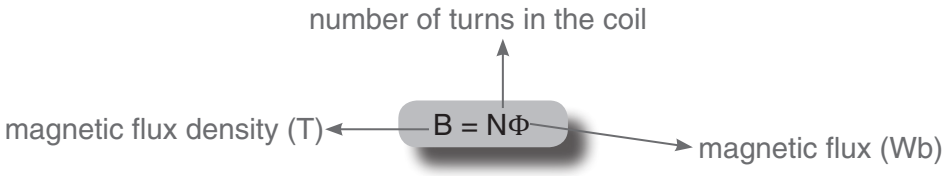
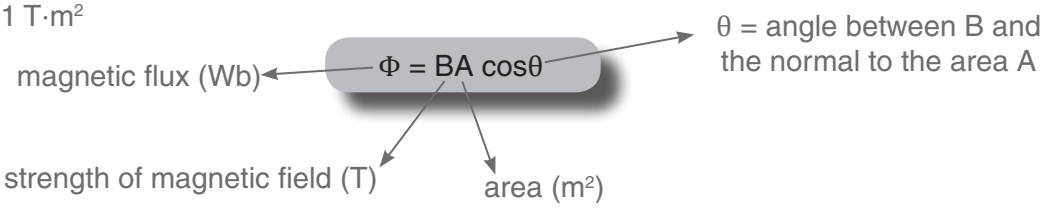
4.2 In which direction does the current flow in the coil? Y to X or X to Y?

4.3 Sketch a graph of potential difference versus time for the generator.

Summary

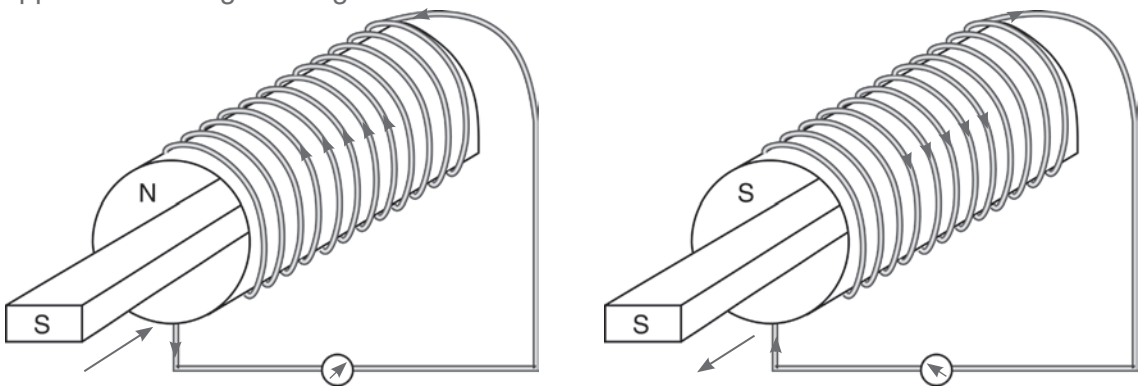
- Magnetic flux density is the product of the number of turns (N) on the coil and the magnetic flux (Φ) through the coil.
- 

- Magnetic flux is the product of the perpendicular component of the magnetic field ($B_\perp$) and the area (A) through which it cuts.
- SI unit for magnetic flux (ϕ): weber (Wb)
- 1 Wb = 1 T·m^2
- 

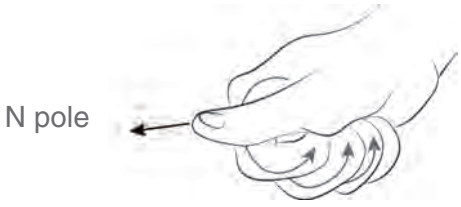
- Faraday's law of electromagnetic induction: when a magnetic field moves relative to a conductor, an emf is induced in the conductor.
  The induced emf in the conductor is directly proportional to the rate of change of the magnetic flux.
- SI unit for emf (ε): volt (V)
- The magnitude of the induced emf depends on:
  - area (A) covered by the magnetic field;
  - strength of magnetic field (B);
  - rate of change of magnetic flux (ϕ);
  - number of windings (N).

