Answer on Question #43119 – Physics – Electromagnetism

Question.

Calculate the magnitude and direction of the force acting on an electron moves with velocity 200 km/h in a magnetic field of induction 2.5 tesla along direction makes 30degree with the direction of magnetic field.

Given:

$e = 1.6 \cdot 10^{-19}\, C$

$v = 200\ \frac{km}{h} = 55.56\ \frac{m}{s}$

$B = 2.5\, T$

$\alpha = 30°$

Find:

$\vec{F} = ?$

$|F| = ?$

Solution.

By definition Lorentz force acts on a particle that moves in a magnetic field:

$$\vec{F} = q\left(\vec{v} \times \vec{B}\right)$$

So,

$$F = qvB \sin\alpha$$

In our case, $q = -e$. Therefore,

$$\vec{F} = -e\left(\vec{v} \times \vec{B}\right)$$

$$|F| = evB \sin\alpha$$

Calculate the magnitude of Lorentz force:

$$|F| = 1.6 \cdot 10^{-19} \cdot 55.56 \cdot 2.5 \cdot 0.5 = 1.11 \cdot 10^{-17}\, N$$

We define the direction of Lorentz force by left hand rule:

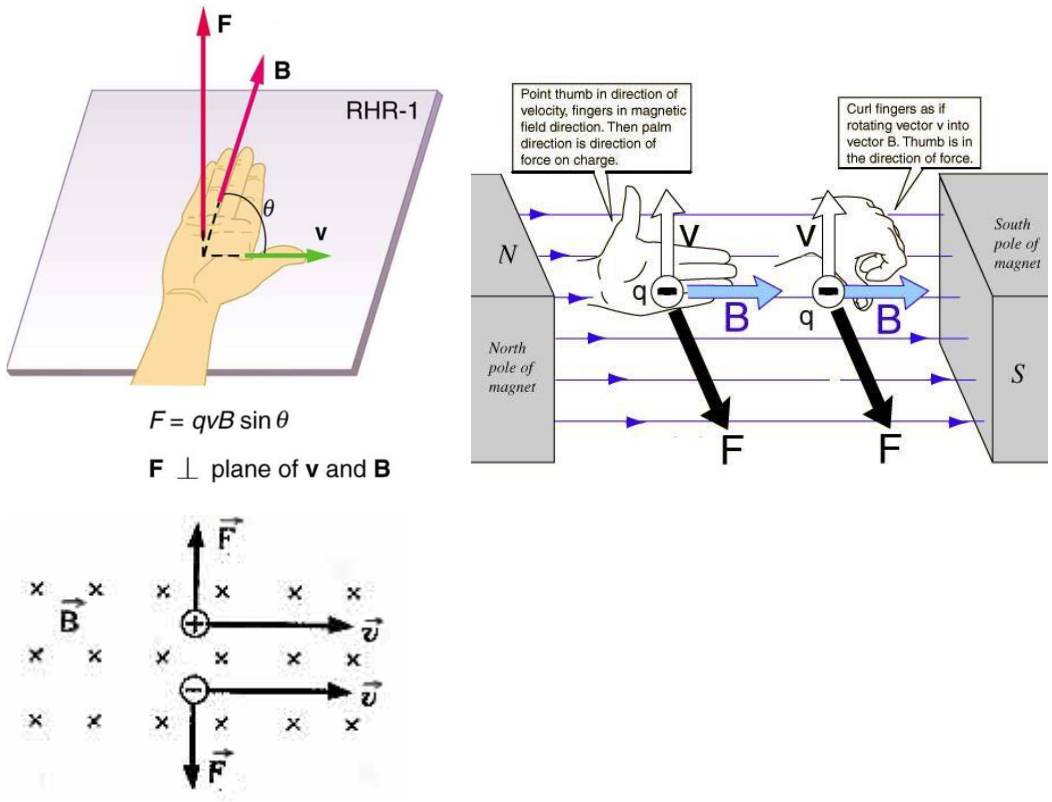

Fig. 1. Left hand rule in different formulations.

So, in our case

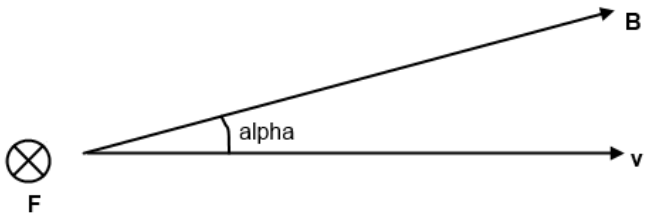

Fig. 2. The direction of Lorentz force.

Answer.

$|F| = evB \sin\alpha = 1.11 \cdot 10^{-17}\ N$