

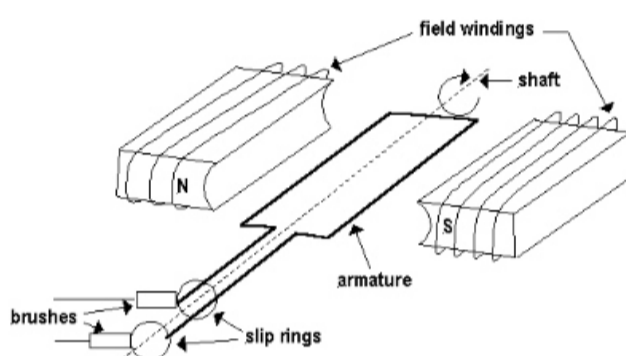
**Physics 3204**  
*Unit 2: Electromagnetism*  
**Worksheet 9: AC/DC GENERATOR**



**Electric generator** refers to devices that convert mechanical energy into electric energy

There are two main types of generators:

- 1) **Alternating Current Generators (AC):** Electricity made by this type of generator is called alternating current, because it changes/alternates direction. AC generators produce an electric current via the motion of coils in a magnetic field or by rotating a magnet within a stationary coil. The term alternator is also often used interchangeably with the term electric generator. Strictly speaking, an alternator refers to an electromagnet rotating inside a fixed coil, such as is the case in most power stations. Consider the diagram of a simple AC generator shown below.

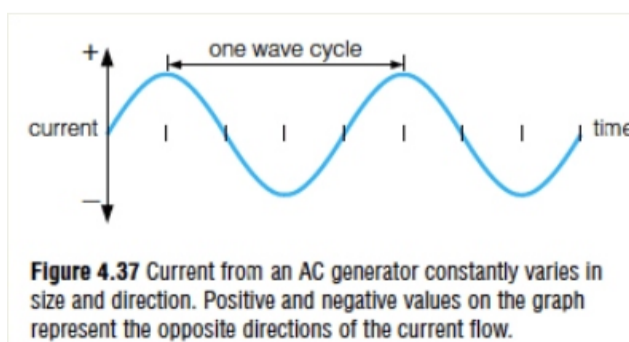


the main components of a generator are:

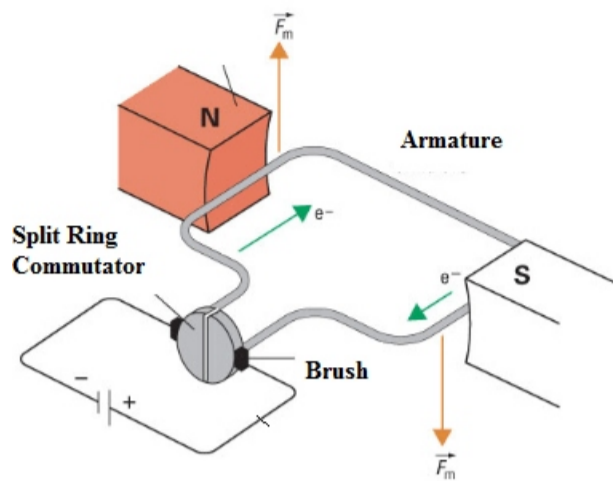
- **Armature** – a coil wound around a metal core and mounted between the poles of an electromagnet.
- **Electromagnet** consisting of an iron core surrounded by a set of coils called the field windings. A steady current flows through these coils to produce the required magnetic field.
- **Slip rings** – each end of the armature coil is connected to a metal ring. These rings are mounted on the armature shaft but are insulated from it and from each other.
- **Graphite brushes** – these connect the slip rings to an external circuit and conduct the current induced in the armature coil to the external circuit.

Each time the coil passes through the position where its plane is perpendicular to the magnetic field lines, the direction of the emf in the coil is reversed. Hence an alternating current is produced at a frequency equal to the number of revolutions per second of the armature.

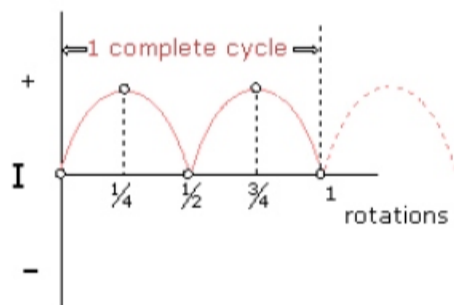
In North America, generators turn at a controlled speed. ! Alternating current changes 120 times per second ! On a graph this current has a wave shape with 60 complete waves per second (or 60 Hz)



