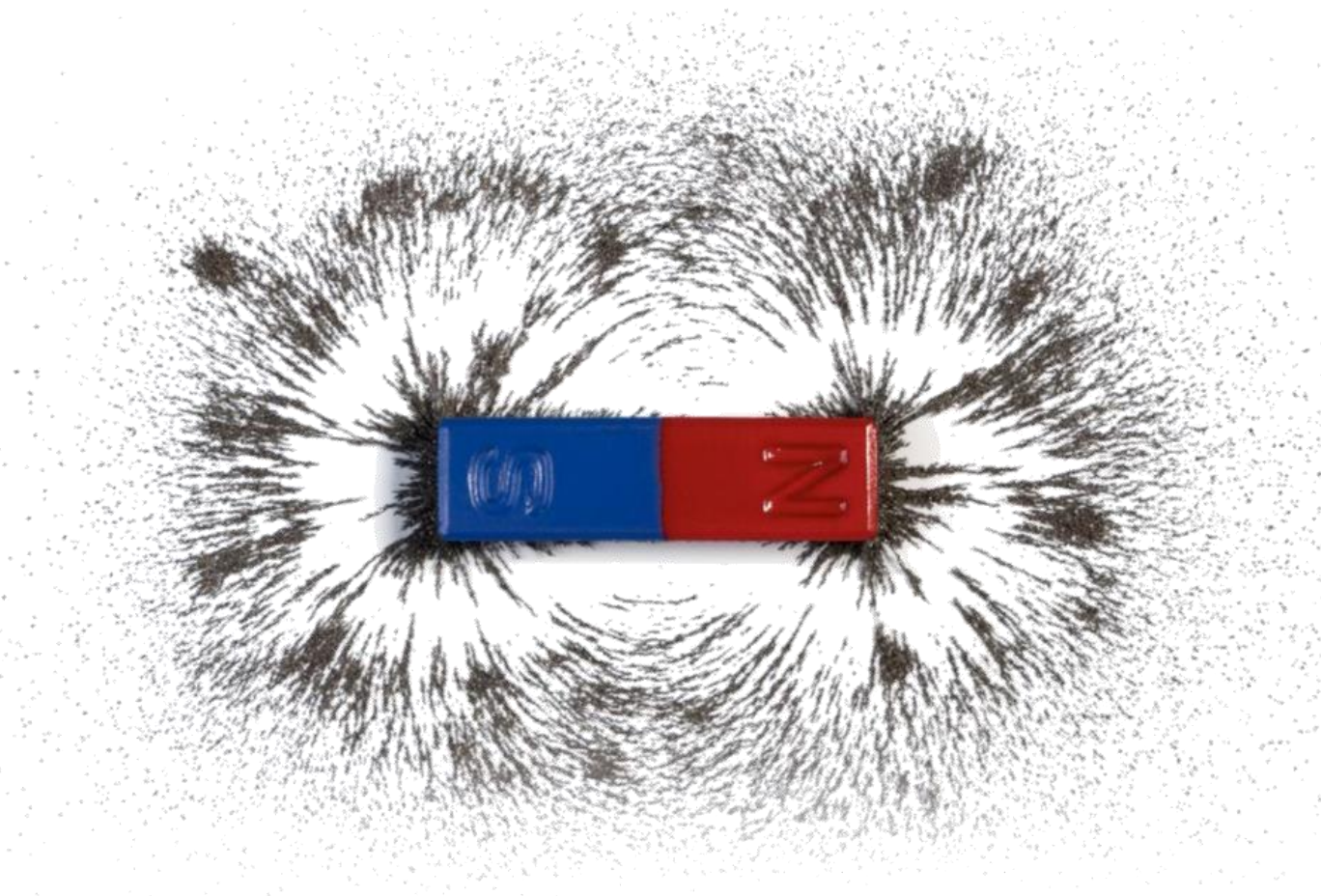


CHAPTER **(8):**
MAGNETISM AND ELECTROMAGNETISM

The magnetic field for the magnetism:

- The magnetic field: is the portion of space near a magnetic body or a current-carrying body in which the magnetic forces due to the body or current can be detected.
- Magnetic flux: is the number of magnetic field lines that pass a surface. (Is a measurement of the total magnetic field which passes through a given area).
- The magnetic flux is directly proportional to the magnet-ic field intensity.

