AFRICA NAZARENE UNIVERSITY

CENTRE:	**RONGAI**
DEPARTMENT:	**COMPUTER SCIENCE**
UNIT TITLE:	**PRINCIPLES OF PHYSICS**
UNIT CODE:	**PHY 101**
LECTURER:	**DR. G. KIHARA**
TRIMESTER:	**2ND TRIMESTER 2012/2013**
DATE:	**15TH APRIL, 2013**
TIME:	**9.00AM – 12 NOON**

Instructions:

1. The paper consists of **FOUR** questions.
2. Attempt **ALL** questions.
3. Write all your answers in the answer booklet provided.
4. Time allowed: Three hours
5. You may find the following useful:

   Acceleration due to gravity : $g = 10$ N/kg

   Specific heat capacity of water: $C = 4200$ J/kg ^{0}C

Question One

(a). Explain the process by which objects becomes negatively and positively charged. **(2 marks)**

(b). What do you understand by the following terms:

(i). Neutral conductor.

(ii). Electrostatic equilibrium **(2 marks)**

(c). Explain briefly the principle of operation of a velocity selector? **(2 marks)**

(d). Explain the equilibrium condition in the Torsion balance experiment performed by Charles Coulomb in his derivation of the Coulomb's force law. **(2 marks)**

(e). What is the physical manifestation of resistance in a material when current flows through it. Cite one example where resistance of a material is used for the benefit of mankind. **(2 marks)**

(f). Explain the two conditions necessary for static equilibrium to be achieved. **(2 marks)**

(g). State Newton's second law of motion and hence show that: $F = ma$ where F is the force, m is the mass and a acceleration. **(3 marks)**

(h). A 11 Ω resistor and a 9 Ω resistor are connected in parallel and the combination is connected across a 24 V D.C line.

(i). What is the resistance of the parallel combination?

(ii). What is the total current through the parallel combination?

(iii). What is the current through each resistor? **(5 marks)**

Question Two

(a). Explain any two situations where an electric charge is imparted by rubbing. **(2 marks)**

(b). How many watts of power are expended when a force of 9 N moves a book 3 meters in a time interval of 5 seconds? **(2 marks)**

(c). Explain the difference between the peak values and root mean square values in an A.C circuit. **(2 marks**

(d). What is the reactance of a 4.2 μF capacitor at a frequency of 60 Hz? **(2 marks)**

(e). What is the force per meter of length on a straight wire carrying a 4.2 A current when perpendicular to a 3.60 T uniform magnetic field? **(2 marks)**

(f). Give an example of a charge distribution around a point P for which:

(i). The electric potential is zero at P but the electric field is non-zero.

(ii). The electric field is zero at P but the electric potential is non-zero.

(2 marks)

(g). Draw the electric field distribution surrounding two negative electric charges of equal magnitude a distance *d* apart. **(2 marks)**

(h). What are the six experimental observations made from the torsion balance experiment conducted by Charles Coulomb? **(6 marks)**

Question Three

(a). State two differences between Magnetic force and Electric force. **(2 marks)**

(b). What is a Capacitor? Write down any two uses of a capacitor. **(2 marks)**

(c). Draw the electric field distribution surrounding an electric dipole. **(2 marks)**

(d). Explain why a dentist uses filling material that has the same rate of expansion as the teeth. **(2 marks)**

(e). Differentiate between *a transverse wave* and *a longitudinal wave.* Give an example in each case **(2 marks)**

(f). Write down the following quantities in terms of length, mass and time:

(i). Power

(ii). Acceleration **(2 marks)**

(g). Water is heated in a pot from an initial temperature of 15^0C to a final temperature of 75^0C. If 2.55×10^6 joules of heat were used, calculate the amount of water in the pot. **(3 marks)**

(h). List down five differences between charging by contact and charging by induction. **(5 marks)**

Question Four

(a). Explain why we use small test charges when measuring electric fields. **(2 marks)**

(b). Given the following forms of electromagnetic radiation: Ultraviolet, gamma rays, visible light and X-ray. Put them in order of *increasing* wavelength starting with the shortest wavelength. **(2 marks)**

(c). What information do we obtain from the distribution of the electric field lines. **(2 marks)**

(d). Calculate the length of a wire 1.6 mm in diameter and resistivity 5.3×10^{-6} Ω.m that would have a resistance of 2.45 Ω . **(2 marks)**

(e). What is the charge in the nucleus of an atom? Explain. **(2 marks)**

(f). Describe a simple experiment which demonstrates that a conductor allows the passage of electric charges through it (Include a diagram). **(4 marks)**

(g). Draw a typical graph showing the behavior of the elongation of a wire when a tensile force is applied. Discuss the regions in the graph as well as its shape. **(6 marks)**