

# UNIVERSITY OF FORT HARE



University of Fort Hare  
Together in Excellence

**PHY 125F**

## DEGREE EXAMINATIONS

**DATE:** November 2018  
**SUBJECT:** PHYSICS 125F (Electricity)  
**TIME:** 2 HOURS  
**MARKS:** 100

## INTERNAL EXAMINER

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## INSTRUCTIONS:

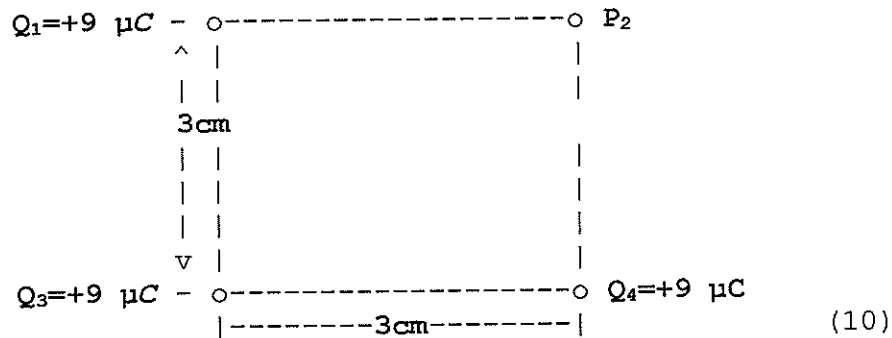
- 1. Answer ALL questions!*
- 2. Useful information on the back page!*

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  $5 \times 10^{-23} \text{ N s}$  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  $1200 \text{ A}$ . There is a potential difference of  $160 \text{ V}$  between two points on the cable that are  $0.24 \text{ m}$  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.



- (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  $20 \text{ N/C}$  directed to the right? (10)

Question 3 [20]

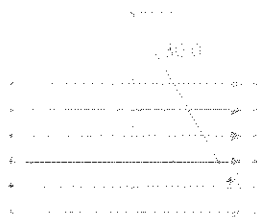
- (a) A cigarette lighter in a car is a resistor that, when activated, is connected across the  $12 \text{ V}$  battery. Suppose a lighter dissipates  $45 \text{ W}$  of power.  
Find (i) the resistance of the lighter and  
(ii) the current that the battery delivers to the lighter. (12)
- (b) A metal sphere has a charge of  $+7.0 \mu\text{C}$ . What is the net charge after  $7.0 \times 10^{13}$  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  $20^\circ\text{C}$ . 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  $6.5 \times 10^{-3} \text{ kg}$  and with a charge of  $+0.15 \mu\text{C}$  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  $30^\circ$  with respect to the vertical. The ball is displaced by  $0.15 \text{ m}$  from its vertical position. What is the magnitude of the electric field between the two plates?



(20)

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**"THE END"**

**USEFUL INFORMATION**

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

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