**Engineering Material**
**Unit I: ELECTRICAL ENGINEERING MATERIALS**
Conducting Materials: Properties of good conducting materials, Brief idea about conductivity & Resistivity.

**Q: What are the properties of good conducting materials?**

A: Good conducting materials typically have high electrical conductivity, low resistivity, and high thermal conductivity. They also exhibit ductility and malleability, allowing them to be easily shaped into wires.

**Q: Can you provide a brief idea about conductivity and resistivity?**

A: Conductivity is a measure of a material's ability to conduct electric current. It is the reciprocal of resistivity, which is a measure of a material's opposition to the flow of electric current. Conductivity is typically denoted by the symbol σ and resistivity by the symbol ρ. Metals are good conductors with high conductivity and low resistivity.

Conductivity and resistivity are important properties of materials that play a key role in the field of physics and engineering. Here are some key points to remember about conductivity and resistivity:

Q. Write short note on Conductivity: Conductivity is a measure of how easily a material allows electric current to flow through it. Materials with high conductivity allow electricity to flow easily, while materials with low conductivity impede the flow of electricity.

Q. What is Conductivity is defined as the reciprocal of resistivity, which means that materials with high conductivities have low resistivities, and vice versa.

-Metals are known for their high conductivity, which is why they are commonly used in electrical wires and circuits. Copper, silver, and gold are examples of metals with high conductivity.

Q. What is Resistivity: Resistivity is the intrinsic property of a material that determines how strongly it resists the flow of electric current. It is denoted by the symbol ρ (rho).

Q.Write factors affecting Resistivity: is affected by factors such as temperature, material purity, and crystal structure. In general, materials with high resistivity inhibit the flow of electricity, while materials with low resistivity allow electricity to flow more easily.

Q.Write measurement of Resistivity: Resistivity is measured in ohm-meters (Ω·m) and is used to calculate the resistance of a material based on its dimensions and conductivity.

Q.Write relationship between conductivity (σ) and resistivity: The relationship between conductivity (σ) and resistivity (ρ) is given by the equation $\sigma = 1/\rho$, where σ is the conductivity of the material.

**MCQ**

1. Which of the following materials typically exhibit high conductivity?

A) Insulators

B) Semiconductors

C) Metals

D) Superconductors

**Answer: C) Metals**

2. Resistivity is a measure of:

A) A material's ability to conduct electricity

B) The reciprocal of conductivity

C) A material's resistance to the flow of electric current

D) The movement of charge carriers within a material

**Answer: C) A material's resistance to the flow of electric current**

3. Which of the following factors does not affect the resistivity of a material?

A) Temperature

B) Material's length

C) Material's cross-sectional area

D) Voltage applied

**Answer: D) Voltage applied**

4. The SI unit of resistivity is:

A) Ohm (Ω)

B) Ohm-meter (Ω.m)

C) Siemens (S)

D) Ampere (A)

**Answer: B) Ohm-meter (Ω.m)**

5. Conductivity of a material is directly proportional to:

A) Resistivity

B) Temperature

C) Area of cross-section

D) Reciprocal of resistivity

**Answer: D) Reciprocal of resistivity**

1. Which of the following properties is NOT characteristic of a good conducting material?

a) High electrical resistance

b) High thermal conductivity

c) Low resistivity

d) High electron mobility

**Answer: a) High electrical resistance**

2. What is the unit of measurement for electrical resistivity?

a) Ohms

b) Siemens

c) Ohm-meter

d) Mho

**Answer: c) Ohm-meter**

3. Which of the following materials is a good conductor of electricity?

a) Rubber

b) Plastic

c) Copper

d) Glass

**Answer: c) Copper**

4. Which property allows conducting materials to carry electric current efficiently without significant loss of energy?

a) High magnetic susceptibility

b) Low thermal conductivity

c) Low resistivity

d) High specific heat capacity

**Answer: c) Low resistivity**

5. Which material is commonly used as a conductor in electrical wiring due to its excellent conductivity and corrosion resistance?

a) Aluminum

b) Zinc

c) Gold

d) Silver

**Answer: a) Silver**

**Unit II: ELECTRICAL MATERIALS : INSULATING AND SEMICONDUCTOR**

(A) Insulating Materials: (a) Plastic insulating materials-definition and classification, thermo-setting and thermoplastic materials, their applications and commercial names & uses in industry.

1. What is Plastic insulating materials

- Definition: Plastic insulating materials are synthetic materials that have the ability to resist the flow of electric current, making them suitable for use as insulators in electrical applications.

