Sample Diploma Problem

4. If the charge of a point source is 0.500 C, then the electric field strength at a distance of 0.250 m from the point source is

A. 8.99×10^{9} N/C

B. 1.80×10^{10} N/C

C. 4.50×10^{10} N/C

D 7.19×10^{10} N/C

Use the following information to answer numerical-response question 8.

A telecommunications satellite is in orbit 4.21×10^7 m from the centre of Earth.

Numerical Response

8. Earth's gravitational field strength at the position of the satellite, expressed in scientific notation, is $\boldsymbol{a.bc} \times 10^{-d}$ N/kg. The values of a, b, c, and d are $\underline{\quad a \quad}$, $\underline{\quad b \quad}$, $\underline{\quad c \quad}$, and $\underline{\quad d \quad}$.

(Record all **four digits** of your answer in the numerical-response section on the answer sheet.)

2251= 0.2250

* m=use mass of earth from data book

Use the following information to answer numerical-response question 8.

Comparison of Earth and Mars

	Mass	Radius
Earth	5.98×10^{24} kg	6.37×10^{6} m
Mars	6.42×10^{23} kg	3.40×10^{6} m

Numerical Response

8. Given the information above, the magnitude of the gravitational field strength experienced by an object located on the surface of Mars is 3.70 N/kg.

(Record your **three-digit answer** in the numerical-response section on the answer sheet.)

Mass is proportional meaning double mass = double g

Radius is inverse meaning (half) radius g is quartered

3. Which of the following planets would have the greatest gravitational field strength at its surface?

A. A planet with ½ the mass of Earth and the same radius.

B. A planet with 2 times the mass of Earth and the same radius.

C. A planet with ½ the radius of Earth and the same mass.

D. A planet with 2 times the radius of Earth and the same mass.

B & C would both make the gravitational strength larger but C would have the greatest effect

$(1/2)r^2$ = 4 times larger

Motors and Generators

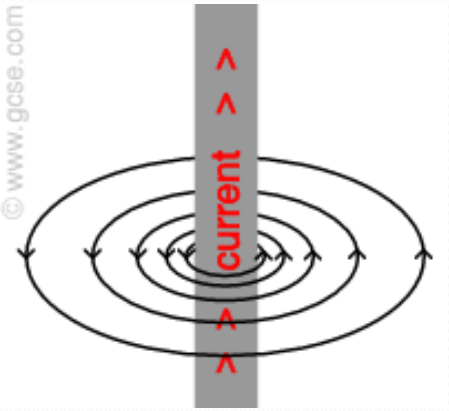
"Bob, the 'check engine' light just came on."

Curriculum

- describe the effect of a conductor moving through a magnetic field and inducing an electrical current
- distinguish between alternating current (AC) and direct current (DC) in terms of electron flow and electric field
- describe the advantage of AC over DC for transmitting and using electrical energy
- compare the general design and function of a DC electric motor and a generator

Magnetic Field and Electricity

- When electricity flows through a wire, it creates a magnetic field the wraps around the wire

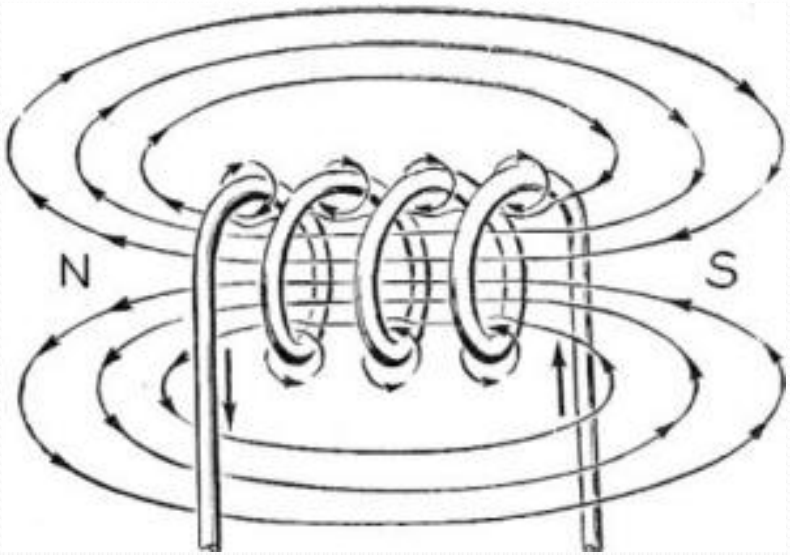


- What can we use to detect a magnetic field?

