



TECHNICAL UNIVERSITY OF MOMBASA
FACULTY OF APPLIED AND HEALTH SCIENCES

DEPARTMENT OF MATHEMATICS & PHYSICS

UNIVERSITY EXAMINATION FOR:
DIPLOMA IN ANALYTICAL CHEMISTRY

APS 2102: PHYSICS II
END OF SEMESTER EXAMINATION

SERIES: MAY 2016

TIME: 2 HOURS

Instructions to Candidates

You should have the following for this examination

Answer Booklet

examination pass

mathematical table or calculator

student ID

This paper consists of **FIVE** questions.

Attempt question ONE (Compulsory) and any other TWO questions.

This paper consists of 6 printed pages

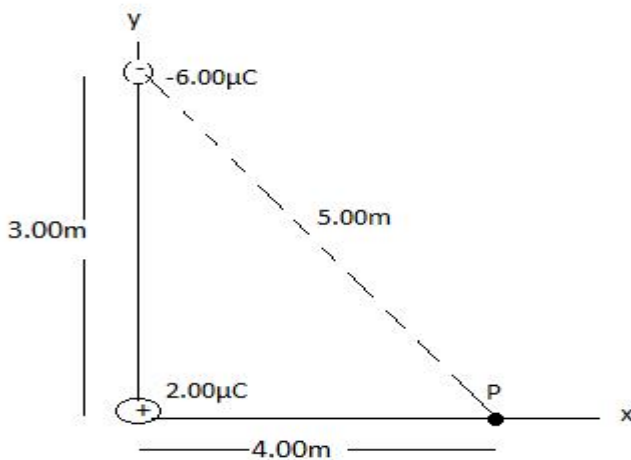
Do not write on the question paper.

Coulomb's constant. $F_e = 8.99 \times 10^9 \text{ Nm}^2/\text{C}^2$

$m_e = 9.11 \times 10^{-31} \text{ kg}$, $m_p = 1.67 \times 10^{-27} \text{ kg}$, $r = 5.3 \times 10^{-11}$

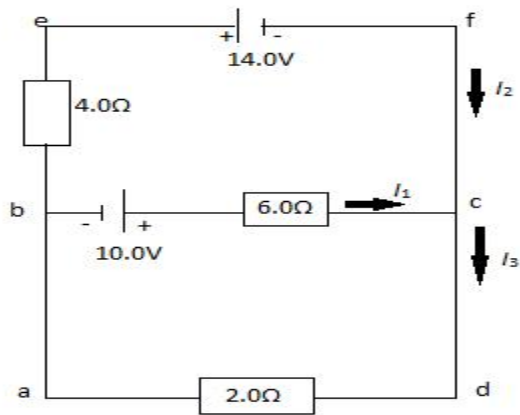
Question ONE (30mks)

- a) State **three** factors that affect the capacitance of a parallel- plate capacitor. (3mks)
- b) Other than temperature state any other **two** factors that affect the resistance of an ohmic conductor. (2mks)
- c)i) Define conductivity and give its SI unit (2mks)
- ii) A material is shaped to make a wire 0.1m long, with a cross sectional area of $5 \times 10^{-6} \text{m}^2$. When a voltage of 12V is applied, a current 0.8amps flows. Calculate the conductivity of the material (3mks)
- d) State Lenz's law (1mk)
- e) A force of $1.6 \times 10^{-3} \text{N}$ exists between 2 charges; $1.3 \mu\text{C}$ and $3.5 \mu\text{C}$. How far apart are they? (3mks)
- f) State the significant differences between electric force and gravity: (2mks)
- g) Draw diagrams showing a forward biased diode and reverse biased bias (3mks)
- h) State Faraday's Law (1mk)
- i) A charge $q_1 = 2.00 \mu\text{C}$ is located at the origin and a charge $q_2 = -6.00 \mu\text{C}$ is located at (0, 3.00)m. Find the electric potential due to these charges at point P whose coordinates are (4.00, 0)m (4mks)



j) Find the currents i_1 , i_2 and i_3 in the circuit shown below

(4mks)



k) Define the following terms

i) Semiconductors:

