

1. Define e.m.f

The energy required to maintain potential difference between the ends of a conductor is called electro motive force (e.m.f)

2. State the SI unit of potential difference and emf.

The SI unit of potential difference and emf is volt.

3. Define electromagnetic induction.

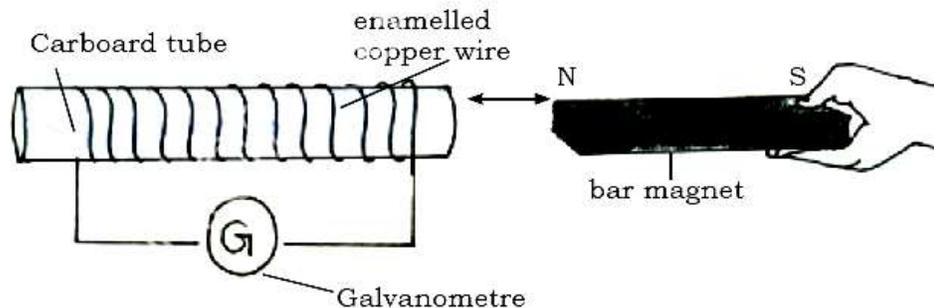
The phenomenon in which electro motive force (emf) is induced in the circuit when the magnetic field linked with a circuit changes is called electromagnetic induction.

4. Explain Faraday experiment to illustrate the phenomenon of electromagnetic induction.

Faraday wound a long copper wire on a cardboard cylinder. He wound twine between the turns and placed calico cloth between the layers. He moved a pole of bar magnet quickly into the coil. The deflection in the galvanometer indicated electric current in the coil. When the magnet was at rest inside the coil, no electricity was produced. When he pulled the magnet out of the coil, the galvanometer deflected in the opposite direction.

The amount of deflection, increased with increase in the speed of the magnet.

This experiment shows that magnetic field can produce electricity

**5. Give reason: In the experiment conducted by Faraday the induced electric current was not DC.**

The deflection in the galvanometer was to one side when the magnet was pushed in and the deflection was to opposite side when the magnet was taken out. Hence it was AC and not DC.

6. What is a galvanometer? What is its use?

Galvanometer is a device used to measure the electric current flowing through a conductor.

7. What is induced current?

The electric current produced in the circuit when magnetic field linked with a circuit changes is called induced current.

8. Can a static magnet induce an e.m.f in a stationary coil of wire? Give reasons.

No, when both coil and magnet are stationary, the magnetic field linked with the coil remains constant. Only when the magnetic field linked with the coil changes, current is produced.

9. On what factors does the induced emf in the coil depend?

Induced e.m.f in a coil increases with increase in:

- a) the number of turns of the coil,
- b) the strength of the magnetic field
- c) the speed with which the magnet or the coil moves
- d) area of the coil

10. State Faraday's first law of electro-magnetic induction.

Whenever a magnetic field linked with a conductor changes, an induced e.m.f is generated in the conductor.

11. State Faraday's second law of electromagnetic induction.

The Magnitude of the induced e.m.f is directly proportional to the rate of change of magnetic field linking the conductor.

12. State Fleming's right hand rule or Dynamo rule.

Arrange the first three fingers of the right hand mutually perpendicular to each other; if the fore finger indicates the direction of magnetic field, the thumb in the direction of motion of the conductor, then the middle finger indicates the direction of the induced e.m.f

13. What should be the angle between the thumb (main) finger and the central finger in Fleming's rule? What does each finger indicate?

The angle between the thumb and the central finger must be 90° . Fore finger indicates direction of magnetic field, thumb indicates direction of mechanical force / motion of conductor and the central finger indicates the direction of induced current or electric current.

14. Mention the applications of electromagnetic induction.

The three devices which work on the principle of electromagnetic induction are:

- a) A.C. and D.C. Dynamo
- b) Transformer
- c) Induction coil

15. What is a dynamo?

A dynamo is a device which converts mechanical energy into electrical energy.