The magnetic field for a wire carries current:

- When a current flows in a wire, it creates a circular magnetic field around the wire. This magnetic field can deflect the needle of a magnetic compass. The strength of the magnetic field is greater closer to the wire, and increases if the current increases.
- The magnetic field intensity of the wire is directly proportional with the current that passes in the wire and inversely proportional to the distance from the wire.

The magnetic field for sinusoidal coil:

- The magnetic field that produced from sinusoidal coil is similar to magnetic field that produced from permanent magnetism.
- The intensity of the magnetic field is directly proportional to the current intensity, number of loops, and type of the core of the coil.

The magnetic force exerted on the wire carries current:

- The magnetic force that is exerted on the wire carries current and the magnetic field is perpendicular to the wire is given as:

  $F = ILB$

  F is the magnetic force [N], I is the current [A], L is the length of the wire [m], B is the magnetic field intensity [T].
- The magnetic force between two wires each carries current and the two currents in the same direction is attractive force.
- The magnetic force between the two wires if the currents in opposite direction is repulsive force.

1. The number of magnetic field lines that pass a surface is

A Electromagnetic flux
B Magnetic flux
C Electromagnetic fields
D Magnetic fields

2. The magnetic flux is directly proportional to.

A The magnetic pole type
B the magnetic field shape
C the magnetic field intensity
D the magnetic field direction

3. The shape of the magnetic field around a current carrying wire is.

A Oval rings
B Elliptical rings
C Circular rings
D Spiral rings

4. The magnetic field intensity of current carrying wire is proprtional.

A Directly with the mass of the wire
B Directly with the distance from the wire
C Reversely with the mass of the wire
D Reversely with the distance from the wire

5. The magnetic field that produced from permanent magnetism is similar to magnetic field that produced from.

A Straight wire
B Circular coil
C sinusoidal coil
D Wire ring

6. One of the factors that affect the magnetic field intensity which is produced around a sinusoi-dal coil is.

A Voltage
B Coil resistance
C Number of loops
D Coil space

7. **6 A current flows in a 1.5 m length wire lays vertically in a regular magnetic field (0.5 T), how much is the force that affects the wire?**

A 3 N B 4 N
C 4.5 N D 6 N

Solution:

F = ILB = 6 x 1.5 x 0.5 = 4.5 N, Answer is C

8. **An attractive force is created between two wires each carries current and the two currents in the.**

A orthogonal B With an acute angle between them
C same direction D Opposite direction

The magnetic force exerted on moving charged particle:

- The magnetic force that exerted on charged particle moves perpendicularly on the magnetic field lines is given as:

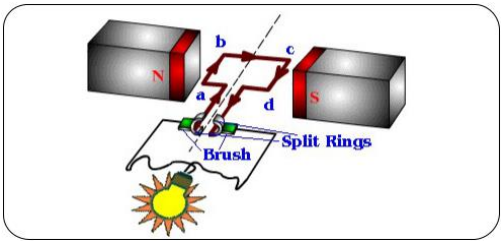
$$F = qvB$$

Where F is the magnetic force [N], q is the charge of the particle [C], v is the speed of the charged particle [m/s], B is the magnetic field intensity [T].

Applications for the magnetic force that is exerted on charged particle:

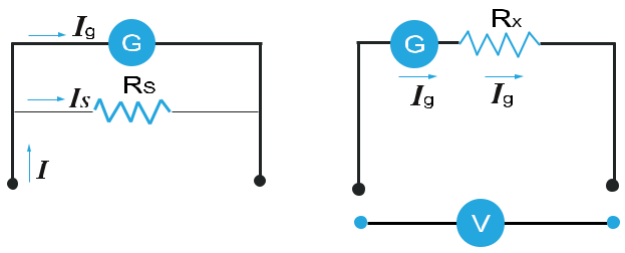
- Recording on the magnetic tape.
- Store data and programs on the computer disk.

The electric generator: convert the mechanical energy into electrical energy.



Galvanometer: is instrument for measuring a small electri-cal current.
Ammeter and voltmeter:

- A galvanometer can be converted into ammeter by connecting a low resistance called shunt in parallel to the galvanometer.
- A galvanometer can be converted in to a voltmeter by connecting a high resistance in series connection within it.



S. No.	Voltmeter	Ammeter
1.	Used to measure the potential difference.	Used to measure the current.
2.	Connected in parallel in the electric circuit.	Connected in series in the electric circuit.
3.	Has high resistance.	Has low resistance.

