

UNIVERSITY OF FORT HARE



University of Fort Hare
Together in Excellence

PHY 123

SUPPLEMENTARY EXAMINATIONS

DATE : *January 2019*
TIME : *2 hours*
SUBJECT : *PHYSICS 123 (Electricity)*
MARKS : *100*

EXAMINER

Dr V. A. Xuza

MODERATOR

Mr. M. Someketa

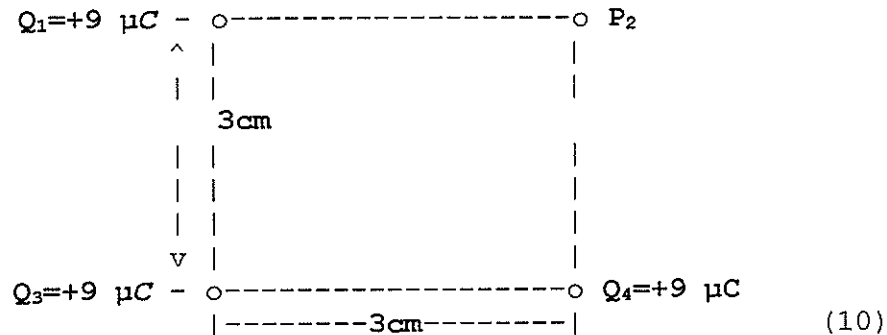
INSTRUCTIONS TO CANDIDATES:

(1) Answer ALL Questions.

(2) Useful Information on the back page:

Question 1 [20]

- (a) Three charges are arranged on a rectangle as shown below. What is the electric field at P_2 ? Give the x and y components only.



- (b) A charge of $16 \times 10^{-9} \text{ C}$ is fixed at the origin of the co-ordinates, a second charge Q , is at $x=3, y=0$, and a third charge of $-12 \times 10^{-9} \text{ C}$ is at $x=6 \text{ m}, y=0$. What is the magnitude of Q if the resultant field at $x=9 \text{ m}, y=0$ is 20 N/C directed to the right? (10)

Question 2 [20]

- (a) A cigarette lighter in a car is a resistor that, when activated, is connected across the 12-V battery. Suppose a lighter dissipates 45 W of power. Find (i) the resistance of the lighter and (ii) the current that the battery delivers to the lighter. (12)
- (b) A metal sphere has a charge of $+7.0 \mu\text{C}$. What is the net charge after 7.0×10^{13} electrons have been placed on it? (8)

Question 3 [20]

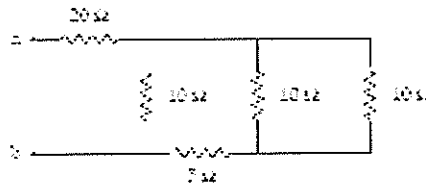
- (a) A proton is moving parallel to a uniform electric field. The electric field accelerates the proton and increases its momentum to $5 \times 10^{-23} \text{ N s}$ from $1 \times 10^{-23} \text{ N s}$ in a time of $6 \times 10^{-6} \text{ s}$. What is the magnitude of the electric field? (10)
- (b) A cylindrical copper cable carries a current of 1200 A . There is a potential difference of $1.6 \times 10^2 \text{ V}$ between two points on the cable that are 0.24 m apart. What is the radius of the cable? (10)

Question 4 [20]

- (a) A wire of unknown alloy has a resistance of $R_0 = 35 \Omega$ when immersed in water at 20°C . When the wire is placed in boiling water, its resistance rises to 47Ω . What is the temperature of a hot summer day when the wire has a resistance of 37.8Ω (10)
- (b) A $60\text{-}\Omega$ resistor is connected in parallel with an $80\text{-}\Omega$ resistor. This parallel group is connected in series with a $20\text{-}\Omega$ resistor. The total combination is connected across a 15-V battery. Draw this circuit and find
- (i) the *current* in the $60\text{-}\Omega$ and (5)
- (ii) the *power* dissipated in the $80\text{-}\Omega$ resistor. (5)

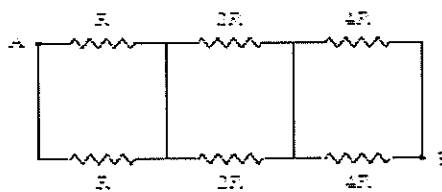
Question 5 (20 marks)

- (a) What is the equivalent resistance between points a and b ?



(10)

- (b) What is the equivalent resistance between points A and B in the figure when $R = 10\Omega$?



(10)

"THE END"

USEFUL INFORMATION

<u>Name</u>	<u>Symbol</u>	<u>Value</u>
1. <i>Electron Charge</i>	<i>e</i>	$1.6 \times 10^{-19} \text{ C}$
2. <i>Mass of Electron</i>	m_e	$9.11 \times 10^{-31} \text{ kg}$
3. <i>Mass of Proton</i>	m_p	$1.68 \times 10^{-27} \text{ kg}$
4. <i>Coulombs constant</i>	<i>k</i>	$9 \times 10^9 \text{ N.m}^2/\text{C}^2$
5. <i>Resistivity of Copper</i>	ρ	$1.72 \times 10^{-8} \Omega \text{ m}$
6. <i>Resistivity of Tungsten</i>	ρ	$5.6 \times 10^{-8} \Omega \text{ m}$
7. <i>Gravitational acceleration</i>	<i>g</i>	10 m/s^2
8. $x = ut + \frac{1}{2}at^2$		
9. $v = u + at$		
10. $v^2 = u^2 + 2ax$		
11. $R = R_0[1 + \alpha(T - T_0)]$		

Never Give Up!!