compass

Magnetic Field and Electricity

- The magnetic field that is created is very weak, to make it stronger we could:
  - increase the current running through the wire
  - wrap the wire into a coil



Solenoid

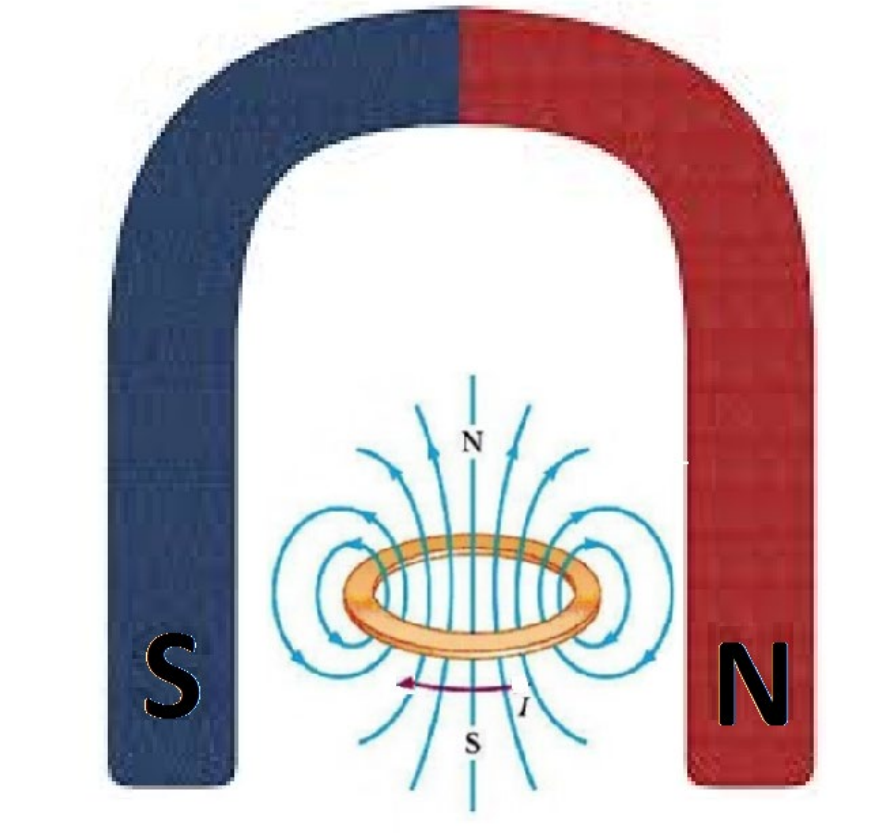
- A coil of wires works the exact same as a bar magnet, except you can turn it on and off
- They are called an **electromagnet or a solenoid**

- What happens when two magnetic fields interact?

  - The North and south poles will attracts each other while they repel

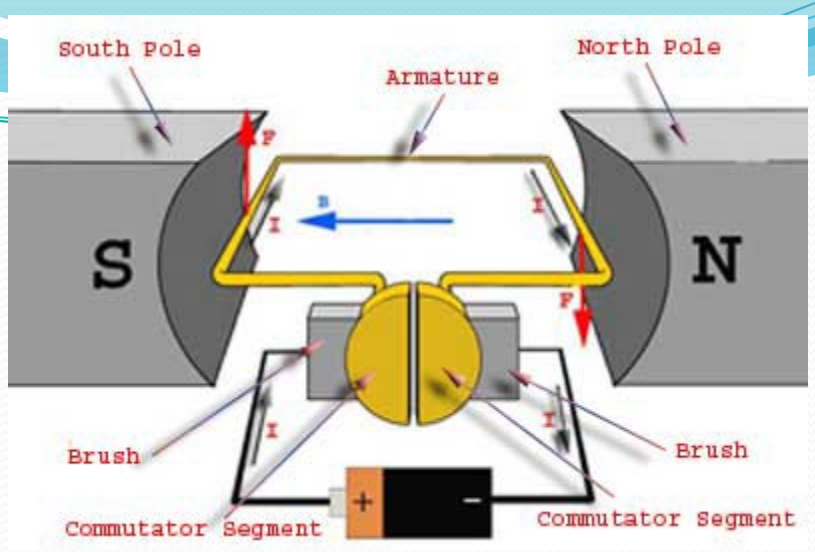
Electric Motors

- What would happen in this situation?



