Special Relativity

Series of exercise 04

Special relativity and Electromagnetism

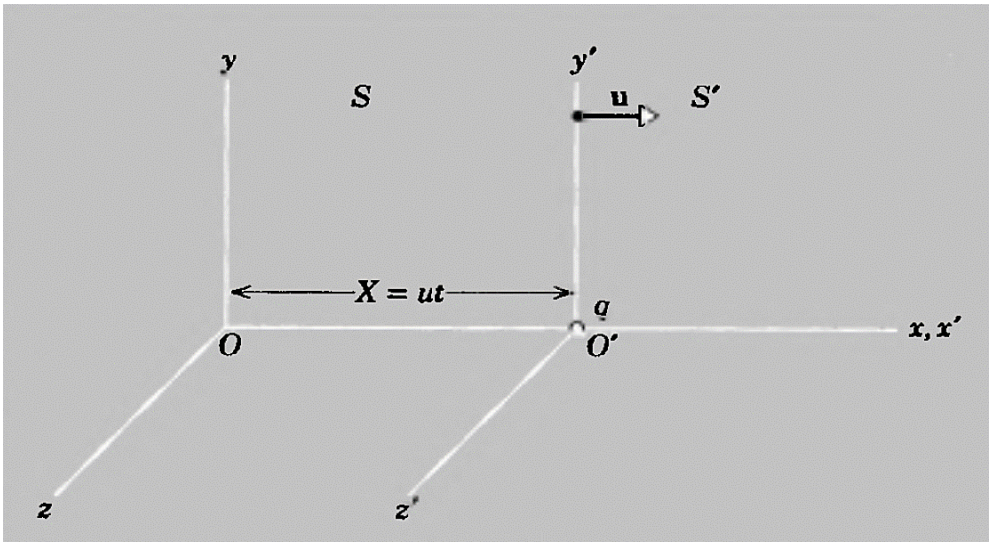
Exercise 01:

1. In a given frame (R), the electromagnetic field is purely electric: $\vec{E} \neq 0$; $\vec{B} = 0$. Describe this field in another frame (R') moving with a velocity $\vec{u}$ along x-axis with respect to (R).
2. In a given frame (R), the electromagnetic field is purely magnetic: $\vec{E} = 0$; $\vec{B} \neq 0$. Describe this field in another frame (R') moving with a velocity $\vec{u}$ along x-axis with respect to (R).

Indication: *Use L.T of electromagnetic field under vector form*

Exercise 02:

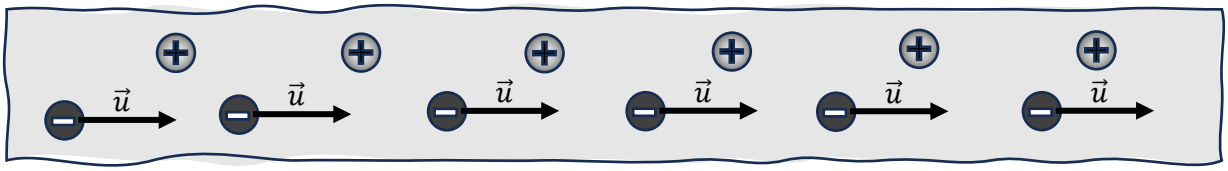
A point charge is moving within an inertial frame (S) as shown in the figure below, with a velocity $\vec{u}$ along OX. A moving frame (S') is attached to this charge.



1. What is the most convenient frame to describe the E.M field of this point charge, in the most possible simple way?
2. Deduce the expression of E.M field in the other frame, by using corresponding L.T.

Exercise 03:

On the figure below, we sketch an electrical current within conducting wire (S). The free charges (electrons) are moving in the OX direction with a velocity $\vec{u}$. These electrons $(-e)$ leaving behind fixed positive ions $(+e)$. The both types of charge are present with same density n.



1. What is the total density of charges within this conducting wire?
2. Deduce the current density in this wire.
3. By using the L.T of the four-vector charge-current, retrieve the new density of charge within a moving frame (S') with a velocity $\vec{v}$ along OX direction.