UNIVERSITY OF FORT HARE

University of Fort Hare
Together in Excellence

PHY 123

DEGREE EXAMINATIONS

DATE: November 2018

SUBJECT: PHYSICS 123 (Electricity)

TIME: 2 HOURS

MARKS: 100

INTERNAL EXAMINER

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INSTRUCTIONS:

1. Answer ALL questions!

2. Useful information on the back page!

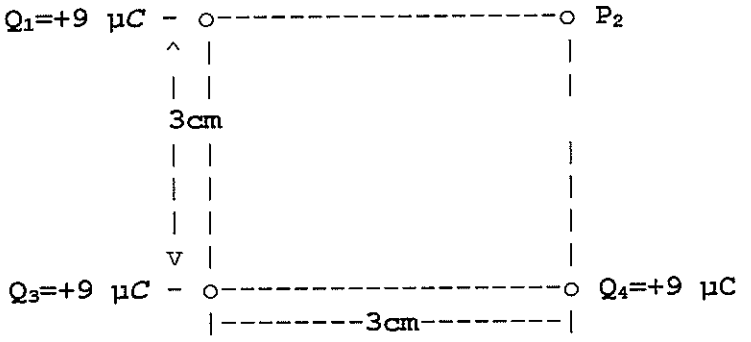
Question 1 [20]

(a) A proton is moving parallel to a uniform electric field. The electric field accelerates the proton and increases its momentum to $5x10^{-23}$ *Ns* from $1x10^{-23}$ *Ns* in a time of $6x10^{-6}$*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 *160 V* between two points on the cable that are *0.24 m* apart. What is the radius of the cable? (10)

Question 2 [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.



(10)

(b) A charge of $16x10^{-9}$ *C* is fixed a the origin of the co-ordinates, a second charge Q, is at *x=3, y=0*, and a third charge of $-12x10^{-9}$ *C* is at *x=6m, y=0*.
What is the magnitude of Q if the resultant field at *x=9m, y=0 is 20 N/C* directed to the right? (10)

Question 3 [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 $+7.0\ \mu C$. What is the net charge after 7.0×10^{13} electrons have been placed on it? (8)

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 $47\ \Omega$ What is the temperature of a hot summer day when the wire has a resistance of $37.8\ \Omega$? (10)

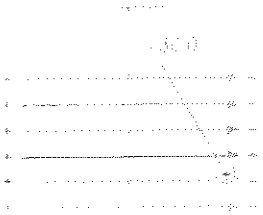
(b) A $60\text{-}\Omega$ resistor is connected in parallel with a $80\text{-}\Omega$ resistor. This parallel group is connected in series with a $20\text{-}\Omega$ resistor. The total combination is connected across a $15\text{-}V$ battery. *Draw this circuit* and find

(i) the *current* in the $60\text{-}\Omega$ and (5)

(ii) the *power* dissipated in the $80\text{-}\Omega$ resistor. (5)

Question 5 [20]

A small plastic ball with a mass of $6.5x10^{-3}\ kg$ and with a charge of $+0.15\ \mu C$ is suspended from an insulating thread and hangs between the plates of a capacitor (see the drawing). The ball is in equilibrium, with the thread making an angle of $30°$ with respect to the vertical. The ball is displaced by $0.15\ m$ from its vertical position. What is the magnitude of the electric field between the two plates?



(20)

"THE END"

USEFUL INFORMATION

Name	Symbol	Value
1. Electron Charge	e	1.6×10^{-19} C
2. Mass of Electron	m_e	9.11×10^{-31} kg
3. Mass of Proton	m_p	1.68×10^{-27} kg
4. Coulombs constant	k	9×10^{9} N.m^2/C^2
5. Resistivity of Copper	ρ	1.72×10^{-8} Ω m
6. Resistivity of Tungsten	ρ	5.6×10^{-8} Ωm
7. Gravitational acceleration	g	10m/s^2

8. $x = ut + \frac{1}{2}at^2$
9. $v = u + at$
10. $v^2 = u^2 + 2ax$
11. $R = R_o[1 + \alpha(T - T_o)]$

Speed never killed anyone; suddenly coming to rest.....that what gets you!