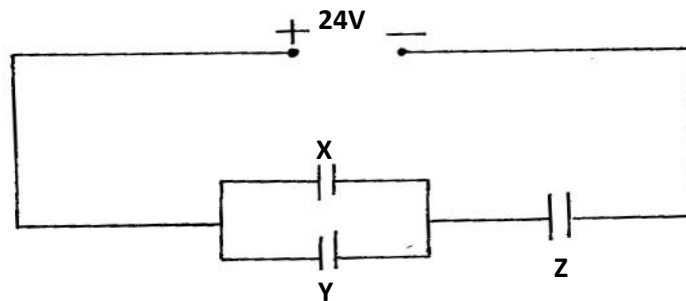
(1mk)

ii) Diode:

(1mk)

Question TWO (15mks)

a) The figure below shows an electrical circuit with three capacitor **X**, **Y** and **Z** of Capacitance $8.0 \mu\text{F}$, $10.0 \mu\text{F}$ and $6.0 \mu\text{F}$ respectively connected to a 24V battery.



Determine;

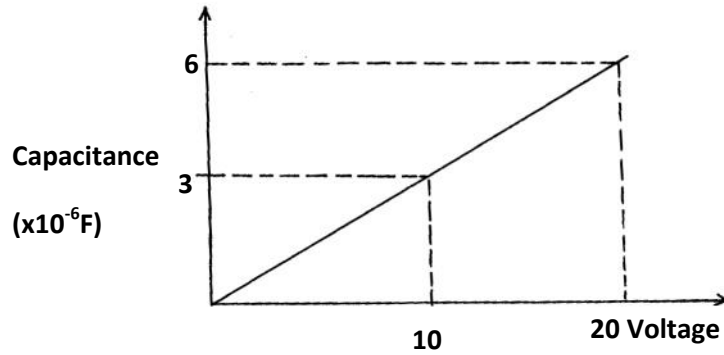
(I) The combined capacitance of the three capacitors.

(3mks)

(II) The charge on the capacitor **Z**

(2mks)

(iii) The graph below shows the variation of capacitance of a capacitor with voltage supplied across it.

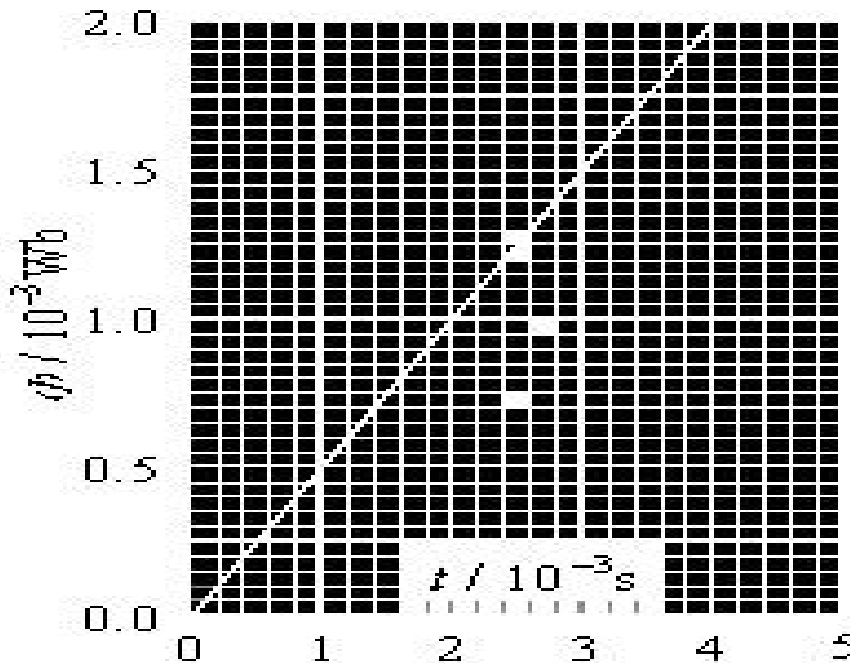


Use the graph to determine the quantity of charge stored in the capacitor. (3mks)

- b) i) State Ohm's law (1mk)
- ii) What is the resistance of an automobile headlight through which a 2.5A flows when 12.0v is applied onto it? (2mks)
- c) Gold has a conductivity of 45 MS m^{-1} . What is the resistance of a 0.01m across gold connector, 0.05m long? (4mks)

