



**TECHNICAL UNIVERSITY OF MOMBASA**  
**FACULTY OF APPLIED AND HEALTH SCIENCES**

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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.**

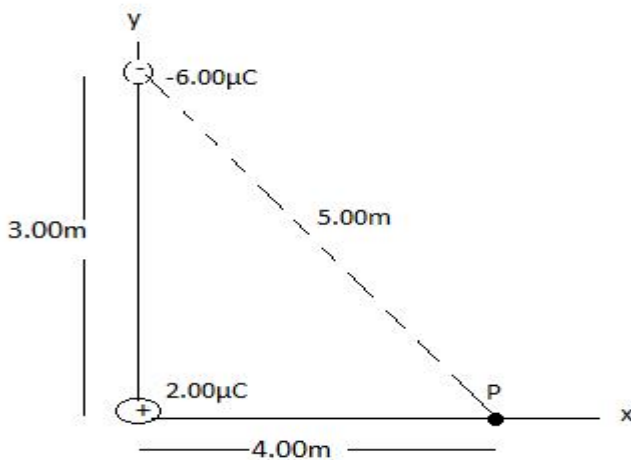
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Coulomb's constant.  $F_e = 8.99 \times 10^9 \text{ Nm}^2/\text{C}^2$

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

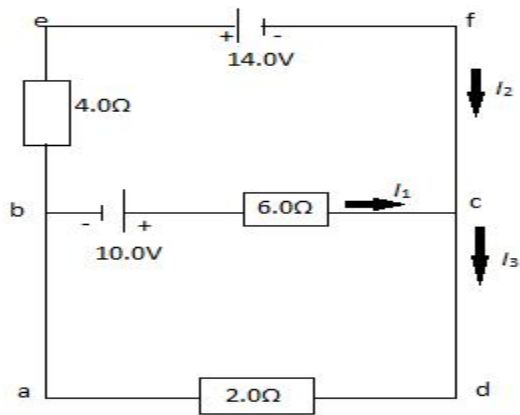
**Question ONE (30mks)**

- 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:

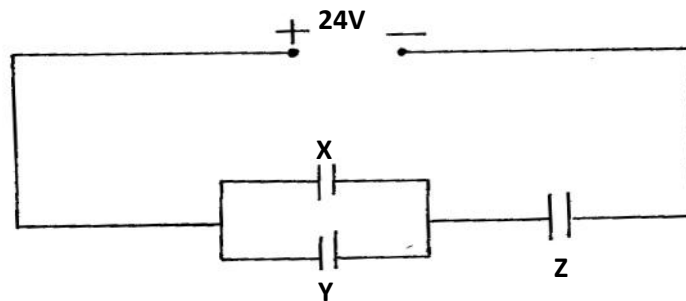
(1mk)

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;

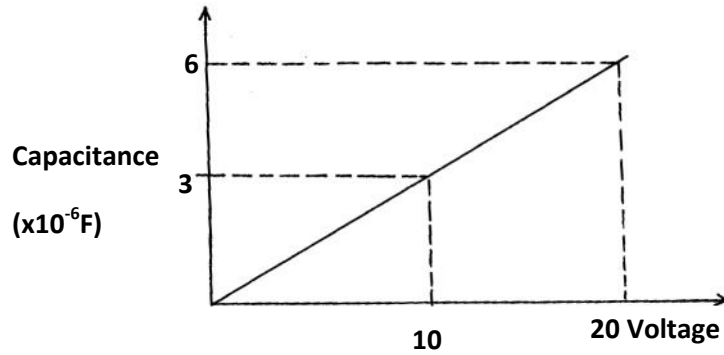
(I) The combined capacitance of the three capacitors.

(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.