The coil would spin (kinetic energy) generating electrical energy

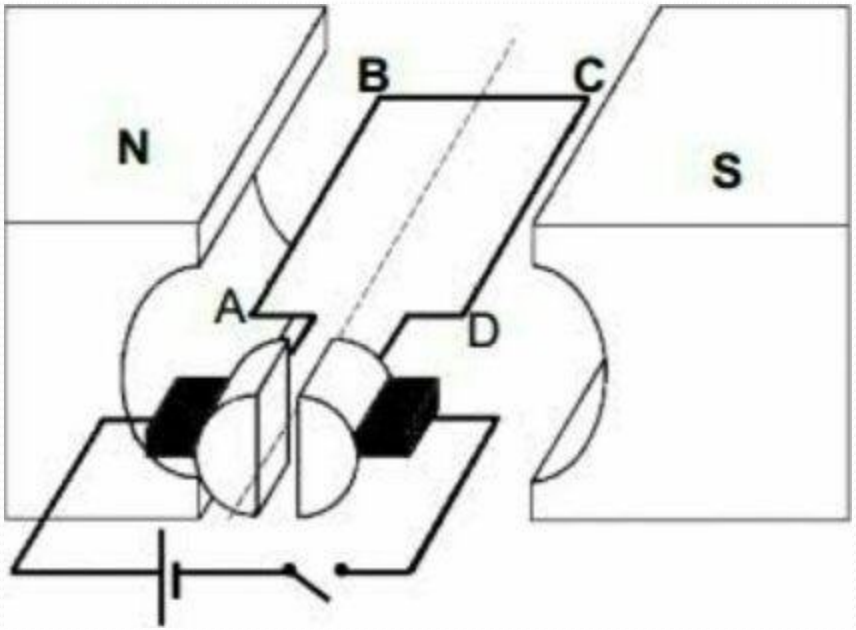
Parts of a motor



- **Armature**: spinning part of motor (shaft, wire coil, commutator).
- **Commutator**: provides electrical contact; current flows to coil.
- **Shaft**: supports coil, provides axis of rotation.
- **Brush**: stationary part that connects with rotating commutator.

Split ring commutator

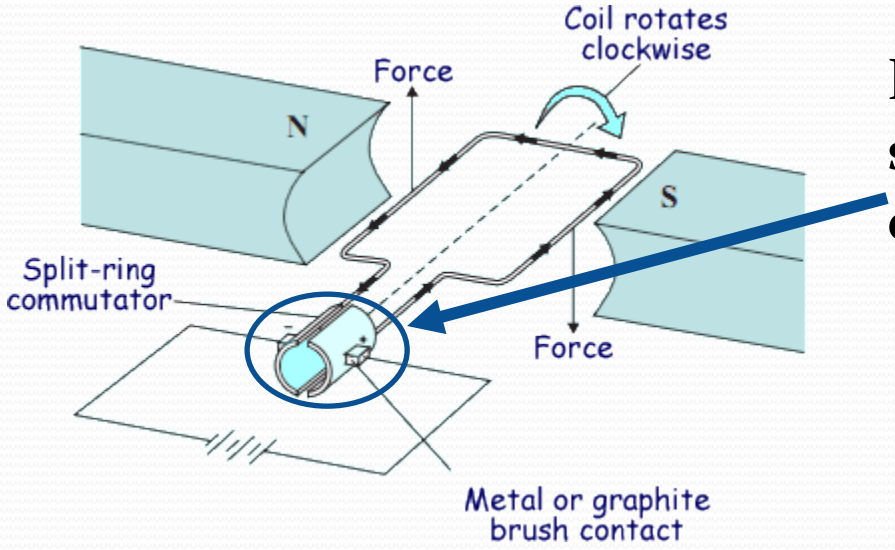
- Switches the direction of the current flow every half turn of the motor
- This changes the direction of the magnetic field every half turn