9. **An electron moves vertically in a magnetic field (0.4 T) at speed of $,5 \times 10^{!}$ / , if the charge of electron is $1.6 \times 10^{!"\#}$, how much is the force that affects the electron?**

A $2´10^{-13}$ B $2´10^{13}$
C $3.2´10^{-13}$ D $3.2´10^{13}$

Solution:

F = qvB = 1.6 x 10^{19} x 5 x 10^{6} x 0.4 = 3.2 x 10^{-13} N, Answer is C

10. **The recording on magnetic tape can be consid-ered an application for:**

A The magnetic field which produces from current.

B The magnetic force that exerted on charged particle.

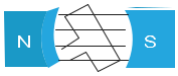
C The influence of both electric and magnetic fields on the motion of charged particle.

D The magnetic force that exerted on conductor caring current.

11. **Khaled has a toy if he move it, it will produce electric energy, this toy can be considered as:**

A Electrical generator. B Electrical resistance
C Electrical motor. D Electrical capacitor

12. The following diagram represents the composition of:

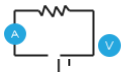


A Electrical generator
B Electrical capacitor
C Electrical motor
D Sensitive balance

13. ---------- is a device used to measure the small current:

A Voltmeter
B Ammeter
C Electrical scope
D Galvanometer

14. Which of the following electric circuits is correct for the ammeter and voltmeter:

A 
B 
C 
D 

Electromagnetic induction:

- Discovered by Faraday
- Electromagnetic induction: is the production of an electromotive force across an electrical conductor in a changing magnetic field.
- The electromotive force work as potential difference which produced induction current through the conductor.
- To produce current in the conductor the magnetic field must be changed and that can take place when the wire is moving through the magnetic field or the magnetic field is moving through the wire.
- No induction current will be produced if the wire in magnetic field is static or moving parallel to the magnetic field lines.
- Electromotive force (EMF) of induction
- EMF =BLv
- Where EMF is the electromotive force [V], B is the magnetic field intensity [T], L is length of a conductor [m], and v is the speed of wire [m/s].
- Applications about the electromotive force of induction: Microphones and electrical generators.

Effective current and effective voltage:

- The power average:

$$P_{Avg} = \frac{1}{2} P_{max} = \frac{1}{2} I_{max} V_{max}$$

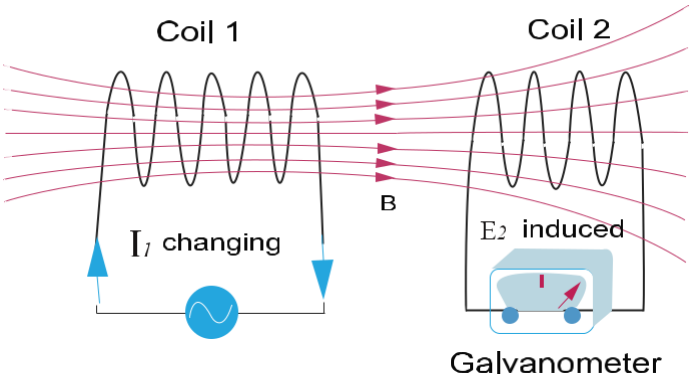
Where Pmax is the maximum power [W], Imax is the maximum intensity of current [A], and Vmax si the maxi-mum voltage [V].

- The effective current is given as:

$$V_{max} = \frac{1}{\sqrt{2}} V_{max}$$

The change in magnetic field:

- Lenz law: statement that an induced electric current flows in a direction such that the current opposes the change that induced it.
- Self-induction: the production of an electromotive force in a circuit when the magnetic flux linked with the circuit changes as a result of a change in current in the same circuit
- Mutual induction: the current flowing in one coil that induces a voltage in an adjacent coil.



- The change in the current through the primary coil produces varied magnetic field which flows through the secondary coil and produces varied electromotive force.

15. The scientist that discover the electromagnetic induction is:

A Faraday
B Thompson.
C Millikan
D Rontgen

16. **In the following diagram, a student put a wire in a magnetic field which is connected to an ammeter and he studied 4 cases as:**

A The wire is static

B Moved the wire down

C Moved the wire up

D Moved the wire parallel to the magnetic field lines

17. **The electromotive force that produces when a wire with length of 1m moves with 4 m/s perpendicular to the magnetic field lines of 0.5 T is ---------- :**

A 2 V B 5.5 V

C 6 V D 8 V

Solution:

F = BLv = 0.5 x 1 x 4 = 2 N , The answer is A

18. **The maximum power that is dissipated through lamp has average power 75 W is ---------- :**

A 3.75 W B 15 W

C 37.5 W D 150 W

19. **An alternative current generator generates a maximum voltage 100 V, and supplies an external circuit with 180 A maximum current, then the average produced power in watt is ----------:**

A 9000 B $9000\sqrt{2}$

C $\frac{18000}{\sqrt{2}}$ D 18000

Solution:

Pave = 0.5 xImax x Vmax = 0.5 x100 x 180 = 9000 W , Answer is A

20. **The direction of the induction current opposites the change in magnetic field that generated it, this statement represents ---------- law :**

A Henry B Worsted.

