FACULTY OF ALLIED HEALTH SCIENCES
UNIVERSITY OF RUHUNA
Department of Medical Laboratory Science
Year End Examination, Year 1 – 2017/2018 (11th) Batch – August 2020
MLS 1101 - Basic Science – Physics (Theory)

27th August 2020   Time: 9.00 a.m. – 10.30 a.m.   Duration: 1 hour and 30 minutes

All symbols have their usual meaning.

$$\mu_0 = 4\pi \times 10^{-7} \ Hm^{-1}$$

$$\varepsilon_0 = 8.85 \times 10^{-12} \ C^2 N^{-1} m^{-2}$$

$$e = 1.602 \times 10^{-19} \ C$$

Answer all questions.

1. a) Can a constant magnetic field set into motion an electron initially at rest? Explain your answer.

    b) The magnetic field of the earth at a certain location is directed vertically downward and has a magnitude of 50 µT. A proton is moving horizontally toward the west in this field with a speed of $6 \times 10^6 \ ms^{-1}$. The mass of a proton is 1.67×10^{-27} kg.

(i)   Find the direction and the magnitude of the magnetic force exerts on this particle?
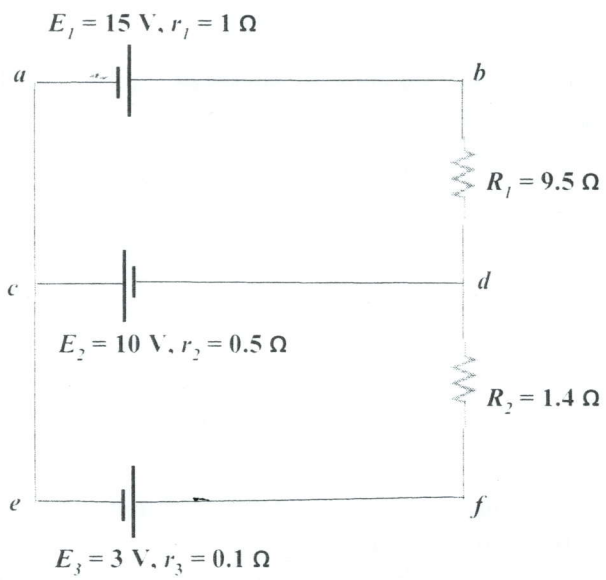
(ii)   Calculate the radius of the circular arc followed by this proton.

(iii) Find the angular speed of the proton.

2. a) Write down Kirchhoff's laws.

b)

$E_1 = 15 \text{ V}, r_1 = 1 \, \Omega$

a b

$R_1 = 9.5 \, \Omega$

c d

$E_2 = 10 \text{ V}, r_2 = 0.5 \, \Omega$

$R_2 = 1.4 \, \Omega$

e f

$E_3 = 3 \text{ V}, r_3 = 0.1 \, \Omega$

(i) Find the current through each battery.

(ii) Calculate the potential difference between points b and e.

3. a) What is the refractive index in a medium where the speed of light is 1.8×10^8 ms^{-1}?
        (The speed of light in vacuum is 3×10^8 ms^{-1})

    b) A narrow light beam traveling through an optical fibre of refractive index of core material
        1.44 reaches the end of the fibre and leaves into air.
        (i) Sketch the light beam at the interface by indicating the direction of the bending from
            the normal.

        (ii) The angle of incidence at the end. inside the fibre is 30^0. What is the angle of refraction
             outside the fibre when the light beam leaves fibre medium?

(iii) Can the light leaves outside the fibre if the angle of incidence were 50°?

(114)

4. a) Calculate the speed in ms^{-1} at which the Earth revolves about the Sun. You may assume that the Earth's orbit is nearly circular with radius 1.5×10^{11} m.

    b) A car of mass 1200 kg moves at 25 ms^{-1}. Find the braking force that needs to bring the car to be stopped in 10 s.

c) If a truck and a motorcycle undergo a head-on collision, upon which vehicle is the impact force greater? Which vehicle undergoes the greater change in its motion? Explain your answers.