

Wollo University, College of Natural Science,
Department of physics
By: Tegenu Argaw (Assistance professor)

Course title: Electromagnetism (phys2002)
Exit exam from chapter Five to Twelve

I) Choose the best answer for the following questions

1. Which one of the following is true?

- A) Magnetic monopole doesn't exist.
- B) A magnet is a substance that generates electric field.
- C) In magnet similar poles attract each other.
- D) Magnetic field lines cross each other.
- E) None

2. A straight wire of length ℓ carries current I . When it is bent into a circular loop of radius r , the magnetic field at its center is B . If it is bent into a loop of two turns the magnetic field at its center is B_1 . Then, which of the following relations is correct?

- | | |
|------------------------|--------------|
| A) $B_1 = \frac{B}{4}$ | D) $B_1 = B$ |
| B) $B_1 = \frac{B}{2}$ | E) None |
| C) $B_1 = 4B$ | |

3. A constant current of 2.0 A is flowing through a long thick copper wire held horizontally in East-West direction. If the direction of current in the wire is reversed, the direction of magnetic field produced would be from North to South

- A) above only at the mid point of the wire
- B) below only at the mid point of the wire
- C) above at all the points of the wire
- D) below at all the points of the wire
- E) None

4. Three infinity length of long wires, each carrying equal current are placed in the xy-plane along $x=0$, $x=d$, and $x=-d$, On the xy-plane the magnetic field become zero at————.

- | | |
|---------------------------------------|---------------------------------|
| A) $x = \pm \frac{d}{2}$ | D) $x = \pm \frac{d}{\sqrt{3}}$ |
| B) $x = \pm [1 + \frac{d}{\sqrt{3}}]$ | E) None |
| C) $x = \pm [1 - \frac{d}{\sqrt{3}}]$ | |

5. A moving electric charge produces —————.

- | | |
|----------------------------|---------------------------------------|
| A) $\vec{E}$ and $\vec{B}$ | C) $\vec{B}$ only |
| B) $\vec{E}$ only | D) neither of $\vec{E}$ and $\vec{B}$ |
| | E) None |

6. ————— is a field that produced by accelerated charged particle.

- | | |
|-------------------|--------------------------|
| A) Electric field | D) Electromagnetic field |
| B) Magnetic field | E) None |
| C) static field | |

7. An electromagnet is —————.

- | | |
|------------------------|------------------------------------|
| A) a temporary magnet | D) neither temporary nor permanent |
| B) a permanent magnet | E) None |
| C) not a strong magnet | |

8. The magnetic field lines inside a current carrying long solenoid are in the form of —————.

- | | |
|--------------|----------------------------|
| A) ellipse | D) parallel straight lines |
| B) parabola | E) None |
| C) hyperbola | |

9. Which one of the following statement is correct about the magnetic field inside current carrying solenoid?

- A) The $\vec{B}$ inside solenoid is zero.
 B) The $\vec{B}$ inside solenoid is uniform at all the points.
 C) The $\vec{B}$ inside solenoid increases as we move toward the ends.
 D) The $\vec{B}$ inside solenoid decreases as we move toward the ends.
 E) None

10. Two parallel wires, separation d carrying current I_a and I_b in the same direction will have the force on a length ℓ of either wire is

- A) $\frac{\mu_0 I_a I_b}{2\pi d}$, repulsion
 B) $\frac{\mu_0 I_a I_b}{\pi d}$, attraction
 C) $\frac{\mu_0 I_a I_b}{\pi d}$, repulsion
 D) $\frac{\mu_0 I_a I_b}{2\pi d}$, attraction
 E) None

11. Ampere circuital law state that ———.

- A) $\oint \vec{B} \cdot d\vec{\ell} = \mu_0 I$
 B) $\oint \vec{B} \cdot d\vec{\ell} = \mu_0 I$
 C) $\vec{\nabla} \times \vec{B} = I$
 D) $\vec{\nabla} \cdot \vec{B} = I$
 E) None

12. A magnetic needle is kept in non-uniform $\vec{B}$. It experiences ———.

- A) a force, but not torque
 B) a force and a torque
 C) a torque, but not a force
 D) undetermined
 E) None

13. A circular coil of radius 0.5 m and 100 turns carrying a current of 80.0mA is placed such that the normal to its plane make an angle of 30.0° with uniform magnetic field of 0.40 T. What is the magnitude of torque acting on the coil?

- A) 4π Nm
 B) 6π Nm
 C) 2π Nm
 D) 8π Nm
 E) None

14. A current of 10.0A is passing through a long wire which is semicircular with radius of 20.0cm as shown in Figure below. What is the magnetic field produced at the center of loop?



- A) $10.0\pi\mu\text{T}$
 B) $5.0\pi\mu\text{T}$
 C) $4.0\pi\mu\text{T}$
 D) $2.0\pi\mu\text{T}$
 E) None

15. The torque acting on current carrying loop placed in magnetic field does not depend on ———.

- A) shape of loop
- B) area of loop
- C) value of current
- D) magnetic field
- E) None

16. A charge of 0.2C moves with velocity $\vec{v} = (3\hat{i} + 4\hat{j})\text{m/s}$ in uniform magnetic field of $5.0\hat{k}\text{T}$. What is the magnetic force experienced by charge?