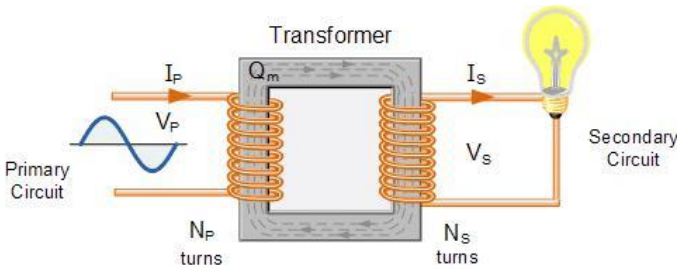
C Faraday D Lenz

21. **The production of an electromotive force in a circuit when the magnetic flux linked with the circuit changes as a result of a change in cur -rent in the same circuit is ----------:**

A Self-induction B Mutual induction

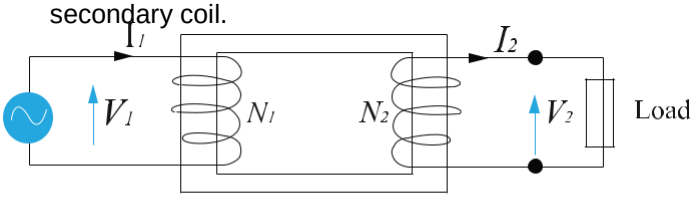
C Magnetic induction D Varied induction

Electrical transformer:



- Used to increase or decrease the alternative voltage.
- Components: Primary coil, secondary coil, and metal core.
- Types of electrical transformer:

1. Step up transformer: Number of turns of the secondary coil is greater than number of turns of the primary coil.
2. Step down transformer: Number of turns of primary coil is greater than number of turns of secondary coil.



$$I_1/I_2 = N_2/N_1 = V_2/V_1$$

N_1 =Number of turns in primary winding

N_2 =Number of turns in secondary winding

V_1 =primary voltage

V_2 =Secondary current

Mass of electron and the spectrometer:

Thomson Experiment:

- Thomson first determined the specific charge (charge to mass ratio e/m) of the electron in 1887. In his ex-periment, J. J. Thomson had found a charged particle that had a specific charge two thousand times that of the hydrogen ion, the lightest particle known at that time.

Where q is the charge of electron [C], m is the mass of electron [kg], v is the speed of electron [m/s], B is the magnetic field intensity [T], and r is the radius of the electron's path.

- Thomson observed that glowing of two points when he used the Neon gas and he concluded that there are different atoms for the same element and is called isotopes.

- Mass spectrometry, also called mass spectroscopy, analytic technique by which chemical substances are identified by the sorting of gaseous ions in electric and magnetic fields according to their mass-to-charge ratios. It is used to determine the mass of ions and studying isotopes.

$$\frac{q}{m} = \frac{2V}{B^2 r^2}$$

Where q/m is the ratio of charge of ion to its mass [C/kg], V is the voltage [V], B is the magnetic fild intensity [T], r is the radius of the path of ion.

22. A device that is used to increase or decrease the alternative voltage is ----------:

A Electrical transformer
B Electrical generator
C Alternative current generator
D Direct current generator.

23. An electrical transformer, its primary coil's turns are 300 turns, and it's secondary coil's turns are 8000, if the primary coil connected to alternative voltage 90V, determine the voltage of the secondary coil…

A 2400 V
B 1200 V
C 120 V
D 12 V

Solution: $\frac{N_2}{N_1} = \frac{V_2}{V_1}$ $\quad \frac{8000}{300} = \frac{V_2}{90}$

V2 =(8000/300)x 90 = 2400 V , The answer is A

24. An ideal electrical transformer, its primary coil's turns are 200 turns carries 20 A current, what is the current in the secondary coil with turns of 50 turns?

