BPY1101 BASIC ELECTRICITY AND OPTICS

BBIT and BIT, Virtual Sep – Dec 2019 CAT 1

Useful Constants

Electron charge, e = 1.602×10^{-19} C

Permeability of free space,
$\mu_o = 4\pi \times 10^{-7}$ Tm/A or $4\pi \times 10^{-7}$ H/M

Permittivity of free space,

$\varepsilon_0 = 8.85 \times 10^{-12}$ C^2/Nm^2

Planks Constant $h = 6.63\ x\ 10^{-34}\ Js$

Mass of an electron, $m_e = 9.1 \times 10^{-31}$ kg

Mass of a proton, $m_p = 1.7 \times 10^{-27}$ kg

Refractive index of air $n = 1.00$

$N_A = 6.0221 \times 10^{23}$ mol^{-1}

Answer ALL questions

a) State Coulomb's law and express it mathematically. (3 marks)

b) Two charges are attracted by a force of $25\ N$ when separated by $10\ cm$. What is the force between the charges when the distance between them is $50\ cm$? (3 marks)

c) Calculate the magnitude of the electric filed, **E** strength at a point $5\ x10^{-8}\ m$ from an electron, which is in a vacuum. (3 marks)

d) State **three** factors that determine the magnetic force, $\boldsymbol{F_B}$ experienced by a conductor carrying current when placed in a region with a magnetic field. (3 marks)

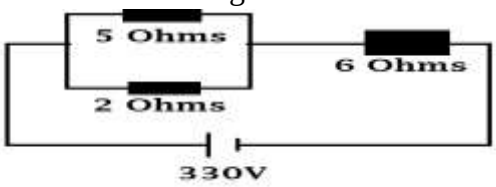
e) A solenoid 20 cm long is wound with 300 turns of wire and carries a current of 1.5 A. Calculate the magnetic field inside the solenoid. (3 marks)

f) State and explain **three** types of atomic bonding. Give one example of a substance in each type. (3 marks)

g) Define the following physical quantities and their SI unit:
   i) Electric current (1 mark)
   ii) Terminal voltage (1 mark)
   iii) Resistance (1 mark)

h) Calculate the resistivity of a wire whose length is 200 m and a cross section area of $15\ mm^2$ if the total resistance across its ends is 10 ohms. (3 marks)

i) Consider the following circuit and answer the questions that follows:



j) Determine:
   i) Total current in the circuit (2 marks)
   ii) Current flowing through each resistor (1 mark)
   iii) Voltage drop across each resistor (1 mark)