{-19} \text{C}$
Electronic mass,	m_e	=	$9.11 \times 10^{-31} \text{kg}$
Permeability of free space,	μ_o	=	$4\pi \times 10^{-7} \text{H m}^{-1}$
Permittivity of free space,	ε_0	=	$8.85 \times 10^{-12} \text{F m}^{-1}$
The Constant,	$\frac{1}{4\pi\varepsilon_0}$	=	$9.0 \times 10^{9} \text{F}^{-1} \text{m}$

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SECTION A

1. (a). Define refractive index of a material. (1 mark)

(b).(i) Describe with the aid of a diagram, how the refractive index of a liquid can be measured using an air cell. (5 marks)

(ii)Derive the expression used to obtain the refractive index of the liquid in(b)(i)a (3 marks)

(c). Describe the adjustments that have to be made before a spectrometer can be (4 marks)

(d). (i) define the terms magnifying power and the exit pupil of a telescope (1mark)

(ii) A Galilean telescope has an objective lens of focal length 12 cm and eye piece of focal length 5 cm. It is focused on a distant object so that the final image seen by the eye appears to be situated at a distance of 30 cm from the eye piece. Find the angular magnification produced (4marks)

(e). state one advantage and one disadvantage of using a microscope when it is not in normal adjustment (2marks)

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

(ii) Derive an expression relating the radius of curvature of a convex mirror to the object and image distances. (4 marks)

(iii) Sketch a graph of object distance against image distance for a concave mirror and use it to describe the image formed by the mirror as the object distance varies from very large to very small values. (2 marks)

b. (i) define the term principal focus of a convex lens (1mark)

(ii) describe how the focal length of a diverging lens can be determined using a concave mirror (5marks)

c. A thin diverging lens of focal length **30cm** is placed **10cm** behind a converging lens of focal length **30cm**. an object is placed on the common axis of the lenses at a point **20cm** in front of the converging lens. Find

(i) the position of the image formed by the two lenses (4marks)

(ii) the linear magnification produced. (2marks)

SECTION B

3. a) define the terms amplitude and intensity as applied to waves . (2marks)

b) Briefly describe an experiment to show that a wire under tension can vibrate with more than one frequency. (5marks)

c) A uniform wire of length 1.0m and mass 2.0 x 10^{-2}kg is stretched between two fixed points. The tension in the wire is 200N. The wire is plucked in the middle and released.

(i) Show that $f_n = nf_o$ where f_n is the frequency of the nth note and f_o is the fundamental frequency (3marks)

(ii) Calculate the Frequency of the fundamental note (3marks)

d) (i) describe an experiment to determine the beat frequency of a note. (4marks)

(ii) Derive an expression for the beat frequency. (3marks)

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

(ii) Explain with the aid of a diagram how interference occurs in an air-wedge. (3 marks)

(b) An air-wedge film formed by placing an aluminium foil between two glass slides at a distance of 75 mm from the line of contact of the slides. When the air wedge is illuminated normally, by light of wave length 5.60×10^{-7} m, parallel interference fringes of separation 1.20 mm are produced.
Calculate the;

(i) angle between the slides. (2 marks)

(ii) thickness of the aluminium foil. (2 marks)

(c) (i) What is ***plane polarized light?*** (1 mark)

(ii) Describe with the aid of a labelled diagram, one application of plane polarized light. (4 marks)

(d) (i) Describe an experiment to determine the wavelength of light waves used in a diffraction grating. (5 marks)

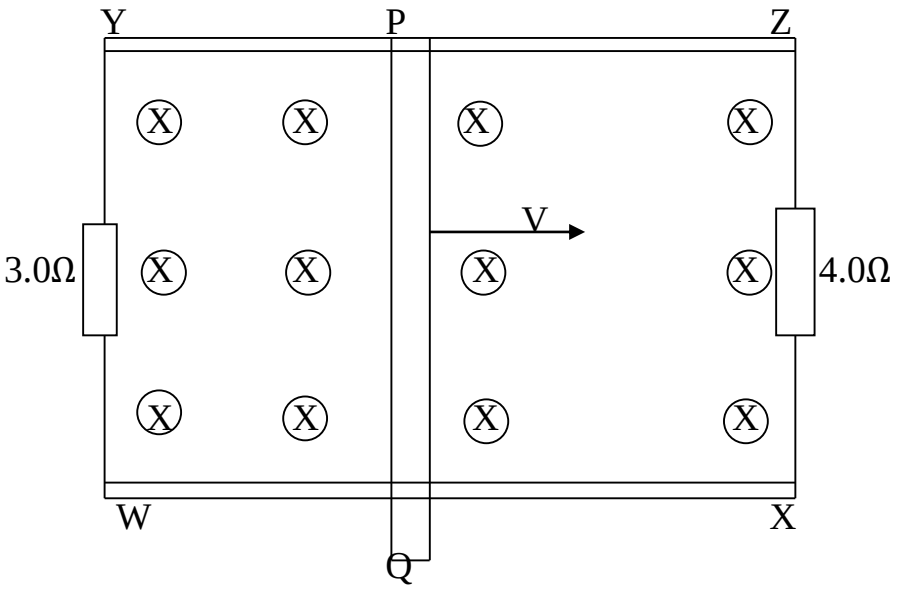
(ii) A parallel beam of sodium light of wavelength 5.89×10^{-7} m is incident normally on a diffraction grating having 6000 lines per cm. Find the angle for which the second order image will be seen. (2 marks)