Summary

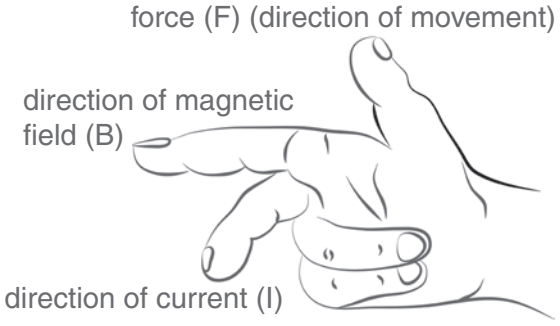
- Lenz's law: the induced current flows in a direction so as to set up a magnetic field to oppose the change in magnetic flux



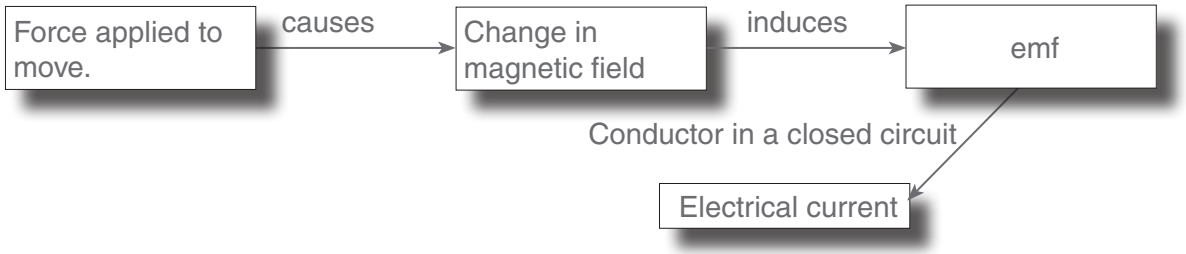
- Right hand rule to determine the direction of the induced current: Hold the solenoid in your right hand. Determine where the N pole will be induced.
  Then:
  thumb: N pole;
  fingers curl: induced conventional current (+ to -).



- Fleming's right-hand rule: Hold your index finger, middle finger and thumb of your right hand perpendicular to one another. If your index finger points in the direction of the magnetic field and your thumb points in the direction in which the conductor moves, then your middle finger will point in the direction of the induced current.

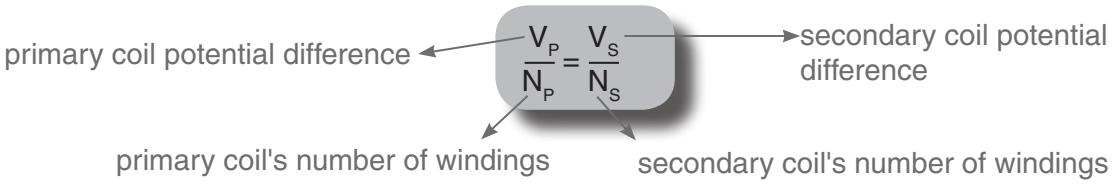


- The basic principle of generators:



Summary

- A generator consists of a coil placed in magnetic field connected to an external circuit. The coil is turned manually or mechanically.
- In generators, mechanical energy is converted to electrical energy – the opposite of electrical motors.
- A transformer consists of:
  - primary coil with windings;
  - secondary coil with windings;
  - ferromagnetic core.
- A step-up transformer has more windings on the secondary coil than on the primary coil.
- A step-down transformer has more windings on the primary coil then on the secondary coil.
- An isolating transformer has the same number of windings for both coils.
- According to Faraday's law:
  $\varepsilon = (V) = \frac{-N\Delta\phi}{\Delta t}$ manipulation of the formula gives:
  $\frac{V}{N} = \frac{-\Delta\phi}{\Delta t}$ where $\frac{\Delta\phi}{\Delta t}$ are the same for both coils.
  Therefore, the transformer equation is as follows:



- $P_P = P_S$
  $V_P I_P = V_S I_S$

Notes