# AFRICA NAZARENE UNIVERSITY

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| **CENTRE:** | **RONGAI** |
| **DEPARTMENT:** | **COMPUTER SCIENCE** |
| **UNIT TITLE:** | **PRINCIPLES OF PHYSICS** |
| **UNIT CODE:** | **PHY 101** |
| **LECTURER:** | **DR. G. KIHARA** |
| **TRIMESTER:** | **3RD TRIMESTER 2012/2013** |
| **DATE:** | **5TH AUGUST, 2013** |
| **TIME:** | **9.00AM – 12 NOON** |

**Instructions:**

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

**Question One**

(a). Explain why you can hold your fingers beside the candle flame without harm but not above the flame. **(2 marks)**

(b). What are the temperatures for freezing and boiling water on the Celsius and Fahrenheit scales? **(2 marks)**

(c). Explain why water is the preferred liquid in cooling automobile engines. **(2 marks)**

(d). State Kirchoff's rules of circuit analysis. **(2 marks)**

(e). Three resistors 3 Ω, 4 Ω and 5 Ω are connected in parallel in a d.c circuit. Calculate the value of a single resistor that can replace the three. **(2 marks)**

(f). How do you connect an Ammeter and a Voltmeter in an electrical circuit. Give a reason in each case. **(2 marks)**

(g). State Newton's third law of motion and write down two scenarios where it is observed to play a role. **(3 marks)**

(h). Describe the torsion balance experiment performed by Charles Coulomb. Include a diagram. What is the significance of this experiment? **(5 marks)**

**Question Two**

(a). Convert the following units as required in each case:

(i). 40 nm to μm

(ii) 1500 kg to mg. (Write your answers in standard form in each case) **(2 marks)**

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

(i). Force

(ii). Density **(2 marks)**

(c). A bulb has a resistance of 15 Ohms and is connected across a 240 V source. Calculate the amount of current drawn by the bulb. Determine also the power of this bulb. **(2 marks)**

(d) Where would your weight be greater- on the earth or on the moon? How about your mass? Explain in each case. **(2 marks)**

(e). Cite two examples of a vector quantity and two of a scalar quantity. **(2 marks)**

(f). When can a 2000 kg car and a 3000 kg truck have the same momentum? **(2 marks)**

(g). What is the evidence for saying whether or not work is done on an object? **(2 marks)**

(h). Water is heated in a pot from an initial temperature of $25^0$C to a final temperature of $85^0$C. If $2.55\times10^6$ joules of heat were used, calculate the amount of water in the pot. **(3 marks)**

(i). Describe the energy transformations in the following cases:

(i). Hammering a nail.

(ii). Lighting a bulb using a battery.

(iii). Energy from the sun, contained in petrol which moves a car. **(3 marks)**

**Question Three**

(a). What is the reactance of a 5.2 μF capacitor at a frequency of 60 Hz? **(2 marks)**

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

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

(i). Electric dipole.

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

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

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

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

(g). If a water wave oscillates up and down four times each second and the distance between wave crests is 6 meters:

(i). What is its wavelength?

(ii). What is its wave speed. **(2 marks)**

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

(i) When the current in a battery is 0.35A, the electric potential difference across the terminals of the battery is 1.425V, and the joule–heating rate in the battery is 0.026W. What are the internal resistance and the e.m.f of the battery? Calculate also the rate at which chemical energy stored in the cell is decreasing **(4 marks)**

**Question Four**

(a). Calculate the length of a wire 3.4mm in diameter and resistivity $8.0\times10^{-6}\Omega m$ that would have a resistance of $5.85\Omega$. **(2 marks)**

(b). Derive an expression for the combined resistance R, of three resistors $R_1$, $R_2$, $R_3$ placed in parallel. **(2 marks)**

(c). 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)**

(d). How much power is expended when lifting a 3000 N load through a vertical distance of 8 meters in a time of 5 seconds? **(2 marks)**

(e). 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)**

(f). List down four differences between charging by contact and charging by induction. **(4 marks)**

(g). A 8 Ω resistor and a 7 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)**