SECTION C

5. a) (i) State the laws of electromagnetic induction. (2marks)

(ii) Describe and explain an experiment to verify lenz's law. (5marks)

b)



In the figure, the rod PQ 1.2m long rolls along frictionless rails WX and YZ of negligible resistance in a perpendicular magnetic field of flux density 0.4T at a speed of $4ms^{-1}$. Find:

(i) The rate of energy conversion in the 4.0Ω resistor. (2marks)

(ii) The power generated by the rod PQ (2marks)

c) (i) Description the structure and mode of action of an a.c generator and state one modification necessary to convert it into a d.c generator. (6marks)

(iii) A 10.4kW transformer steps down voltage from 240V to 30V. If the secondary coil has 1200 turns and the transformer is 80% efficient, find, the number of turns in the primary coil and the current flowing in the primary coil. (3marks)

6. a) Define the following terms as applied to earth magnetism.

(i) Magnetic meridian (1mark)

(ii) Angle of dip (1mark)

(iii) Angle of declination (1mark)

b) (i) With the aid of a diagram, describe the term hall effect and state its one application. (4marks)

(ii) A metal strip 2cm wide and 0.1 cm thick caries a current of 20 A at right angles to a uniform magnetic field of flux density 2T. the hall voltage is 4.27μV. calculate the density of charge carriers in the strip . (3marks)

c) (i) What is meant by a radial magnetic field? (1mark)

(ii) Explain the importance of a radial magnetic field to a moving coil galvanometer. (2marks)

(iii) A moving coil galvanometer has a rectangular coil of sides 8cm x 4cm. The coil has 120 turns and it is placed in a magnetic field of flux density 0.8T. Find the current which flows through the coil in order to deflect it through 45^0 if the torsional constant of the coil is 20 rad/Nm. (4marks)

d) Explain why a current carrying conductor experiences a mechanical force. (3marks)

7. a) (i) Distinguish between the terms root mean square value and peak value of an alternating current. (2marks)

(ii) Describe with the aid of a labeled diagram, the structure and mode of operation of a moving iron meter (repulsion type) (6marks)

b) Define the terms;

(i) Pure inductor

(ii) reactance (2marks)

c) (i) A sinusoidal current $I = I_0 \sin 2\pi ft$ is applied across a pure inductor of inductance, L, Henries. Show that the peak value of the p.d across the inductor is given by $V_0 = 2\pi fLI_0$ (4marks)

(ii) Explain the statement that an inductor is a wattles component. (3marks)

d) An electric kettle of resistance 20Ω is connected to a.c. mains. If the voltage applied across the kettle is given by $V = 120\sin 100\pi ft$ volt and the kettle contains 1.5kg of water at 30^0c, how long will it take the temp of the water to rise to 80^0c if the efficiency of the kettle is 80%. (3marks)

SECTION D

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

(ii) What is meant by corona discharge? (3marks)

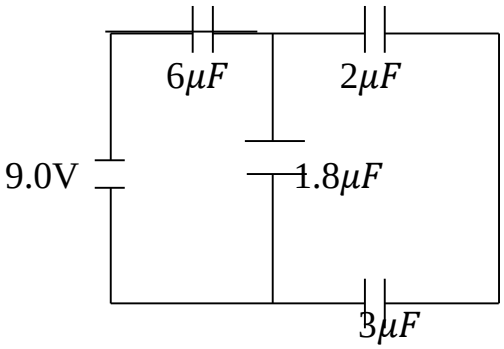
(iii) Explain one industrial application of corona discharge. (6marks)

b) A spherical ball carrying a charge of $+3\mu C$ is lowered into a hollow conductor which initially has a charge of $-5\mu C$ on its outer surface. Calculate the total charge on both the outer and inner surfaces of the conductor after lowering the conductor. (The spherical ball keeps hanging and does not touch the walls of the conductor) (4marks)

c) (i) What is a dielectric. (1mark)