Used in DC motors

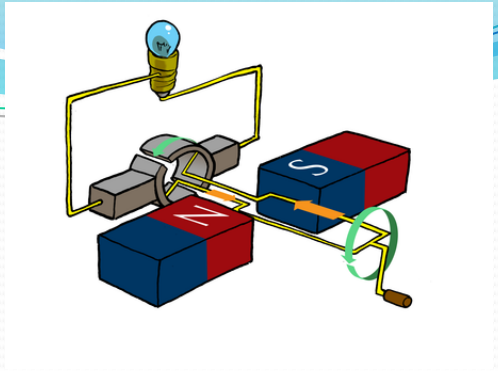
Motor Summary

- A current flowing through a wire causes a magnetic field
- Interacting magnetic fields cause a force, which creates movement

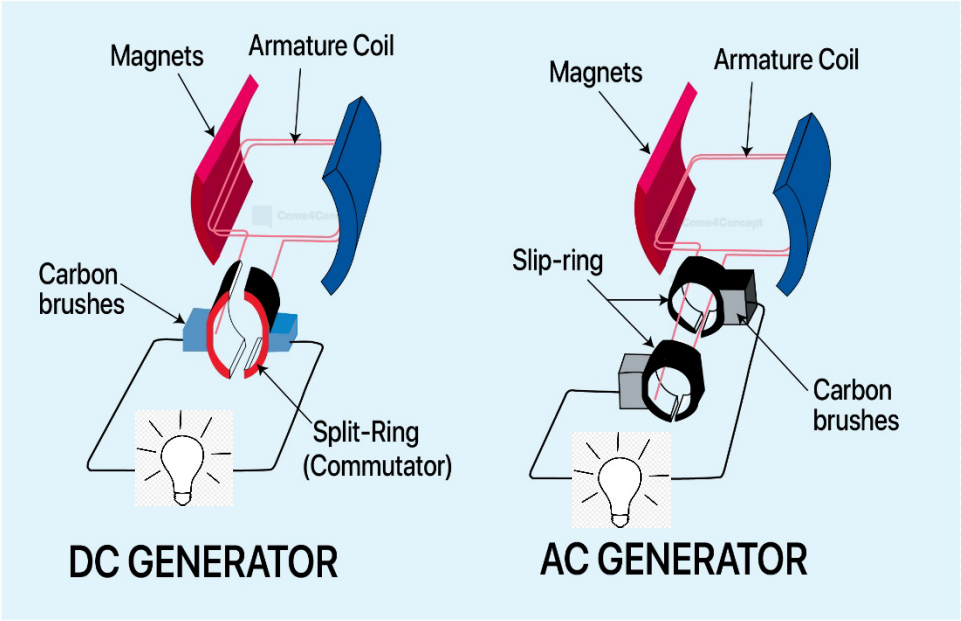


DC needs split ring commutator

Generators



- When a wire moves near a magnet, or a magnet moves near a wire, a current can be produced



Motors turn electricity into motion

Generators turn Ek into electricity

AC = back and forth electrons move

AC/DC (177) Difference between AC and DC Current Explained | AddOhms #5 – YouTube

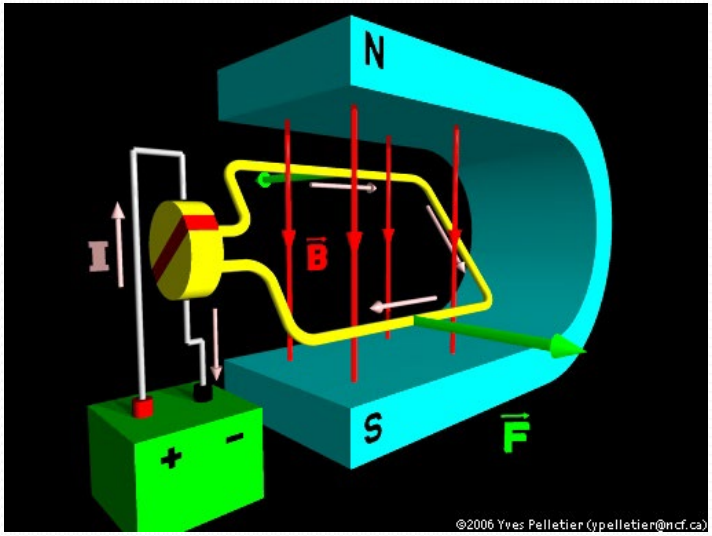
- Some motors run on **direct current** (DC) where the current flows in one direction
- Some motors run on **alternating current** (AC) where the current switches back and forth 60 times every second

