KABARAK UNIVERSITY

UNIVERSITY EXAMINATIONS

2008/2009 ACADEMIC YEAR

FOR THE CERTIFICATE OF PRE- UNIVERSITY PHYSICS

COURSE CODE: **PPHYS 011**

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

STREAM: **SEMESTER ONE**

DAY: **TUESDAY**

TIME: **9.00 – 11.00 A.M.**

DATE: **04/08/2009**

INSTRUCTIONS:

1. Answer **Question ONE** and **any other TWO** questions.
2. Question ONE carries **40 marks** and the other questions carry **15 marks** each.
3. You may need the following constants:
   i. charge of an electron/proton = 1.6×10^{-19}C
   ii. $k = 9 \times 10^{9}$N.m^2/C^2
   iii. $\mu_0 = 4\pi \times 10^{-7}$ T.m/A
   iv. h = 6.63×10^{-34} J.s
   v. $\varepsilon_0 = 8.85 \times 10^{-12}$ C^2/Nm^2

PLEASE TURN OVER

Question ONE (40 Marks)

a) What is the net charge of a collection of 10 electrons?

(3 marks)

b) Which of the following statements is true?

i. a current on a conductor causes a magnetic field
ii. a magnetic field around a conductor causes a current on the conductor
iii. both statements are true

(6 marks)

c) Briefly describe the ways in which excess charge is distributed on a charged conductor.

(4 marks)

d) Briefly describe how the electric field around a charged conductor is distributed.

(4 marks)

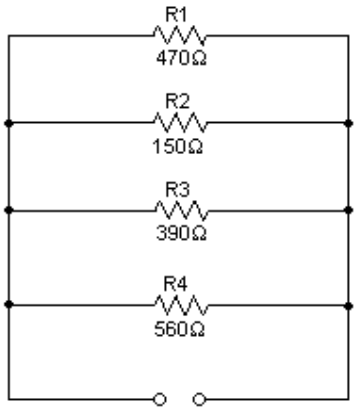
e) An electron and a proton are separated by a distance of 2×10^{-6}m. Calculate the magnitude of the force on the electron.

(4 marks)

f) If a capacitor of 2×10^{-6} F is connected to a battery of 12 V, calculate the charge flowing through the battery.

(3 marks)

g) Calculate the total resistance of the arrangement below.



(5 marks)

h) A fridge of resistance 10 Ω is connected to a 220 V voltage source. What is the power consumed by the fridge?

(3 marks)

i) In your opinion, is it possible to have a finite length magnet consisting of only one pole? Briefly explain why or how?

(4 marks)

j) What do you understand by the term *wave-particle duality* of matter?

(4 marks)

Question TWO (15 marks)

a) A parallel plate capacitor has a plate area of 0.5 m^2 and a plate separation of 2×10^{-3} m. Calculate the capacitance of the capacitor.

(3 marks)

b) Draw the magnetic field lines around the magnets in the arrangement below.

(12 marks)

Question THREE (15 marks)

a) Which of the following statements is true?
   i. a current on a loop inside a magnetic field causes a rotating force on the loop
   ii. rotation of a conducting loop in a magnetic field causes a current to flow in the loop
   iii. both statements are true

(6 marks)

b) If a neutral atom has atomic number 15, what is its electronic configuration?

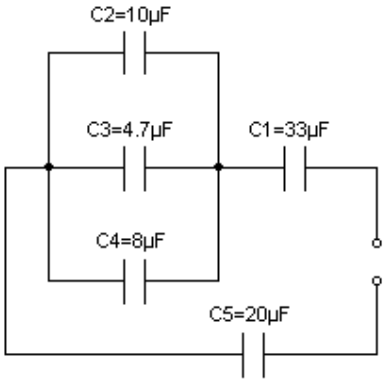
(3 marks)

c) How many energy shells and how many valence electrons does the atom above have?

(6 marks)

Question FOUR (15 marks)

a) Calculate the total capacitance of the capacitors in the circuit below.



(7 marks)

b) Draw the relative energy band diagrams of i) and insulator, ii) a semiconductor and iii) a conductor.

(8 marks)