202: Principles of electrical science  
**Handout 11: Force on current-carrying conductor**

**Learning outcome**

The learner will:

1. Understand the fundamental principles which underpin the relationship between magnetism and electricity.

**Assessment criteria**

The learner can:

5.3 describe the magnetic effects of electrical currents in terms of: (production of a magnetic field, force on a current-carrying conductor in a magnetic field, electromagnetism, electromotive force.).

**Force on current-carrying conductor**

When a conductor is situated in a magnetic field at right angles to it and a current is then passed through the conductor, the latter will experience a mechanical force, causing it to move due to the interaction of the two magnetic fields.

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| 01 electrical equipment.png |

If the direction of the main magnetic field or the current in the conductor were reversed then the force would be in the opposite direction, as shown.

**Changing direction of current**

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**Changing direction of flux**

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The magnitude of the force on a current flowing at right angles to a magnetic field is proportional to:

1. the flux density of the magnetic field
2. the current flowing in the conductor
3. the length of the conductor in the magnetic field.

The strength of the mechanical force is given by the formula:

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This principle of motion is how a motor works, ie the conversion of electrical energy into mechanical motion.

**Example 1**

A conductor of 20cm in length is situated perpendicularly in a magnetic field of flux density 5 teslas and has a current of 10A flowing through it. Calculate the force on the conductor.

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**Example 2**

A conductor of 0.5m in length is situated perpendicularly in a magnetic field of flux density of 10 teslas and has a current of 15A flowing through it. Calculate the force on the conductor.

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The direction of this force can be found by using:

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| **Fleming’s left-hand motor rule** |

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