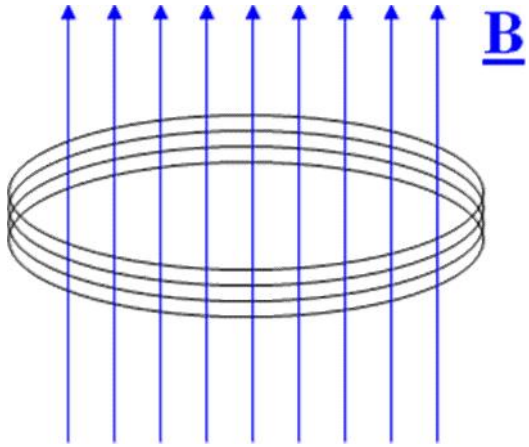
Question THREE (15mks)

a) The magnetic flux ϕ through a coil having 500 turns varies with time t as shown

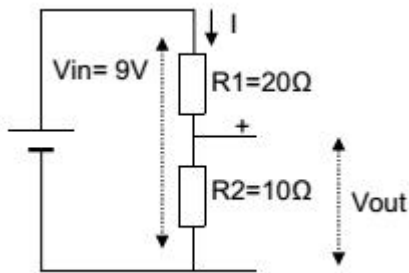


Calculate the magnitude of the induced emf (4mks)

- b) Consider a coil of radius 5 cm with $N = 250$ turns. A magnetic field B , passing through it, changes in time: $B(t) = 0.6t$ [T] ($t =$ time in seconds) The total resistance of the coil is 8Ω . What is the induced current? (5mks)



- c) Calculate the V_{out} by applying the formula of a voltage divider. (3mks)



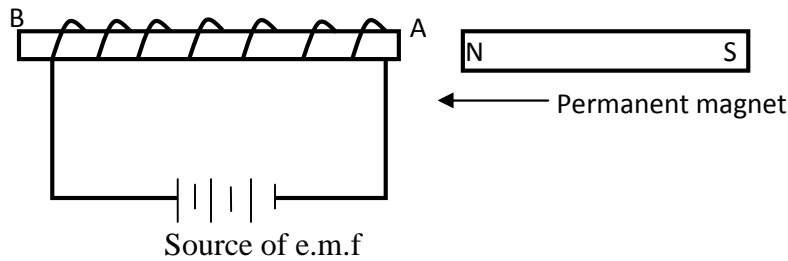
- d) A strand of metal is stretched to twice its original length. What is its new resistance? State your assumptions. (3mks)

Question FOUR (15mks)

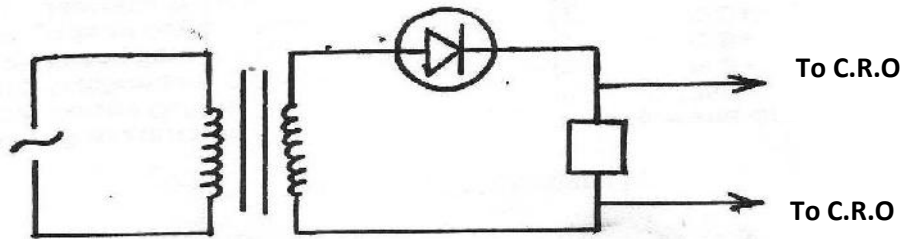
- a) Calculate the strength and the direction of the electric field E due to a point charge of $2.00nC$ at a distance of $5.00mm$ from the charge (4mks)
- b) Compare the magnitude of the electrical and gravitational forces between the electron and proton in the hydrogen atom. $r = 5.3 \times 10^{-11}m$ (4mks)
- c) Explain the conduction in gases and state one application for it (4mks)
- d) Explain what is meant by electrostatic equilibrium and state any two properties of a conductor in electrostatic equilibrium (3mks)

Question FIVE (15mks)

a) Figure 6 shows a permanent magnet placed near a solenoid connected to a source of e.m.f.



- i) State and explain what is observed when the North – pole of the permanent magnet is brought to end A. (2mks)
- ii) State the law applied (1mk)
- b) Extrinsic semiconductors are made through a process called doping. Explain how doping produces an n-type semi-conductor (2mks)
- c) Distinguish between a semiconductor and a conductors (2mks)
- d) Distinguish between intrinsic and extrinsic semi-conductor. (2mks)
- e) Figure 9 shows a PN junction diode used in a reflection



- (i) What type of rectification is shown? (1mk)
- (ii) Describe how the rectification is achieved. (3mks)
- (ii) sketch the output signal displayed on the CRO during the rectification process. (2mks)

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