KABARAK UNIVERSITY

EXAMINATIONS

2008/2009 ACADEMIC YEAR

FOR THE CERTIFICATE OF PRE- UNIVERSITY PHYSICS

COURSE CODE: **PPHYS 011**

COURSE TITLE: **ELECTRICITY, MAGNETISM & MODERN PHYSICS**

STREAM: **SEMETER ONE**

DAY: **WEDNESDAY**

TIME: **9.00 – 11.00 A.M.**

DATE: **18/03/2009**

INSTRUCTIONS:

Answer **QUESTION 1** and **ANY OTHER TWO**

You may need the following constants:

- Electron charge e = -1.6×10^{-19} C.
- Proton charge e = 1.6×10^{-19} C.
- $\pi = 3.14$
- $\varepsilon_o = 8.85 \times 10^{-12}$ F/m
- $\mu_o = 4\pi \times 10^{-7}$ Tm/A
- Planck's Constant $h = 6.626 \times 10^{-34}$ J.s

PLEASE TURN OVER

Question 1 (30 marks)

(a) Give any THREE properties of charge (3 mks)

(b) State how electrostatic charge can be created. (2 mks)

(c) What do electric field lines represent? (2 mks)

(d) Some resistors are colour coded; hence their values can be determined from the colour bands on them.

(i) Give the colour referencing for each value 0-9. (5 mks)

(ii) Determine the value of a resistor with the following colour coding:

1st band - brown

2nd band - black

3rd band - brown

4th band – gold

(6 mks)

(e) Explain why batteries are sometimes referred to as capacitors. (2 mks)

(f) Why is it preferred to use the word "POOR CONDUCTORS" instead of "BAD CONDUCTORS" when referring to electrically insulating materials?

(2 mks)

(g) Explain why a material like steel retains its magnetism when it is magnetised as opposed to soft iron. (4 mks)

(h) A magnetic field can create a force on an object. Give three conditions that must apply for the object to feel a force, and the magnetic field to affect the object.

(3 mks)

(i) Sketch a general radioactivity curve for any radioactive material. (2 mks)

Question 2 (20 marks)

(a) State the Coulomb's law of charges. (2 mks)

(b) (i) For the figure below, determine the force between the two point charges given $q_1 = +12\times10^{-9}$ C and $q_2 = -18\times10^{-9}$ C.

(2 mks)

(ii) Is the force attractive or repulsive? (1 mk)

(iii) Suppose q_1 and q_2 are connected by a conducting wire. Now what is the force?

(5 mks)

(c) (i) Define Capacitance and give its SI units (2 mks)

(ii) If a capacitor has 3.5 μC of charge on it and an electric field of 2.0 kV/mm is desired if they are separated by 5.0 mm of air, what must each plate's area be?

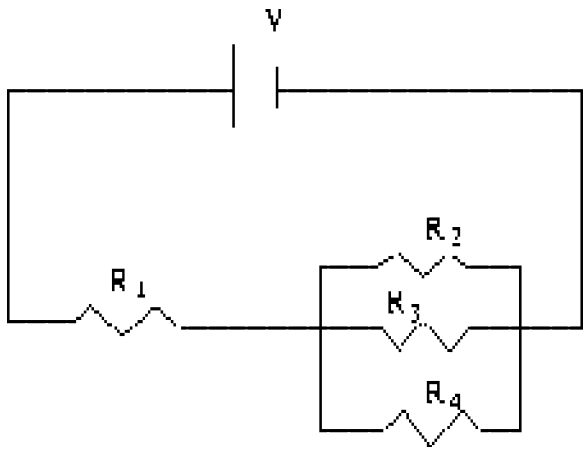
(4 mks)

(d) Two huts A and B were put up in a lightning prone area. The roof of Hut A comprises of iron sheets which were long enough to touch the ground. Hut B was a tent made up of canvas which is electrically insulating. Which hut is relatively safer to be in when lighting strikes? Give a reason for your choice. (4 mks)

Question 3 (20 marks)

(a) State Kirchoff's current and voltage laws (4 mks)

(b) Apply Kirchoff's laws to find the current through R_4 in the circuit below if $V = 30$ V, $R_1 = 12\ \Omega$, $R_2 = 18\ \Omega$, $R_3 = 9\ \Omega$, and $R_4 = 6\ \Omega$. (7 mks)



(c) (i) Draw a sketch of a power transformer (3 mks)

(ii) Explain why for long distances, power companies prefer to transmit electricity at high voltages. (in kilovolts range) (2 mks)

(iii) The input to a primary coil of a transformer is 120 V while the current in the secondary coil is 0.10 A.

(I) Find the voltage across this coil when 60.0 W of power are delivered to the circuit attached to the secondary coil.

(2 mks)

(II) If the primary coil has 20 turns, how many does the secondary coil have? (2 mks)

Question 4 (20 marks)

(a) Explain the term radioactivity. (2 mks)

(b) Explain the following radioactive decay process giving an example of each.

(i) alpha (3 mks)

(ii) beta (3 mks)

(iii) gamma (3 mks)

(c) (i) Give the condition for photoelectric effect to occur in a material. (2 mks)

(ii) Red light of wavelength 670.0 nm produces photoelectrons from a certain metal which requires a stopping potential of 0.5 V to stop. What is the work function and threshold wavelength of the metal?

(7 mks)