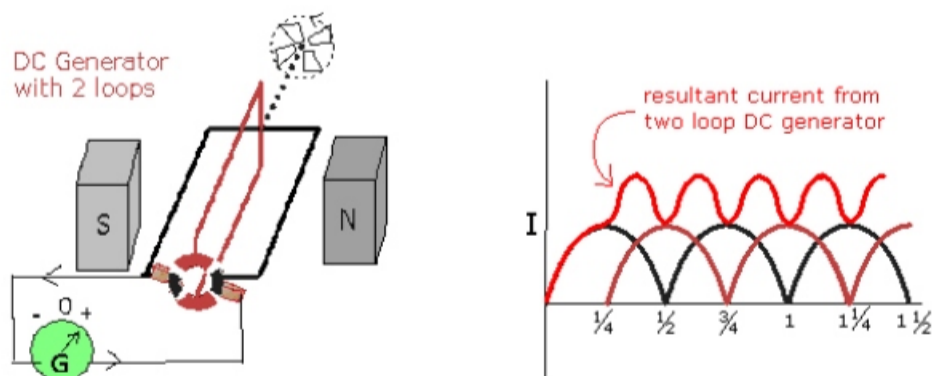
- 2) **Direct Current (DC) Generators:** current in only one direction. Made up of an armature (rotating loop of wire) that is connected to a circuit via split-ring commutator. Generators that make direct current are often called dynamos. Device used on bike wheels to produce electricity for lights



In the DC generator, the split half rings turn with the coil. The current is always going the same way in the external circuit. The needle of the galvanometer fluctuates from 0 to the + end as the loop goes from the vertical position to either one of the horizontal positions. The current in the external circuit never reverses, even though it does reverse in the generator loops. The current graph for a DC generator

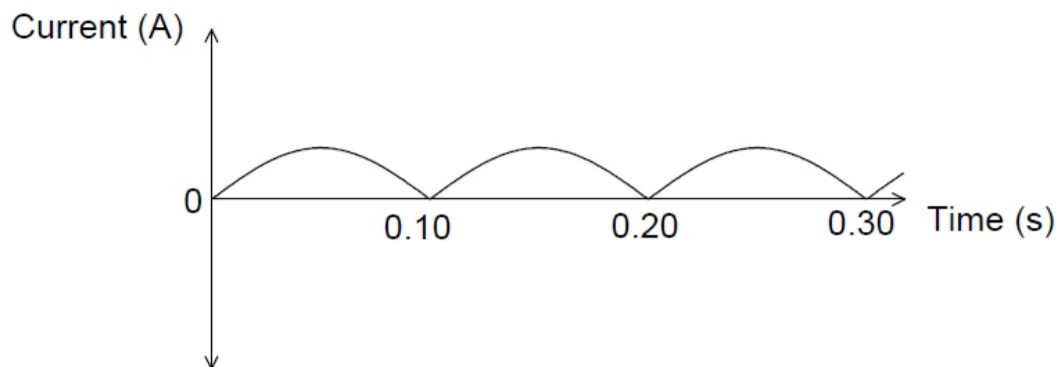


Real generator has many loops. Now look at a DC generator with two loops--one perpendicular to the other. Each loop has its own set of split rings. Notice just as the black loop loses contact with the brushes, the brown loop takes over. A plot of the current from a two-loop DC generator is shown.



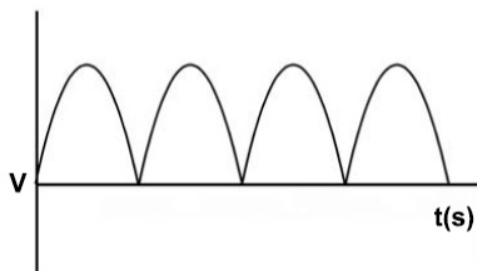
**PART A: Multiple Choice**

1. What is the type of generator and the frequency of rotation for the output shown below?



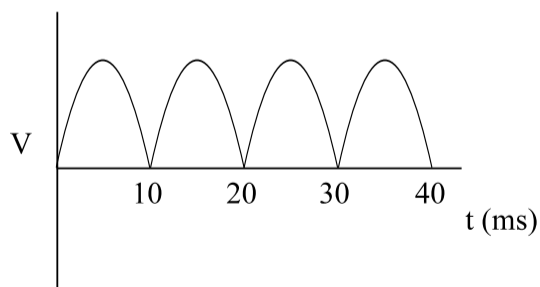
	Type	Frequency (Hz)
(A)	AC	5
(B)	AC	10
(C)	DC	5
(D)	DC	10

2. The graph below shows the output from a generator. What is true of the generator?



- (A) AC with multiple loops
- (B) AC with a single loop
- (C) DC with multiple loops
- (D) DC with a single loop

3. The diagram below illustrates the output from a generator. What is true of the generator?



	Type of Generator	Rotational Rate of Armature (Hz)
(A)		
(B)		
(C)		
(D)		