16. On what principle does a dynamo work?

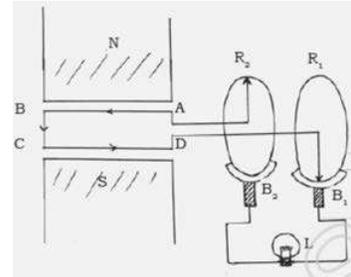
Dynamo works on the principle of electromagnetic induction.

17. What is an AC dynamo?

A dynamo that produces an alternating current is called AC dynamo.

18. Briefly explain the construction and working of an AC Dynamo or generator.

Construction: An AC dynamo or generator consists of an insulated copper coil of many turns wound over a soft iron core. In the figure ABCD represents the insulated coil. The coil is placed between the pole pieces of a concave cylindrical magnet. The free ends of the copper wire are connected to two copper rings R_1 and R_2 . Two carbon brushes B_1 and B_2 touch the rings R_1 and R_2 . The brushes are connected to the external load L.



Working: When the coil is made to rotate in clockwise direction, the magnetic field linked with the coil changes. This induces an electric current in the coil ABCD. During the first half of the rotation, the current flows along ABCD R_1 B_1 B_2 . During the second half of the rotation current is induced in the coil along DCBA R_2 B_2 B_1 .

19. Draw a neat diagram of AC dynamo

20. What an armature?

The coil of insulated copper wire wound over a core of soft iron is called armature.

21. How does the armature rotate in the following?

- Bicycle dynamo: The friction between moving tyre and the cylindrical head of the armature.
- Hydro-electric power station: Turbines rotate by the flow of water.
- Nuclear power reactor: Turbines rotate by the flow of steam.
- Windmills: Turbine rotate by the force of wind.

22. What is the voltage and the frequency of the A.C source supplied to our homes and industries?

The voltage range of domestic AC is 230 to 250 volts.

The frequency of A.C source is 50 Hz or 50 cycles per second.

23. Write the graphical representation of the alternating current.



24. Mention the uses of alternating current.

1. Alternating current is used in domestic appliances like lamps, heaters, fans, ovens, radio etc.
2. It is used to produce required frequency of radio waves for radio and T.V transmission.
3. It is used for RADAR and wireless communication.
4. It is used to produce ultrasonic waves used in industries, ultrasound scanning and SONAR.

25. When is the magnitude of induced current maximum and minimum?

Induced current is maximum when the plane of the coil is perpendicular to the plane of the coil.

Induced current is minimum when the plane of the coil is parallel to the plane of the coil.

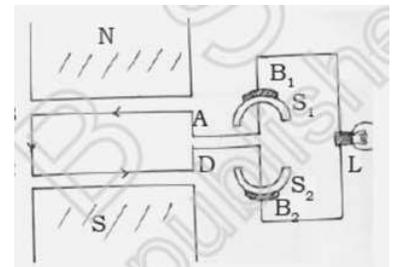
26. What is a DC dynamo?

A dynamo that produces a "direct current" is called DC dynamo.

27. Briefly explain the construction and working of a DC Dynamo.

Construction:

A DC dynamo consists of an insulated copper coil of many turns wound over a soft iron core. In the figure ABCD represent the insulate coil. The coil is placed between the pole pieces of concave cylindrical magnets. The free ends of the copper wire are connected to two half rings S1 and S2 called split ring. Two carbon brushes B1 and B2 touch split rings S1 and S2. The brushes are connected to the external load L.



Working:

When the coil is made to rotate in the clock wise direction, the magnetic field linked with the coil changes and induces an electric current in the coil ABCD. During the first half of the rotation, current flows along ABCD S₁B₁ L B₂. During the second half of the rotation of the coil, current is induced in the coil in the direction DCBA S₂ B₁ L B₂. Since the current flows in the same direction in both the cycles this current is called direct current.

28. Draw a neat diagram of the DC Dynamo.

29. Write the graphical representation of the direct current.



30. Give reason: Split rings are used instead of slip rings to construct DC dynamo

Split rings make the current to flow in the same direction in the external circuit in both cycles.

