Magnetism

Topic Tree for Magnetism and Matter

1. **Introduction**
   - Overview of magnetic phenomena
   - Historical context and early discoveries
2. **Bar Magnet**
   - Characteristics and properties
   - Magnetic field lines
   - Magnetic dipole and its moment
3. **Magnetism and Gauss's Law**
   - Gauss's law for magnetism
   - Magnetic flux and its properties
4. **The Earth's Magnetism**
   - Components of the Earth's magnetic field
   - Causes and effects of the Earth's magnetism
   - Mapping the Earth's magnetic field
5. **Magnetisation and Magnetic Intensity**
   - Definitions and relationships
   - Magnetic susceptibility and permeability
   - Classification of magnetic materials (dia-, para-, and ferromagnetic)
6. **Magnetic Properties of Materials**
   - Detailed characteristics of different types of magnetic materials
   - Magnetic hysteresis
   - Applications of magnetic materials
7. **Electromagnets and Permanent Magnets**
   - Construction and functioning of electromagnets
   - Differences between electromagnets and permanent magnets
   - Practical applications

MCQs on Coulomb's Law in Magnetism

1. Coulomb's law for magnetic poles states that the force between two magnetic poles is:
   - (a) Directly proportional to the product of their pole strengths
   - (b) Inversely proportional to the square of the distance between them
   - (c) Both (a) and (b)
   - (d) None of the above
2. The force between two magnetic poles m_1 and m_2 separated by a distance r is given by:
   - (a) $F = k\frac{m_1 m_2}{r^2}$
   - (b) $F = k\frac{m_1 + m_2}{r^2}$
   - (c) $F = k\frac{m_1 - m_2}{r}$
   - (d) $F = k\frac{m_1 m_2}{r}$
3. In Coulomb's law of magnetism, the constant k depends on:

- (a) The medium between the poles
- (b) The pole strengths
- (c) The distance between the poles
- (d) The shape of the poles

4. Which of the following statements is true about magnetic monopoles?
   - (a) They exist and can be isolated
   - (b) They do not exist; magnetic poles always come in pairs
   - (c) They exist only at the microscopic level
   - (d) They can be created artificially
5. The force between two magnetic poles in vacuum is:
   - (a) Maximum
   - (b) Minimum
   - (c) Zero
   - (d) Depends on the material of the poles
6. Coulomb’s law in magnetism is analogous to which law in electrostatics?
   - (a) Ohm’s law
   - (b) Gauss’s law
   - (c) Coulomb’s law for electric charges
   - (d) Ampere’s law
7. What happens to the force between two magnetic poles if the distance between them is halved?
   - (a) It becomes one-fourth
   - (b) It remains the same
   - (c) It doubles
   - (d) It becomes four times
8. Coulomb’s law for magnetism can be applied to:
   - (a) Only bar magnets
   - (b) Only electromagnets
   - (c) Both bar magnets and electromagnets
   - (d) Neither bar magnets nor electromagnets
9. The unit of pole strength in Coulomb’s law of magnetism is:
   - (a) Ampere-meter
   - (b) Weber
   - (c) Tesla
   - (d) Henry
10. If two magnetic poles repel each other, they must be:
    - (a) Both north poles
    - (b) Both south poles
    - (c) One north and one south pole
    - (d) Either (a) or (b)
11. The force between two magnetic poles in a material medium is:
    - (a) Greater than in a vacuum
    - (b) Less than in a vacuum
    - (c) The same as in a vacuum
    - (d) Zero
12. In the context of Coulomb's law in magnetism, which of the following factors does not affect the force between two poles?
    - (a) Pole strength
    - (b) Distance between poles
    - (c) Medium between poles
    - (d) Shape of the poles

13. The magnetic force between two poles is:
    - (a) Always attractive
    - (b) Always repulsive
    - (c) Either attractive or repulsive
    - (d) Neither attractive nor repulsive
14. What is the effect on the force between two magnetic poles if one pole strength is doubled?
    - (a) The force is halved
    - (b) The force remains the same
    - (c) The force doubles
    - (d) The force quadruples
15. Coulomb's law for magnetism fails at:
    - (a) Very large distances
    - (b) Very short distances
    - (c) Both very large and very short distances
    - (d) Moderate distances

Answer Key

1. (c)
2. (a)
3. (a)
4. (b)
5. (a)
6. (c)
7. (d)
8. (c)
9. (a)
10. (d)
11. (b)
12. (d)
13. (c)
14. (c)
15. (c)