P510/2
PHYSICS
Paper 2
July/Aug. 2022
2 ½ hours

ASK INTERGRATED TEACHERS' MOCK EXAMINATIONS BURREAU

AITEL JOINT MOCK EXAMINATIONS

Uganda Advanced Certificate of Education

PHYSICS

Paper 2

2 Hours 30 Minutes

INSTRUCTIONS TO CANDIDATES:

*Answer **five** questions, including **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 additional question(s) answered will **not** be marked.*
Non-programmable scientific calculators may be used.

Assume where necessary:

Acceleration due to gravity	g	=	$9.81ms^{-2}$
Speed of sound in air		=	$330ms^{-1}$
Speed of light in vacuum	c	=	$3.0 \times 10^{8}ms\text{-}1$
Electronic charge	e	=	$1.6 \times 10^{-19}\ C$
Electron mass		=	$9.11 \times 10^{-31}\ kg$
Planck's constant	h	=	$6.6 \times 10^{-34}Js$
Permeability of free space,	$\mu_{0.}$	=	$4.0\pi \times 10^{-7}\ Hm^{-1}$
Permittivity of free space,	ε_0	=	$8.85 \times 10^{-12}Fm$
The constant	$\frac{1}{4\pi\varepsilon_0}$	=	$9x10^{9}F^{-1}m$
One electron volt	(eV)	=	$1.6 \times 10^{-19}\ J$
Avogadro's number	N_A	=	$6.02\ X\ 10^{23}\ mol^{-1}$
Resistivity of Nichrome wire at 25^0C		=	$1.2x10^{-6}\Omega m$

SECTION A

1. (a) Define focal and power of a lens. **2 marks**

(b) (i) Describe an experiment to determine the focal length of a concave lens Using a concave mirror. **5 marks**

(ii) Explain why monochromatic light is usually preferred in experiments when using lenses. **2 marks**

(c) A concave lens of focal length 30cm is arranged with a convex lens of focal length 18cm, placed 4 cm apart. An object 3cm high is placed 40cm in front of the concave lens, on the side remote from the convex lens. Find the;

(i) Position of the final image. **5 marks**

(ii) Height of the image **2 marks**

(d) With aid of a diagram, describe how prism binoculars work. **4 marks**

2. (a) (i) Draw a ray diagram to show how a convex mirror forms an image of a real object. **2 marks**

(ii) Describe how you could determine the focal length of a convex mirror using a convex lens. **5 marks**

(b) An object is placed at a distance, d on one side of the principle focus; f of a convex lens of focal length f. the image is formed at some point c. show that when the object is displaced to point d, on the opposite side of f, the image gets displaced by distance $\frac{2f^2}{d}$. **6 marks**

(c) The objective and eye piece of an astronomical telescope have focal lengths of 95cm and 5cm respectively. Find the;

(i) Separation of the two lenses when the final image is formed at 150cm from the eye piece. **4 marks**

(ii) Position of the eye ring **2 marks**

(d) (i) What is the significance of the eye ring of an astronomical telescope.

(ii) State two advantages of reflecting telescope over a refracting telescope.

1 mark

SECTION B

3. (a) What is meant by the terms free forced and dumped osculation? **6 marks**

(b) Describe with aid of a diagram, an experiment to investigate the variation of frequency of a stretched string with length. **4 marks**

(c) (i) What is meant by the term beats? **1 mark**

(ii) Describe how you can determine the frequency of a tuning fork using beats. **4 marks**

(d) Two open pipes of length 92 cm and 93 cm are found to give beat frequency of 3.0Hz when each is sounding in its fundamental note. If the end corrections are 1.5cm and 1.8cm respectively, calculate the;

(i) Velocity of sound in air **3 marks**

(ii) Frequency of each note. **2 marks**

4. (a) What is meant by interference and diffraction with reference to light? **2 marks**

(b) (i) With the aid of a diagram, explain how newton's rings are formed. **5 marks**

(ii) Explain the change in spacing of rings in b (i) above when the air film is replaced with water. **2 marks**

(c) An air wedge is formed using two flat glass plates of length 150mm in contact at one end separated by a thin wire at the other end- when the wedge is illuminated about normally with monochromatic light of wavelength 470mm, 20 fringes are counted in a distance of 1385mm. find the diameter of the wire. **4 marks**

(d) Describe how the wavelength of light may be determined using a transmission grating. **5 marks**

(e) Find the angular position for the second order image when light of wave length 548, is made incident normally on a grating of 600 lines per nm. **2 marks**

SECTION C

5. (a) (i) Define the tesla **1 mark**

(ii) Write down an expression for the force experienced by an electron having charge e, moving at an average velocity in a wire placed at right angles to a field of flux density B. **1 mark**

(b) (i) With the aid of a diagram, describe the structure and mode of operation of Moving coil galvanometer. **6 marks**

(ii) A rectangular coil of 100 turns is suspended in a uniform magnetic field of flux density 0.02t with the plane of the coil parallel to the field. The coil is 3cm high and 2cm wide. If a current of 50A through the coil causes a deflection of 30^0. Calculate the torsional constant of the suspension. **3 marks**

(c) (i) Define the ampere. **1 mark**

(ii) Explain how the definition in c(i) above is used in the measurement of current. **5 marks**

(iii) Two parallel wires carrying currents of 5A and 3A respectively are 10cm apart. If the wire carrying the 5A is 50cm long, find the force exerted on it **3 marks**

6. (a) Define the terms magnetic flux and magnetic flux density. **2 marks**

(b) A straight wire of length 30cm and resistance 0.36≏ lies at right angles to a magnetic field of flux density 0.45T. The wire moves when a P.d of 2.0V is applied across its ends. Calculate the;

