1. Faraday's law of electromagnetic induction states that the induced emf in a circuit is:

A) Directly proportional to magnetic field
B) Directly proportional to rate of change of magnetic flux
C) Inversely proportional to time
D) Independent of magnetic flux

Answer: B
Explanation: The emf is directly proportional to the rate of change of magnetic flux through the circuit.

2. The SI unit of magnetic flux is:

A) Weber
B) Tesla
C) Gauss
D) Henry

Answer: A
Explanation: Magnetic flux is measured in Weber (Wb), which is the SI unit.

3. Lenz’s law is in accordance with the law of:

A) Conservation of charge
B) Conservation of energy
C) Conservation of momentum
D) Conservation of mass

Answer: B
Explanation: Lenz’s law ensures that the induced current opposes the cause, conserving energy.

4. The magnetic flux through a coil changes from 5 Wb to 0 Wb in 0.01 s. The average emf induced is:

A) 0.5 V
B) 50 V
C) 500 V
D) 5 V

Answer: C

Explanation: emf = $\Delta\Phi / \Delta t = (5 - 0) / 0.01 = 500$ V

5. A coil of area 0.1 m^2 with 100 turns is placed in a uniform magnetic field of 0.2 T. The maximum magnetic flux through the coil is:

A) 1 Wb
B) 2 Wb
C) 0.2 Wb
D) 0.1 Wb

Answer: B
Explanation: $\Phi = N \times B \times A = 100 \times 0.2 \times 0.1 = 2$ Wb

6. When a magnet is moved towards a coil, the induced current in the coil:

A) Is always zero
B) Opposes the motion of the magnet
C) Aids the motion of the magnet
D) Is in the same direction as the magnet

Answer: B
Explanation: According to Lenz's law, the induced current opposes the motion of the magnet.

7. A straight wire of length 2 m is moved perpendicular to a magnetic field of 0.5 T with a speed of 3 m/s. The emf induced is:

A) 3 V
B) 2 V
C) 1.5 V
D) 0.5 V

Answer: A
Explanation: emf = $B \times l \times v = 0.5 \times 2 \times 3 = 3$ V

8. Which of the following does not cause electromagnetic induction?

A) Changing the magnetic field

B) Rotating a coil in a magnetic field
C) Moving a magnet inside a coil
D) Keeping a magnet stationary inside a coil

Answer: D
Explanation: No change in magnetic flux occurs if the magnet is stationary.

9. The self-inductance of a coil is 2 H. If the current changes from 0 to 5 A in 0.2 s, the emf induced is:

A) 25 V
B) 20 V
C) 50 V
D) 10 V

Answer: C
Explanation: emf = $L \times (\Delta I / \Delta t) = 2 \times (5 / 0.2) = 50$ V

10. The direction of induced current in a coil is given by:

A) Fleming's left-hand rule
B) Right-hand thumb rule
C) Lenz's law
D) Ampere's law

Answer: C
Explanation: Lenz's law gives the direction of the induced current.

11. Mutual induction depends on:

A) Number of turns in the coil
B) Permeability of the medium
C) Area of cross-section
D) All of these

Answer: D
Explanation: All these factors affect mutual induction between two coils.

12. A rectangular coil is placed in a uniform magnetic field. Maximum emf is induced when:

A) Coil is parallel to the field
B) Coil is perpendicular to the field
C) Coil rotates about an axis perpendicular to the field
D) No motion is given

Answer: C
Explanation: Maximum change in magnetic flux occurs in this configuration.

13. A transformer works on the principle of:

A) Self-induction
B) Mutual induction
C) Electrostatic induction
D) Resonance

Answer: B
Explanation: Transformers use mutual induction between primary and secondary coils.

14. In a transformer, the current in the secondary coil increases when:

A) The primary coil current is constant
B) The magnetic flux changes rapidly
C) Both coils are disconnected
D) There is no magnetic core

Answer: B
Explanation: A rapid change in flux leads to greater induced emf and current.