A 5 A
B 20 A
C 40 A
D 80 A

25. The cathode ray experiment recognizes the …

A Mass of nucleus
B Charge of electron
C Charge of proton
D Mass of electron

26. Which amount equals q/m related to the electron?

A $\frac{B}{vr}$
B $\frac{v}{Br}$
C $\frac{rv}{B}$
D $\frac{Br}{v}$

27. In Thompson experiment , the glowing of two points on the screen of cathode ray tube for Neon gas is concluded as …

A Different atoms for different elements
B Similar atoms for different elements
C Different atoms for the same element
D Similar atoms for the same element

28. To separate Ions with different masses we use the …

A Scanning microscope
B x-ray tube
C Mass spectrometry
D Laser

29. Two charges the value of each one is q, and their masses are m1, m2, get into mass spectrometry, if the radius of the first curved path is r1 and the second is r2=3r1 , so …

A m1 = 3m2
B m2 = 3m1
C m1 = 9m2
D m2 = 9m1

The electric and magnetic field:

- Electromagnetic spectrum: is the range of all types of EM radiation. The other types of EM radiation that make up the electromagnetic spectrum are micro-waves, infrared light, ultraviolet light, X-rays and gamma-rays.
- Electromagnetic waves: or EM waves are waves that are created as a result of vibrations between an electric field and a magnetic field. In other words, EM waves are composed of oscillating magnetic and electric fields.

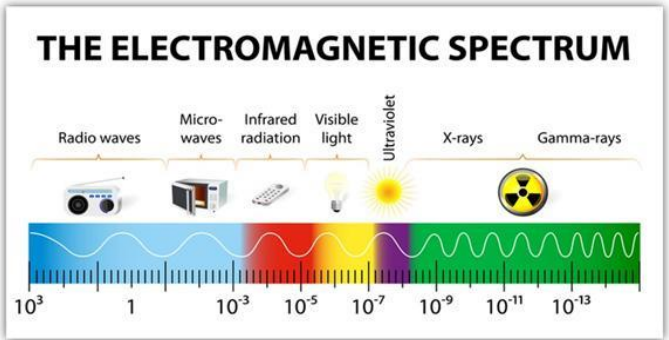
- Electromagnetic waves transfers in insulator materials with speed less than its speed in vacuum, as the relation:

$$v = \frac{c}{\sqrt{k}}$$

Where v is the speed of wave in insulator material [m/s], c is the speed of light in vacuum [m/s], and k is the dielectric constant.

Electromagnetic waves:

- Types of EM waves from the least frequency (great-er wavelength) to greatest frequency (shorter wave-length).



- Properties:
- The frequency is inversely proportional to the wave-length.
- All EM waves transfer in speed of light in vacuum $3x10^8$ m/s.
- The scientist who discovered the x-rays is Roentgen.
- Can be produced:

1. AC source
2. Capacitor – Inductor circuits where connecter in series to generate waves with high energy.
3. Piezoelectricity.

30. How much is the electromagnetic waves in a medium its di electric constant is 4 ? knowing that the speed of light is $3x10_8$ m/s.

A $6x10^8$ m/s
B $3x10^8$ m/s
C $2x10^8$ m/s
D $1,5x10^8$ m/s

Solution:

$V = c/\sqrt{k} = 3 \times 10^8 / \sqrt{4} = 1.5 \times 10^8$m/s ,
Answer is D

31. A student reads examples about electromagnetic waves I a scientific magazine, which of the following waves is not included in the examples?

A Radio waves
B Television waves
C Microwaves
D Sound waves

32. The waves with the longest wavelength are …

A Radio waves
B Gamma rays
C x-rays
D microwaves

33. The microwaves and radio waves have the same…

A frequency
B Wavelength
C Speed
D energy

34. Microwaves and radio waves have the same properties except that they…

A are electromagnetic waves
B have the same wavelength
C transfer in vacuum at the same speed
D don't need a medium to transfer

35. The x- rays have…

A High frequency and wavelength
B High frequency and low wavelength
C Low frequency and wavelength
D Low frequency and high wavelength

36. The scientist who discovered the x- rays is …

A Faraday
B Hertz
C Roentgen
D Maxwell

37. To generate high energy electromagnetic waves, we use an inductor connected with a…

A Capacitor in series
B Capacitor in parallel
C Resis tance in series
D Resistance in parallel

Chapter 8 Answers

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
B	C	C	D	C	C	C	C	C	B	A	A	D	B	A	D	A	D	A	D

21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37
A	A	A	D	D	B	C	C	D	D	D	A	C	B	B	C	A