(i) Initial force on the wire. **2 marks**

(ii) Force on the wire when it moves at a speed of $12ms^{-1}$ **4 marks**

(iii) Maximum speed attained by the wire. **2 marks**

(c) (i) Using an illustrative diagram, explain why a current carrying conductor in a Magnetic field experiences a force **3 marks**

(ii) Draw a magnetic field pattern for two current carrying wires experiencing attractive force. **3 marks**

(d) Describe with the aid of a diagram an absolute method of determining resistance. **4 marks**

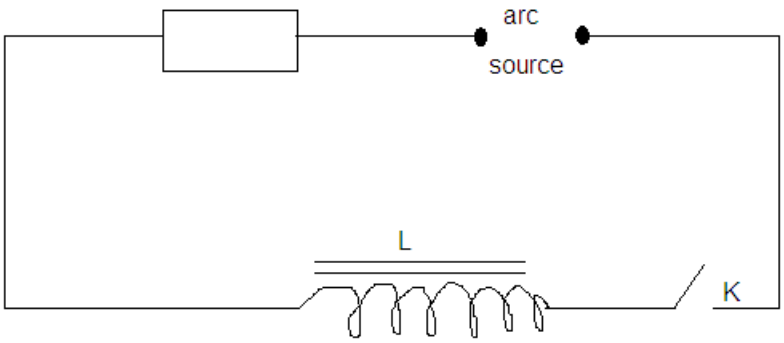
7. (a) (i) Describe how a hot wire ammeter works. **7 marks**

(ii) Explain why the instrument in a(i) above suitable for measuring alternating current while a moving coil galvanometer is not. **3 marks**

(b) Define resistance and state its unit. **2 marks**

(c) Show that the current leads voltage by phase angle 90^0 when a sinusoidal voltage is applied is across a capacitor, hence find the expression for reactance of the capacitor. **5 marks**

(d) A240v, 60Hz alternating voltage is applied across an inductor of 0.2H and negligible resistance. Find the maximum value of current that flows through the inductor.



An iron cored coil L is connected in series with a reissitor and switch K across a strong source as above. Swtich K is closed and after sometime it is openeded. Explain why a spark occurs at the switch. **3 marks**

SECTION D

8. (a) Define the terms electrical resistivity and temperature coefficient of resistance. **2 marks**

(b) An electric heater consists of 5.0m of nichrome wine of diameter 0.58mm. When connected to a 240V supply, the heater dissipates 2.5kw and the temperature of the heater is found to be 1020^0c. If the resistivity of nichrome at 10^0c is $1.02\text{x}10^{-6}$ m. Calculate;

(i) The resistance of nichrome at 10^0c. **3 marks**

(ii) The mean temperature coefficient of nichrome between 10^0C and 1020^0C **3marks**

(c) (i) Derive the balance condition for Wheatstone bridge. **4 marks**

(ii) Explain why the Wheatstone bridge is not suitable for measuring very low or very high resistances. **4 marks**

(d) A dry cell gives a balance length 85.0cm on a potentiometer wire. When a resistor of resistance 16 is connected across the terminals o the cell, a balance length of 76.0cm is obtained. Find the internal resistance of the cell. **4 marks**

9. (a) Define the terms

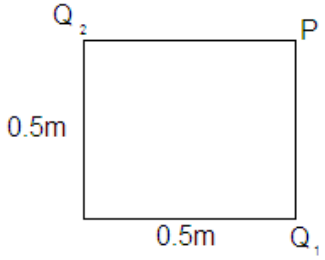
(i) Electric potential **1 mark**

(ii) Electric field intensity **1 mark**

(b) (i) Explain briefly what happens to the potential energy as two point charges of the same sign are brought closer. **2 marks**

(ii) Explain how two insulating bodies rubbed together acquire charge. **3 marks**

(c) the figure below shows two point charges Q_1 and Q_2 of +44.4uc and -22.2uc respectively placed at the corners of a square of side 0.5m.



Define the;

(i) Electric field insensitivity at point P **3 marks**

(ii) Electric potential of a charge Q_3 of magnitude +10uc placed at P. **3 marks**

(d) Describe briefly how a lighting conductor works. **7 marks**

10. (a) Define

(i) Capacitance of a capacitor **1 mark**

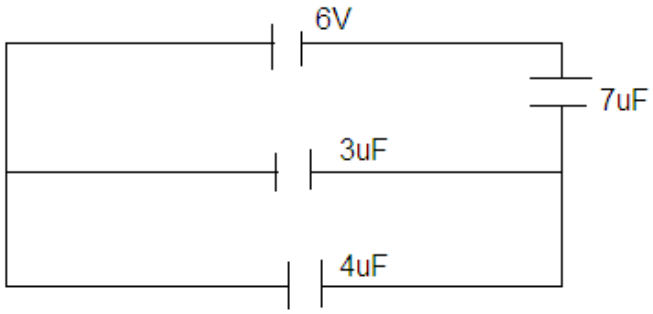
(ii) Relative permittivity **1 mark**

(b) Describe an experiment to determine the relative permittivity of a material given using a capacitor and a ballistic galvanometer. **4 marks**

(c) Show that two identical capacitors connected in parallel across a voltage source store eight times the amount of energy they would store, if they were in series. **3 marks**

(d) Explain how the dielectric placed between the plates of a capacity increases the capacitance. **4 marks**

(e)



The figure above shows a network of three capacitors 3µF, 4µf and 7µf connected by a 6V battery. Find the;

(i) Charge stored in the 4µF capacitor **5 marks**

(ii) Energy stored in the 7µF capacitor. **2 marks**

END