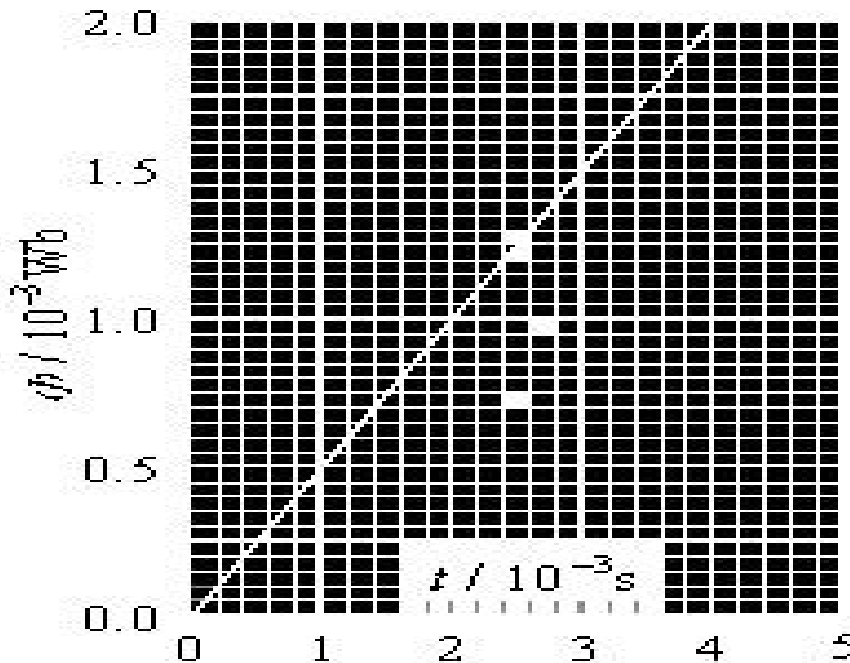


Use the graph to determine the quantity of charge stored in the capacitor. (3mks)

- 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  $45 \text{ MS m}^{-1}$ . What is the resistance of a 0.01m across gold connector, 0.05m long? (4mks)

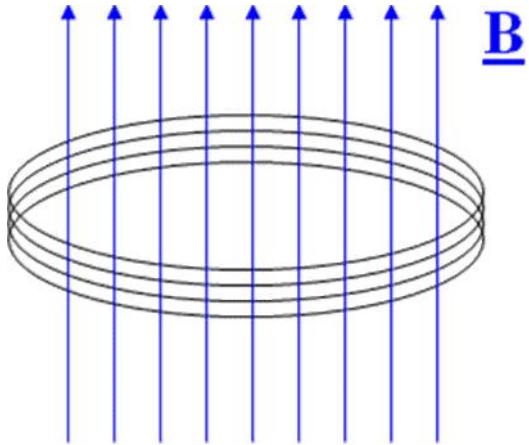
**Question THREE (15mks)**

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

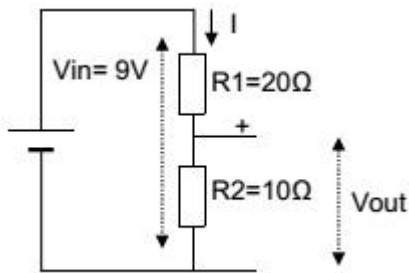


Calculate the magnitude of the induced emf (4mks)

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  $8 \Omega$ . 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)

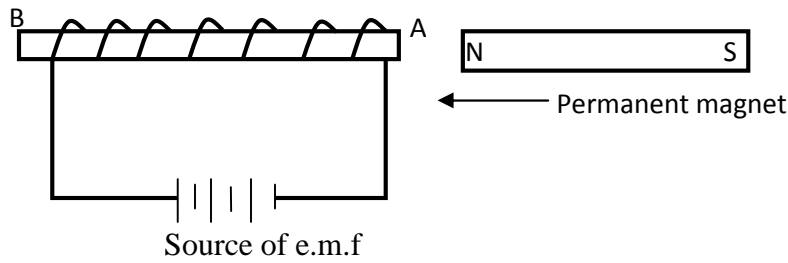
b) Compare the magnitude of the electrical and gravitational forces between the electron and proton in the hydrogen atom.  $r = 5.3 \times 10^{-11}m$  (4mks)

c) Explain the conduction in gases and state one application for it (4mks)

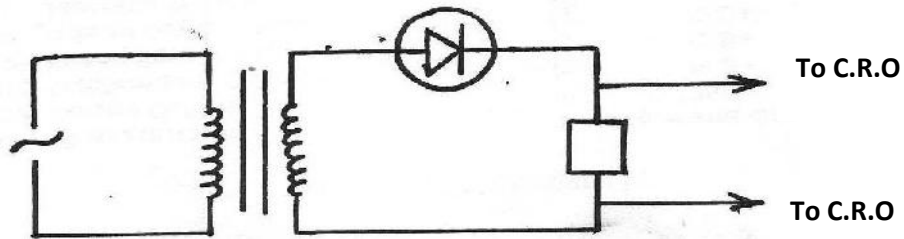
d) Explain what is meant by electrostatic equilibrium and state any two properties of a conductor in electrostatic equilibrium (3mks)

**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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