AC	DC
AC = alternating current	DC = direct current
Electrons flow in one direction in the circuit and then they flow the other way	Electrons flow in a continuous loop in ONE direction only
Ex: a generator	Ex. Fresh batteries (no moving parts)
Use transformers	Can not be used with transformers
More efficient	
Long distances	

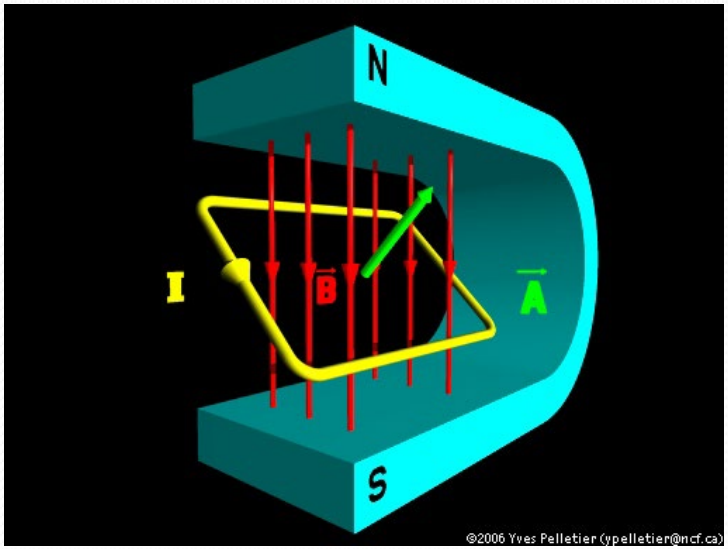
DC

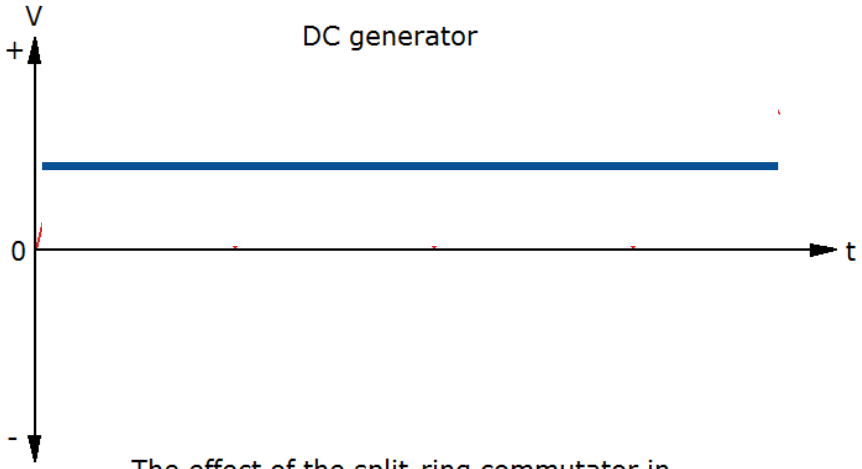
AC

DC generators

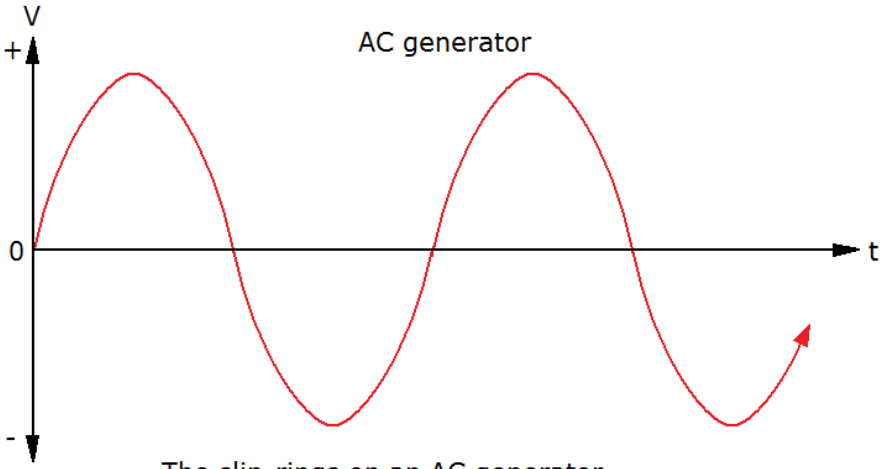


AC generators



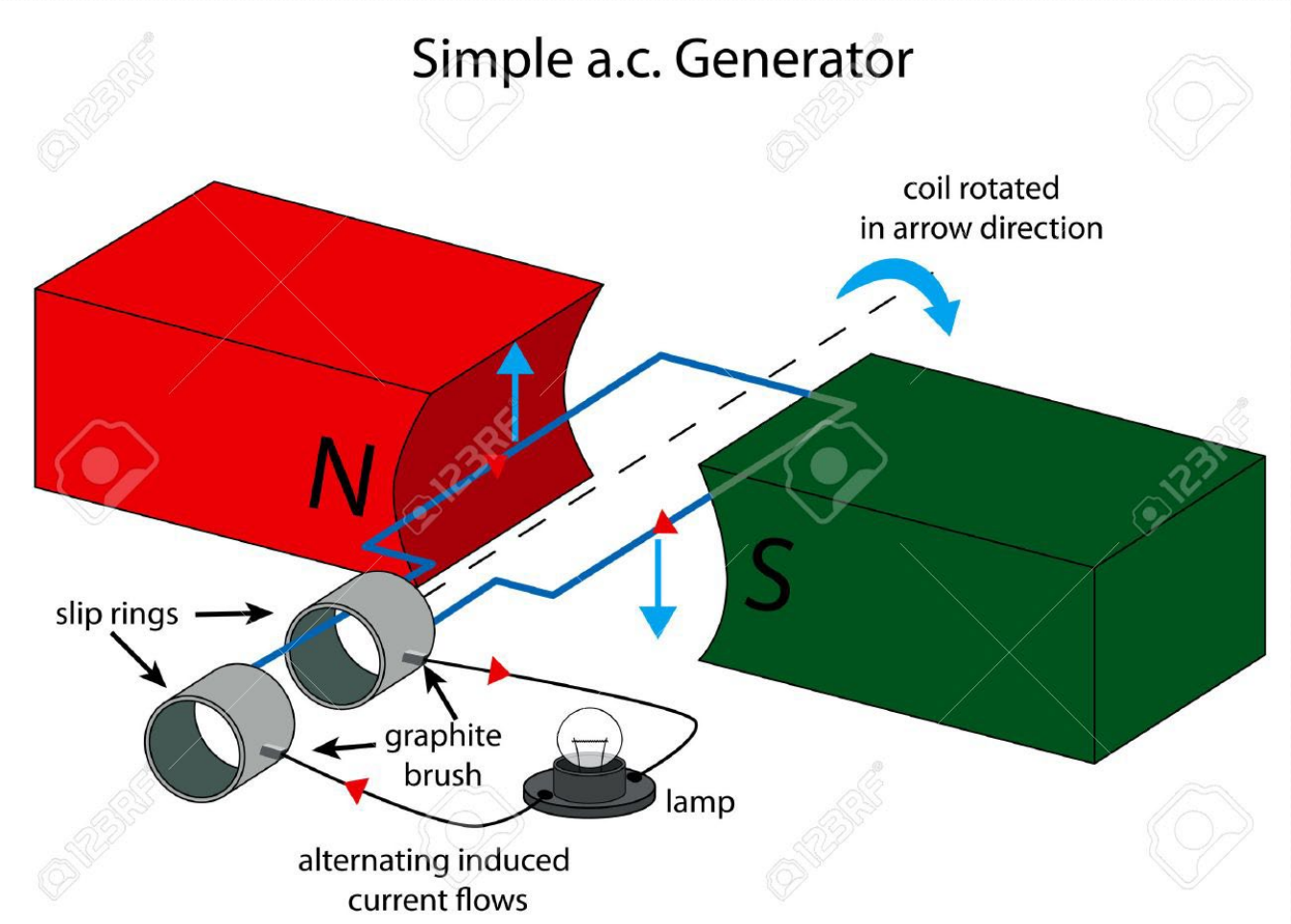


The effect of the split-ring commutator in DC generators is to ensure the induced EMF is always in one direction.