31. What should be the type of source of electric current to get electric current of constant magnitude?

Direct current

32. What is a commutator?

The two half rings or split rings used to produce current in the same direction in a DC dynamo is called commutator.

33. Give reason: A.C cannot be used for electrolysis.

In electrolysis the ionisation of the electrolyte takes place where the positive and negative charges move towards opposite electrodes. But if we pass an alternating current the

polarity of the electrodes will be continuously changing and the ions will not be attracted toward any particular electrode resulting in no ionisation. Hence electrolysis cannot take place with alternating current.

34. Mention the differences between an AC dynamo and a DC dynamo.

AC dynamo	DC dynamo
1) The two ends of the coil are connected to two full rings of copper.	1) The two ends of the coil are connected to a commutator consisting of two half rings of copper.
2) The direction of current produced changes every half revolution.	2) The direction of current produced is same in both revolutions

35. What is an electric motor?

An electric motor is a device that converts electric energy into mechanical energy.

36. On what principle does an electric motor work?

An electric motor utilizes the magnetic effect of current. It works on the principle that a conductor carrying current in a magnetic field experiences a mechanical force.

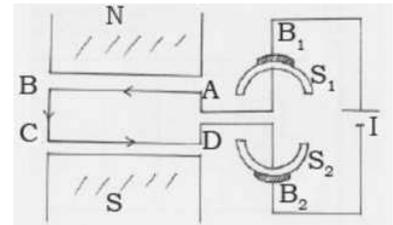
37. State Fleming's left hand rule (motor rule).

If the first three fingers of the left hand are held mutually perpendicular to each other such that the finger points in the direction of magnetic field, the middle finger points in the direction of current, then the thumb points in the direction of mechanical force acting on the conductor.

38. Explain the construction and working of a DC motor.

Construction: An electric motor consists of a rectangular coil ABCD of insulated copper wire, wound on a soft iron core. The coil is mounted between the concave cylindrical poles of a permanent magnet in such a way that it can rotate between the poles N and S. The two ends of coil are connected to the two half rings S_1 and S_2 of a commutator.

Two carbon brushes B_1 and B_2 are kept in contact with the split rings. The brushes are connected to the poles of a battery.



Working: When electric current is passed through the coil in the direction ABCD, it sets up a magnetic field which is at right angles to the plane of the coil and a mechanical force acts on its limbs in opposing direction. Therefore the coil begins to rotate about its axis.

During the first half of its rotation S_1 is in contact with B_2 . When S_2 comes in contact with B_1 electric current flows in the coil in DCBA, due to the magnetic momentum picked up by the coil during its rotation, it continues rotating. Thus a motor converts electrical energy into mechanical energy.

39. Mention the devices that work on AC motor.

Electric fans, electric mixer, electric grinder, washing machine work on AC source.

40. Mention the differences between a dynamo & a motor.

Dynamo	Motor
1) It converts mechanical energy into electric current.	1) It converts electrical energy into mechanical energy.

2) The coil is rotated in an electric field by an external force. It induces an electric current of the coil of the motor.

2) Current is supplied to the coil resulting in the rotation of the coil of the motor.

41. What determines the frequency of AC produced in a generator?

The number of rotations of the coil in one second determines the frequency of a AC generator.

42. What is the effect on the magnitude of emf generated in an AC generator if the speed of rotation is increased?

The magnitude of emf generated increases.

43. Suggest two ways in an AC dynamo to produce a higher emf.

- a) By increasing the speed of rotation of coil
- b) By increasing the number of turns of the coil.

44. In an AC dynamo, the speed at which the coil rotates is doubled. How would this affect a) the frequency of output voltage b) the maximum output voltage?

- a) Frequency is doubled
- b) Maximum output voltage is doubled.

45. What energy conversion does take place in a dynamo when it is in use?

Mechanical energy changes into electrical energy.

46. A cyclist riding a cycle fitted with a dynamo to a tyre gets bright light in the bulb connected, when he pedals fast. Why?