- A) $(4\hat{i} + 3\hat{j})\text{N}$
- B) $(4\hat{i} - 3\hat{j})\text{N}$
- C) $(3\hat{i} - 4\hat{j})\text{N}$
- D) $(-4\hat{i} + 3\hat{j})\text{N}$
- E) None

17. A proton and α -particle, having kinetic energies of k_p and k_α respectively enter into magnetic field at right angles. The ratio of the radii of trajectory of proton to α -particle is 2:1. What is the ratio of k_p to k_α ?

- A) 1:4
- B) 4:1
- C) 8:1
- D) 1:8
- E) None

18. In Faraday's law of electromagnetic induction, an emf is induced in a conductor whenever it—.

- A) lies perpendicular to magnetic flux
- B) lies in $\vec{B}$.
- C) cuts magnetic flux
- D) moves parallel to the direction of $\vec{B}$.
- E) None

19. Which one of the following circuit element stores energy in electromagnetic field?

- A) Inductor
- B) Resistor
- C) Capacitor
- D) variable resistor
- E) None

20. The direction of induced emf can be found by — .

- A) Lenz's law
- B) Faraday's law
- C) Laplace's law
- D) Kirchhoff's law
- E) None

21. The magnitude of induced emf in a conductor depends on the ——— .

- A) flux density of $\vec{B}$
 B) amount of flux cuts
 C) amount of flux linkages
 D) rate of change of flux linkages
 E) None

22. Which one of the following circuit element will oppose the change in circuit element?

- A) Capacitance
B) Inductance
C) Resistance
D) All are answers
E) None

23. Which one of the following gives the correct equation for Gauss's law of magnetism?

- A) $\oint \vec{E} \cdot d\vec{A} = \frac{q}{\epsilon_0}$
 B) $\oint \vec{E} \cdot d\vec{A} = 0$
 C) $\oint \vec{B} \cdot d\vec{A} = 0$
 D) $\oint \vec{B} \cdot d\vec{A} = \frac{q}{\epsilon_0}$
 E) None

24. Which one of the following explain the non-existence of magnetic monopoles?

- A) Faraday's law
B) Lenz's law
C) Gauss's law of magnetism
D) Henry's law
E) None

25. Maxwell equations for Faraday's law is ——— .

- A) $\vec{\nabla} X \vec{H} = \frac{d\vec{B}}{dt} + \vec{J}$ C) $\vec{\nabla} \cdot \vec{B} = \rho$
 B) $\vec{\nabla} X \vec{E} = -\frac{d\vec{B}}{dt}$ D) $\vec{\nabla} \cdot \vec{E} = \rho$
 E) None

26. A capacitor of capacitance 'C' connected across an AC source of voltage V is given by $V = V_0 \sin(\omega t)$. The displacement current between the plates of capacitor is given by _____ .

- A) $I_d = V_0 \omega C \sin(\omega t)$
 B) $I_d = V_0 \omega C \cos(\omega t)$
 C) $I_d = (\frac{V_0}{\omega C}) \sin(\omega t)$
 D) $I_d = (\frac{V_0}{\omega C}) \cos(\omega t)$
 E) None

27. A parallel plate capacitor of capacitance $20.0\mu\text{F}$ is being charged by voltage source whose potential is varying at the rate of 3.0V/s . The conduction current through the connecting wires, and the displacement current through the plates of the capacitor, would be _____ respectively.

- A) 0, $60.0\mu\text{A}$
- B) $60.0\mu\text{A}$, $60.0\mu\text{A}$
- C) $60.0\mu\text{A}$, 0
- D) 0, 0
- E) None

28. When does a ferromagnetic material become paramagnetic material?

- A) At Curie temperature only
- B) Below Curie temperature
- C) Above Curie temperature
- D) not change
- E) None

29. An electron moves through a uniform electric field $\vec{E} = (2.50\hat{i} + 5.00\hat{j})$ V/m and a uniform magnetic field $\vec{B} = (0.400\hat{k})$ T. Determine the acceleration of the electron when it has a velocity $\vec{v} = 10.0\hat{i}$ m/s.

- A) $[-4.39 \times 10^{11}\hat{i} - 1.76 \times 10^{11}\hat{j}] \text{ m/s}^2$.
- B) $[4.39 \times 10^{11}\hat{i} + 1.76 \times 10^{11}\hat{j}] \text{ m/s}^2$.
- C) $[4.39 \times 10^{11}\hat{i} - 1.76 \times 10^{11}\hat{j}] \text{ m/s}^2$.
- D) $[4.39 \times 10^{11}\hat{i} + 1.76 \times 10^{11}\hat{j}] \text{ m/s}^2$.
- E) None

30. An AC source drives an RLC circuit with a fixed voltage amplitude. If the driving frequency is ω_1 , the circuit is more capacitive than inductive and the phase angle is -10.0° . If the driving frequency is ω_2 , the circuit is more inductive than capacitive and the phase angle is $+10.0^\circ$. The largest amount of power is delivered to the circuit at ———.