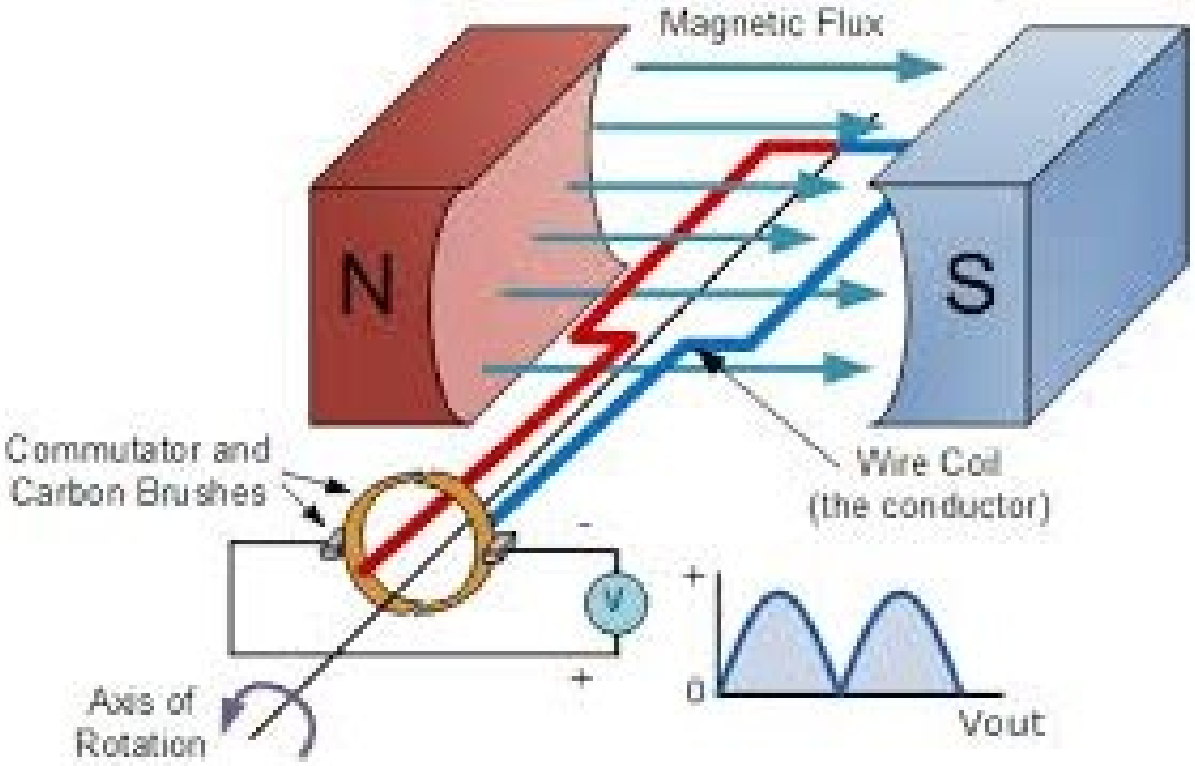


The slip-rings on an AC generator preserves the sinusoidal EMF produced at the rotating coils