(ii) Explain briefly the charging process of a capacitor. (2marks)

d)



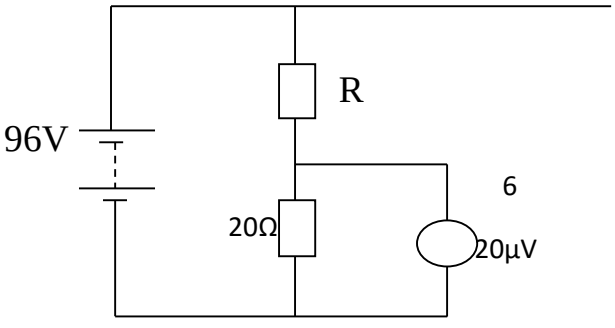
In the figure, find the energy stored in the $3\mu F$ capacitor. (3marks)

9. a) (i) Define temperature coefficient of resistance. (1mark)

(ii) Draw a diagram of a meter bridge and use it to derive the balance condition. (4marks)

b) Explain how you would use a meter bridge to determine the temperature coefficient of resistance. (5marks)

c) (i) Describe an experiment to verify Ohm's law. (4marks)



The figure above shows a potential divider. When a voltmeter is connected across a 20Ω resistor, it reads 48.0V and when it is connected across the resistor of RΩ, it reads 46.08V. Find:

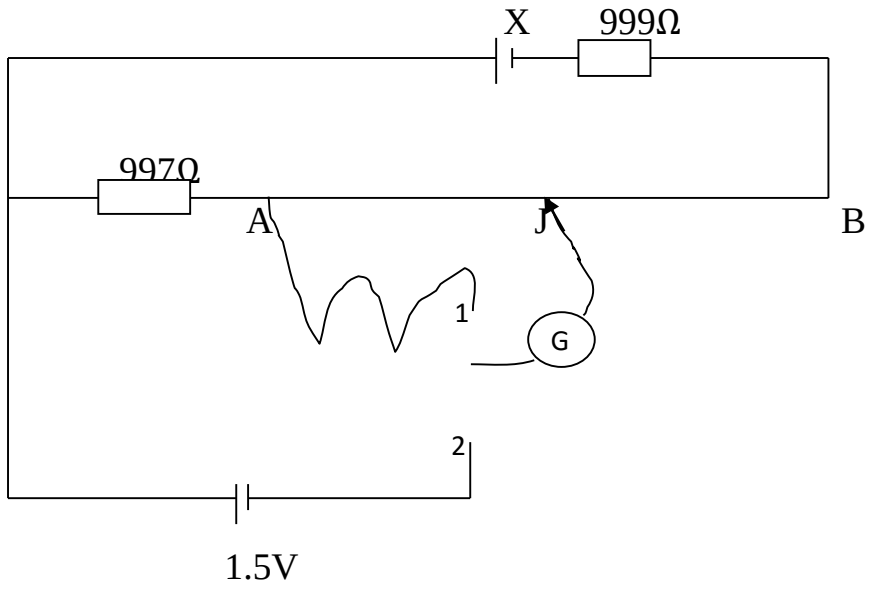
(i) The resistance of the voltmeter (3marks)

(ii) The resistance R (3marks)

10. a) (i) Outline the principle of a slide wire potentiometer. (3marks)

(ii) Describe how you would use a potentiometer to calibrate an ammeter. (5marks)

b)



In the figure, X is a cell of negligible internal resistance and unknown e.m.f. AB is a uniform slide wire 100cm long and having a resistance of 4Ω. When S is put in position 1, G shows no deflection when AJ = 30.0cm. When S is put in position 2, G shows no deflection when AJ = 60.0cm. Find:

(i) The current flowing in the slide wire (3marks)

(ii) The e.m.f of cell, X. (2marks)

(iii) e.m.f of the thermocouple (2marks)

c) When the temperature of a coil placed in the left hand gap of a meter bridge was raised to 40^0C, a balance length of 42.5cm was obtained. When the temperature was raised to 95^0C, a balance of 54.5cm was obtained. Find the temperature coefficient of resistance of the coil and its resistance at 80^0C.
5marks

END