- A) ω_1
- B) ω_2
- C) the same power for ω_1 and ω_2
- D) unknown
- E) None

31. An electromagnetic wave propagates in the -y direction. The electric field at a point in space is momentarily oriented in the +x direction. The magnetic field at that point is momentarily oriented in the ———.

- A) - x direction
- B) + y direction
- C) +z direction
- D) -z direction
- E) None

32. A DC motor converts ————energy.

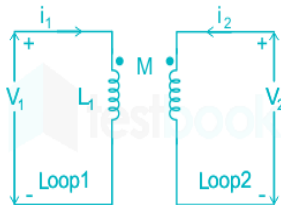
- A) electrical to mechanical
- B) mechanical to electrical
- C) magnetic to electrical
- D) electrical to magnetic
- E) None

33. Which section of the spectrum is the ONLY one we can see?

- A) X-rays
- B) Visible Light
- C) Gamma Rays

- D) Ultraviolet Rays
- E) None

34. Consider given the circuit



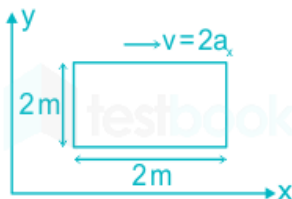
what will be the differential equation for loop 1?

- | | |
|--|--|
| A) $V_1 = L_1 \frac{di_1(t)}{dt} + M \frac{di_2(t)}{dt}$ | C) $V_1 = M \frac{di_1(t)}{dt} + L_1 \frac{di_2(t)}{dt}$ |
| B) $V_1 = L_1 \frac{di_1(t)}{dt} - M \frac{di_2(t)}{dt}$ | D) $V_2 = L_1 \frac{di_1(t)}{dt} + M \frac{di_2(t)}{dt}$ |
| | E) None |

35. A conductor of length 100.0cm, moves at right angle to uniform field flux density of 1.5 Wb/m^2 with velocity of 50.0 m/s. The emf induced in the conductor will be _____.

- | | |
|-----------|-----------|
| A) 150.0V | D) 37.5 V |
| B) 70.0 V | E) None |
| C) 50.0 V | |

36. In certain coordinates, the magnetic field is given $\vec{B} = -\frac{2}{x}\hat{a}_z$. A square loop of 2.0m lying in the xy plane and parallel to y-axis. Now, the loop is moving in that plane with a velocity of $v = 2a_x$ as shown in figure below;



what will be the circulation of induced electric field around the loop?

- | | |
|------------------------|------------------------|
| A) $\frac{16}{x(x+2)}$ | C) $\frac{x(x+2)}{16}$ |
| B) $\frac{8}{x(x+2)}$ | D) $\frac{8}{x}$ |
| | E) None |

37. The Maxwell's equations $\vec{\nabla} \times \vec{E} = -\frac{d\vec{B}}{dt}$ is based on _____.

- A) Coulomb's law
- B) Ampere's law
- C) Faraday's law
- D) Gauss's law
- E) None

38. A square side of L meters in the x - y plane in a region, where the magnetic field by $\vec{B} = B_0(2\hat{i} + \hat{j} + 4.0\hat{k})T$, where B_0 is constant. The magnetic flux through passing through the square is ———.

- A) $2B_0L^2$ Wb
- B) $3B_0L^2$ Wb
- C) $4B_0L^2$ Wb
- D) $\sqrt{20}B_0L^2$ Wb
- E) None

39. Ampere's loop law is used to find ———.

- A) the magnetic field due to a system of moving charges
- B) the force on moving charge due to magnetic field
- C) the electric field due to a system of charges
- D) the force on stationary charge due to electric force
- E) None

40. 20.0 A current is flowing through a straight line wire. The intensity of magnetic field at a point 10.0 cm from the wire will be ———.

- A) 10^{-5} Wb/m²
- B) $2 * 10^{-5}$ Wb/m²
- C) $4 * 10^{-5}$ Wb/m²
- D) $18 * 10^{-5}$ Wb/m²
- E) None

41. The concentric circular coil of 20 turns each are situated in the same plane. Their radii are 25cm and 45cm respectively and they carry 0.5 A and 0.9A current in the opposite direction. What will be the magnetic field at the center?

- A) 2.0 T
- B) 0.0 T
- C) 4.0 T
- D) 10.0 T
- E) None

42. If the frequency of the AC current increase, the impedance of R-C circuit will —.

- A) increases
- B) decreases
- C) remain unchanged
- D) first increases then decreases
- E) None

43. Which one of the following can not measured by using Hall effect?

- A) carrier concentration
- B) mobility of charge carriers
- C) type of semiconductors
- D) diffusion constant
- E) None

44. A long straight wire of radius x carries a steady current I . The current is uniformly distributed across its cross section. Calculate the ratio of the magnetic field at $\frac{x}{4}$ and $8x$.

- A) 4
- B) 1
- C) 2
- D) 3
- E) None