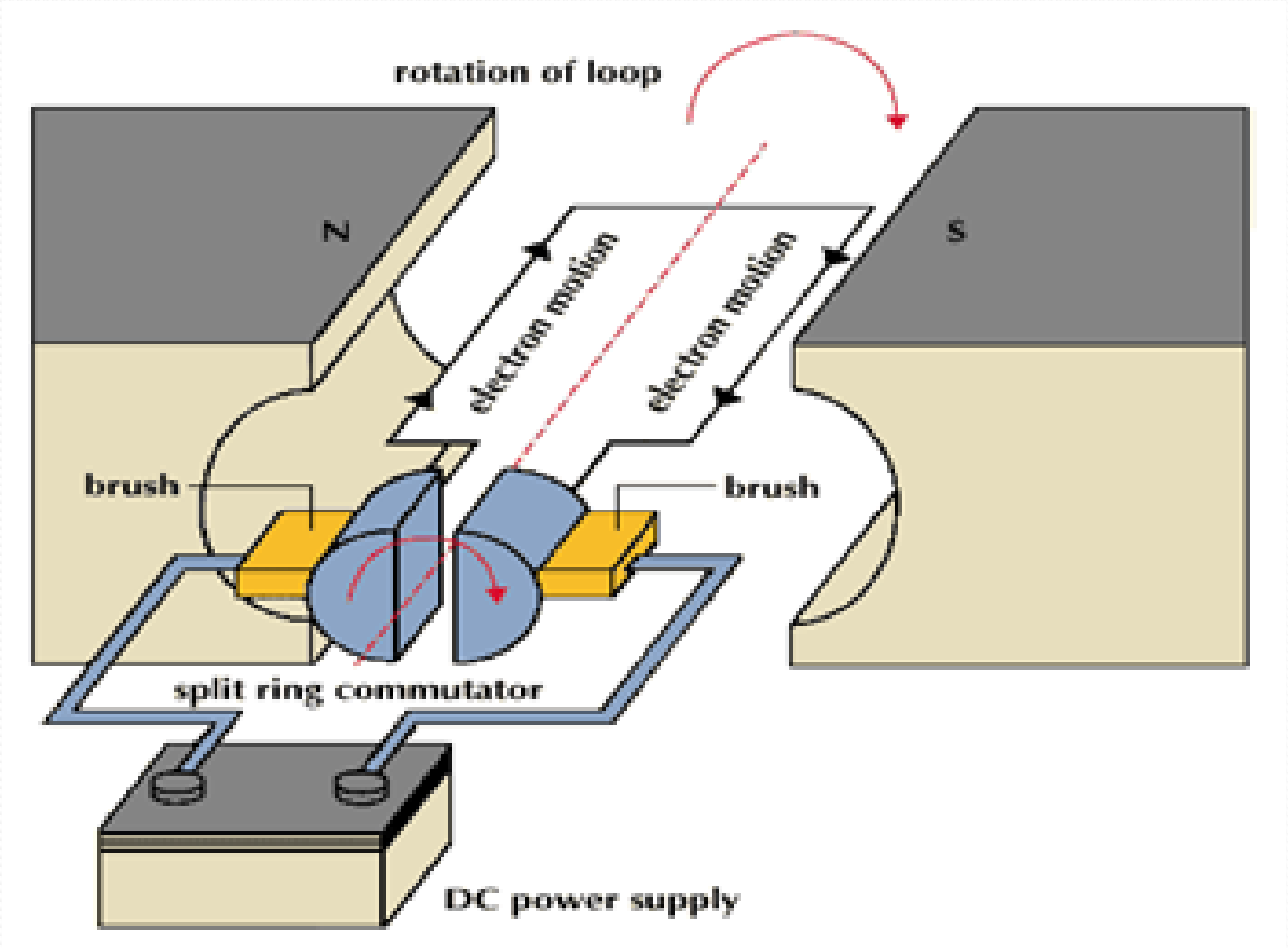
AC generators



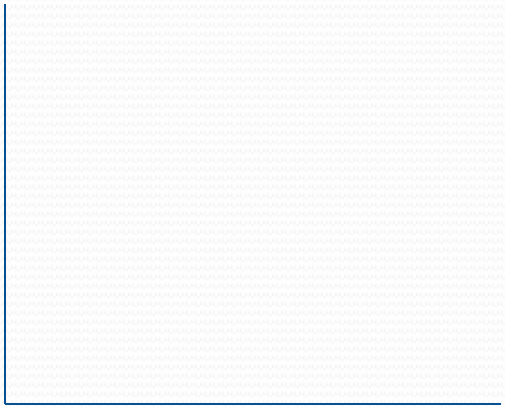
DC generator

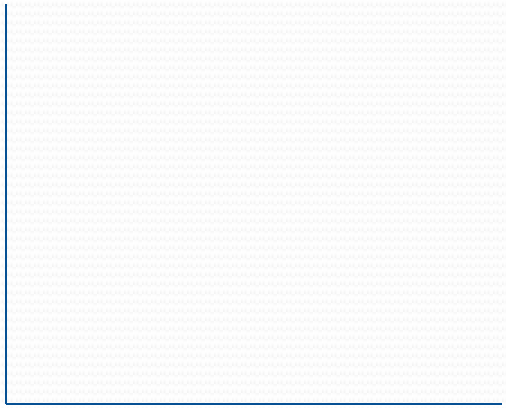


DC motor


rotation of loop
N
S
electron motion
electron motion
brush
brush
split ring commutator
DC power supply

Voltage vs time Graphs





Example:

- A head light in an automobile draws a current of 5.0A from the cars 12.0V battery.
- Is the current passing through the headlight AC or DC?

- Since the source of the electric current is the car's battery, this is an example of direct current , DC

example

- A light bulb of a typical lamp is connected to the 120V wall outlet. When the bulb is operating, it has a resistance of 240Ω
- Is the current passing through the bulb AC or DC?

- All household circuity is designed around alternating current. Therefore, the current through the bulb is AC