More magnetic lines of force change with respect to the coil, leading to more current being produced.

47. Give reason: Stationary coil and stationary magnet cannot produce induced electric current.

An emf is induced in the coil only when there is relative motion between the coil and the magnet.

48. What is a transformer?

A transformer is a device which is used for increasing or decreasing the AC voltage.

49. On what principle does a transformer work?

Transformer works on the principle of electromagnetic induction.

50. Draw the symbolic representation of transformer.

51. What is meant by mutual induction?

The production of induced e.m.f in secondary coil due to change of current in a neighbouring primary coil is called mutual induction.

52. What is a step up transformer?

A transformer which increases the input voltage of an AC source is called a step up transformer.

53. What is a step down transformer?

A transformer which decreases the input voltage of the AC source is called step down transformer.

54. What are primary and secondary coil in a transformer?

The coil which is connected to input source is called primary coil. The coil which is connected to the output source is called secondary coil.

55. Mention the factors on which the magnitude of the e.m.f induced in the transformer depends.

- 1) E.m.f in the primary coil
- 2) Number of turns in the primary coil
- 3) Number of turns in the secondary coil
- 4) The core material

56. Write the relationship between the voltage and number of turns of primary and secondary coils of a transformer.

$$\frac{\text{emf in the secondary}}{\text{emf in the primary}} = \frac{\text{Number of turns in the secondary}}{\text{Number of turns in the primary}}$$

$$\frac{V_s}{V_p} = \frac{N_s}{N_p}$$

57. Write the relationship between the Current and voltage in primary and secondary coils of a transformer.

$$\frac{\text{emf in the secondary}}{\text{emf in the primary}} = \frac{\text{Current in the primary}}{\text{Current in the secondary}}$$

$$\frac{V_s}{V_p} = \frac{I_p}{I_s}$$

58. Mention the differences between step up & step down transformer.

Step Up Transformer	Step down Transformer
It is used to increase the AC voltage	It is used to decrease the AC voltage
Primary coil has less number of turns than that of secondary coil	Primary coil has more number of turns than that of the secondary coil.
Primary coil is thicker than that of the secondary coil	Primary coil is thinner than that of the secondary coil
The turns ratio $N_s/N_p > 1$	The turns ratio $N_s/N_p < 1$

59. If an AC source of 250 volts has to be stepped down to 10 volts, what should be the turns ratio of the primary coil and secondary coil?

60. A primary of 800 turns is connected to a 220V AC supply and the secondary has 8 turns. What will be the output voltage?
61. A transformer is designed to work from 240V AC mains and to give a supply of 8V to ring a house-bell. The primary coil has 4800 turns. How many turns would you expect the secondary to have?
62. The input and output voltages of a transformer are 220V and 44V respectively. Find the turns ratio.
63. A transformer lowers e.m.f from 220 volts to 12 volts. If the number of turns in primary is 8800, how many turns are in secondary coil?
64. Applying e.m.f to primary coil is 210V. If the number of turns in primary coil is 200 turns and that of in secondary is 20 turns then find the output voltage. Name the transformer.

65. If the primary of a transformer has 10 turns and the secondary of the transformer has 200 turns. What type of transformer is it? Express mathematical form related to this.

It is a step up transformer. $\frac{V_s}{V_p} = \frac{N_s}{N_p}$

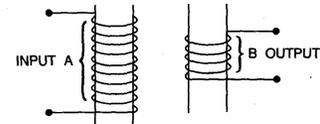
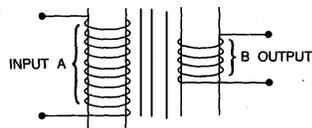
66. Name the device you would use to convert 200 V AC to 15V AC.

Step down transformer.

67. Name the parts labelled A and B. What is the material of this part? Is this transformer a step-up or step-down? Give reason.

The part A is the primary coil. Part B is secondary coil

The complete diagram is



The material is made from thin laminated sheets of soft iron.

The diagram is of step-down transformer as the number of turns in the primary coil is more than that of the secondary.