15. In an AC generator, maximum emf is produced when the coil:

A) Is parallel to the magnetic field
B) Is perpendicular to the magnetic field
C) Rotates at low speed
D) Is at rest

Answer: A

Explanation: Maximum rate of change of flux happens when the coil cuts the magnetic field lines perpendicularly during rotation.

16. In an ideal transformer, the power output is:

A) Greater than power input
B) Less than power input
C) Equal to power input
D) Zero

Answer: C
Explanation: An ideal transformer has no energy loss, so input power = output power.

17. The coefficient of self-induction of a coil depends on:

A) Number of turns
B) Cross-sectional area
C) Length and permeability of core
D) All of the above

Answer: D
Explanation: Self-inductance depends on the coil's geometry and the material of the core.

18. A transformer cannot work with:

A) DC supply
B) AC supply
C) Variable AC supply
D) High-frequency AC

Answer: A
Explanation: A DC supply does not produce changing magnetic flux, hence no induction occurs.

19. A current of 5 A through a coil changes to zero in 0.1 s and induces 50 V emf. The self-inductance is:

A) 0.1 H
B) 1 H

C) 5 H
D) 10 H

Answer: B
Explanation: L = emf × time / change in current = 50 × 0.1 / 5 = 1 H

20. A transformer has 100 turns in the primary and 200 in the secondary. If input is 220 V, output voltage is:

A) 110 V
B) 220 V
C) 440 V
D) 660 V

Answer: C
Explanation: $V_2 = (N_2/N_1) \times V_1 = (200/100) \times 220 = 440$ V

21. The energy stored in an inductor is given by:

A) $L \times I^2$
B) $1/2 \times L \times I^2$
C) $1/2 \times I \times L$
D) L / I^2

Answer: B
Explanation: The energy stored in the magnetic field of an inductor is $U = 1/2 \times L \times I^2$.

22. A conducting rod of length 1 m is moved at 4 m/s in a magnetic field of 2 T perpendicular to it. Induced emf is:

A) 2 V
B) 4 V
C) 6 V
D) 8 V

Answer: D
Explanation: emf = B × l × v = 2 × 1 × 4 = 8 V

23. Which of the following quantities is conserved in an inductor circuit when current changes?

A) Charge
B) Energy
C) Magnetic flux
D) Power

Answer: B
Explanation: Inductors store energy in the magnetic field and conserve it momentarily during current changes.

24. When the rate of change of current is doubled in an inductor, the self-induced emf:

A) Becomes half
B) Doubles
C) Remains the same
D) Becomes zero

Answer: B
Explanation: emf $\propto$ dI/dt, so doubling the rate doubles the emf.

25. The mutual inductance between two coils depends on:

A) Number of turns in both coils
B) Distance between coils
C) Relative orientation
D) All of these

Answer: D
Explanation: All factors affect the coupling and thus mutual inductance.

26. A metallic ring is placed near a current-carrying conductor. If current in the conductor increases, the induced current in the ring is:

A) Clockwise
B) Anticlockwise
C) Zero
D) Depends on orientation

Answer: B
Explanation: By Lenz's law, the induced current will oppose the increase in magnetic flux.

27. The direction of emf induced in a moving conductor is given by:

A) Fleming's left-hand rule
B) Lenz's law
C) Right-hand grip rule
D) Fleming's right-hand rule

Answer: D
Explanation: Fleming's right-hand rule gives the direction of induced emf.

28. An AC generator produces maximum emf when:

A) Coil is perpendicular to magnetic field
B) Coil is parallel to magnetic field
C) Coil rotates at uniform speed
D) Rate of change of flux is maximum

Answer: D
Explanation: Maximum emf occurs when the rate of change of magnetic flux is highest.

29. The value of induced emf becomes zero when:

A) Flux is maximum
B) Flux is minimum
C) Rate of change of flux is zero
D) Magnetic field is zero

Answer: C
Explanation: emf $\propto$ rate of change of flux. If the rate is zero, emf is zero.

30. Eddy currents are produced in:

A) Insulators
B) Conductors placed in changing magnetic field

C) Conductors at rest in a constant magnetic field
D) None of these

Answer: B
Explanation: Eddy currents are induced in conductors due to changing magnetic flux.

31. An inductor of inductance 2 H carries a current of 3 A. Energy stored in the inductor is:

A) 3 J
B) 6 J
C) 9 J
D) 18 J

Answer: C
Explanation:
Energy = $(1/2) \times L \times I^2 = 0.5 \times 2 \times 9 = 9$ J

32. When the number of turns in a coil is doubled, the self-inductance becomes:

A) Half
B) Double
C) Four times
D) Same

Answer: C
Explanation:
Self-inductance $L \propto N^2$, so doubling N makes L four times.

33. The SI unit of magnetic flux is:

A) Tesla
B) Henry
C) Weber
D) Gauss

Answer: C
Explanation:
Weber (Wb) is the SI unit of magnetic flux.

34. A copper ring is dropped over a bar magnet. As it approaches the magnet, the ring:

A) Accelerates
B) Moves at constant speed
C) Slows down
D) Reverses direction

Answer: C
Explanation:
Induced currents oppose motion (Lenz's law), so it slows down.

35. A coil has 200 turns and flux through it changes from 2 Wb to 0 in 0.5 s. Induced emf is:

A) 400 V
B) 200 V
C) 800 V
D) 100 V

Answer: C
Explanation:
emf = $N \times \Delta\Phi / \Delta t = 200 \times 2 / 0.5 = 800$ V

36. The induced emf in a coil is independent of:

A) Magnetic field strength
B) Area of coil
C) Resistance of coil
D) Rate of change of magnetic flux

Answer: C
Explanation:
emf depends on flux change, not on resistance (affects current, not emf).

37. The direction of induced current always opposes the cause that produces it. This is:

A) Faraday’s law

B) Ampere’s law
C) Lenz’s law
D) Ohm’s law

Answer: C
Explanation:
Lenz’s law describes the opposition to the cause of induction.

38. Which of the following reduces eddy current losses?

A) Thick iron core
B) Air core
C) Laminated iron core
D) Solid steel core

Answer: C
Explanation:
Laminations reduce eddy currents by increasing resistance.

39. A wire loop of area 0.01 m^2 is perpendicular to a magnetic field. If B changes from 3 T to 0 in 0.2 s, the average emf is:

A) 0.15 V
B) 1.5 V
C) 0.3 V
D) 0.6 V

Answer: B
Explanation:
emf = $\Delta\Phi / \Delta t = (0.01 \times 3) / 0.2 = 0.03 / 0.2 = 0.15$ V

40. Which of these applications uses electromagnetic induction?

A) Electric bell
B) Transformer
C) Heating coil
D) Galvanometer

Answer: B
Explanation:
Transformer works on the principle of electromagnetic induction.

41. If a magnet is moved inside a coil, the induced current depends on:

A) Magnetic field strength only
B) Coil resistance
C) Rate of motion of magnet
D) Material of magnet

Answer: C
Explanation:
Faster motion changes flux more rapidly → higher emf.

42. A transformer has an efficiency of 90%. If input power is 1000 W, the output power is:

A) 100 W
B) 900 W
C) 1100 W
D) 990 W

Answer: B
Explanation:
Efficiency = output/input = 900/1000 → Output = 90% of 1000 = 900 W

43. A coil with inductance L and resistance R is connected to a battery. The current:

A) Rises immediately to maximum
B) Falls gradually
C) Rises gradually
D) Remains zero

Answer: C
Explanation:
Inductor resists change → current builds gradually.

44. A transformer is used to:

A) Generate electricity
B) Convert AC to DC
C) Increase/decrease voltage
D) Store electrical energy

Answer: C
Explanation:
Transformers change AC voltage levels.

45. In an AC generator, the peak emf depends on:

A) Angular velocity
B) Magnetic field strength
C) Number of turns
D) All of these

Answer: D
Explanation:
$emf_o = NAB\omega \rightarrow$ All factors affect maximum emf.