68. The secondary coil of a transformer in which the voltage is stepped down are usually made of thicker wire than primary. Why?

The secondary coil is made of thicker wire to sustain larger electric current.

69. What is an induction coil?

Induction coil is a device which is used to obtain high D.C voltage from a low voltage DC source.

70. Briefly explain the construction and working of an induction coil.

Construction: An induction coil consists of a primary P having few turns of thick insulated copper wire wound over a soft iron core connected to a battery. It also has a secondary coil S of larger number turns wound over the primary coil. It has a make & break arrangement.

Working: When a direct current flows in the primary, the core C gets magnetized and attracts the head of the switch M. The circuit breaks and current in the primary stops. C gets demagnetized and H comes back. The process repeats. During the make break of the circuit, large e.m.f is induced in the secondary coil.

71. Draw a neat diagram of an induction coil and label the parts.

72. State the functions of the following components in a dynamo /motor.

- a) Commutator: It is used to alter the direction of the current in the coil after every half rotation.
- b) Carbon brushes: it is used to supply a continuous current to the rotating coil through the commutator.

Fill in the blanks:

1. When a current carrying conductor experiences highest mechanical force, the angle between the direction of the conductor and the magnetic field is **90°**.
2. A device which converts mechanical energy into electricity is **dynamo**.
3. The relation between the directions of electric current in magnetic field and the mechanical force acting on the conductor is given by **Fleming's left hand rule**.
4. In a conductor, a changing magnetic field linking a conductor induces **electromagnetic force**.
5. The number of times direction of electric current changes when the armature of an AC dynamo makes five cycles is **ten**.
6. A device which works on the principle that a current carrying conductor experiences a mechanical force in a magnetic field is **electric motor**.
7. The SI unit of electro motive force is **volt**.
8. The type of current required for depositing copper on cathode during electrolytic refining of copper is **direct current**.
9. The current that changes its direction every half rotation is called **Alternating current**.
10. The type of electric current we get in our home is **Alternating current**.
11. The frequency of alternating current we get in our home is **50Hz or 50 cycles**.
12. The device which converts AC emf into DC voltage is called **rectifier**.
13. The conversion of energy in a dynamo is **mechanical energy to electrical energy**.
14. The frequency of the alternating current is **the same** as the frequency with which armature rotates.
15. In a bicycle dynamo the friction between moving tyre and the cylindrical head of the armature make the armature rotate.
16. In nuclear power reactor, the turbines rotate by the **flow of steam**.
17. In AC dynamo, the magnitude of induced current is zero when the plane of the coil is **parallel** to the direction of magnetic field.
18. In AC dynamo, the magnitude of induced current is **maximum** when the plane of the coil is **perpendicular** to the direction of magnetic field.
19. The conversion of energy in a motor is **electrical energy to mechanical energy**.
20. A transformer works on the principle of electromagnetic induction.
21. The production of induced e.m.f in secondary coil due to change of current in a neighbouring primary coil is called **mutual induction**.
22. A transformer which increases the input voltage of an AC source is called a **step up transformer**.

23. A transformer which decreases the input voltage of the AC source is called **step down transformer**.
24. The coil which is connected to input source is called **primary coil**.
25. The coil which is connected to the output source is called **secondary coil**.
26. The magnitude of the emf induced in the secondary coil of a transformer depends on emf of primary / number of turns in primary / number of turns in the secondary / core material.
27. $\frac{N_s}{N_p}$ is called turns ratio of the transformer.
28. The number of turns in the primary of a step up transformer is **less than** that of the secondary.
29. The number of turns in the primary of a step down transformer is **more than** that of the secondary.
30. The device which is used to obtain high D.C voltage from a low voltage DC source is called **induction coil**.
31. A, B and C are the three coils of conductor having different number of turns, wound around a soft iron ring as shown in the figure. Ends of coils B and C are connected to the galvanometers. The observation that can be made when ends of coil A are connected to an A.C. source is **induced electric current is more in B than in C**.