2. Write down classification of Plastic insulating materials

Classification: Plastic insulating materials can be classified into two main categories: thermo-setting and thermoplastic materials.

3. What is Thermo-setting materials:

- Definition: Thermo-setting materials are plastics that, once formed, cannot be melted or reshaped by heating.

4. Write down Applications of Thermo-setting materials

Thermo-setting materials are commonly used in applications where high heat resistance and dimensional stability are required, such as in electrical insulation, automotive parts, and aerospace components.

- Commercial names: Common commercial names for thermo-setting materials include epoxy resins, phenolic resins, and polyurethanes.

- Uses in industry: Thermo-setting materials are widely used in the manufacturing of electrical insulators, circuit boards, coatings, adhesives, and molded parts in various industries.

5. What is Thermoplastic materials

- Definition: Thermoplastic materials are plastics that can be melted and reshaped multiple times by heating.

6. Write down Applications of Thermoplastic materials :

Thermoplastic materials are versatile and used in a wide range of applications, including packaging, consumer goods, automotive parts, and electrical insulation.

- Commercial names: Common commercial names for thermoplastic materials include polyethylene, polypropylene, PVC (polyvinyl chloride), and PET (polyethylene terephthalate).

- Uses in industry: Thermoplastic materials are commonly used in the production of wire and cable insulation, connectors, switches, housings for electrical devices, and packaging materials in various industries.

1. What is a plastic insulating material?

- Plastic insulating materials are materials that are used to prevent the flow of electricity, heat, or sound.

2. Define thermo-setting and thermoplastic materials.

- Thermosetting materials are plastics that once formed, cannot be remelted or reformed. Thermoplastic materials, on the other hand, can be melted and reformed multiple times.

3. What are some applications of plastic insulating materials in industry?

- Plastic insulating materials are commonly used in electrical and electronic equipment, construction materials, automotive components, and packaging.

4. Can you name some commercial names of plastic insulating materials?

- Some commercial names of plastic insulating materials include PVC (polyvinyl chloride), PE (polyethylene), PP (polypropylene), and PET (polyethylene terephthalate).

5. How are plastic insulating materials classified?

- Plastic insulating materials can be classified based on their composition, structure, and properties. Common classifications include thermosetting vs. thermoplastic, rigid vs. flexible, and halogenated vs. non-halogenated materials.

6. How are plastic insulating materials used in the industry?

- Plastic insulating materials are used for wire insulation in electrical cables, casing for electronic devices, protective covers for machinery, and in the production of consumer goods such as toys and household items.

MCQS:

1. Which of the following best describes plastic insulating materials?

A) Materials that conduct electricity well

B) Materials that block the flow of electricity

C) Materials that change their properties when heated

D) Materials that are magnetic in nature

Answer: B) Materials that block the flow of electricity

2. What is the classification of plastic insulating materials based on their ability to set under heat?

A) Thermo-setting materials and thermoplastic materials

B) Conducting materials and insulating materials

C) Hard materials and soft materials

D) Magnetic materials and non-magnetic materials

Answer: A) Thermo-setting materials and thermoplastic materials

3. Which type of plastic insulating material is irreversibly hardened when heated?

A) Thermo-setting materials

B) Thermoplastic materials

C) Conducting materials

D) Insulating materials

Answer: A) Thermo-setting materials

4. What are some common applications of plastic insulating materials in industries?

A) Insulation in electrical wires and cables

B) Making cooking utensils

C) Manufacturing metal tools

D) Printing newspapers

Answer: A) Insulation in electrical wires and cables

5. Which of the following is a commercial name of a thermo-setting plastic insulating material?

A) PVC (Polyvinyl chloride)

B) Bakelite

C) Nylon

D) Polystyrene

Answer: B) Bakelite

6. Which industry commonly uses plastic insulating materials for their products?

A) Automotive

B) Agriculture

C) Fashion

D) Construction

Answer: A) Automotive

7. What is the definition of plastic insulating materials?

A) Materials that do not conduct electricity

B) Materials made from metal

C) Materials with high thermal conductivity

D) Materials used for cooking

Answer: A) Materials that do not conduct electricity

8. How are plastic insulating materials classified?

A) By color

B) By weight

C) By chemical composition

D) By boiling point

Answer: C) By chemical composition

9. Which type of plastic insulating materials hardens irreversibly when cured?

A) Thermosetting materials

B) Thermoplastic materials

C) Rubber

D) Glass

Answer: A) Thermosetting materials

10. What is an example of a thermoplastic material?

A) PVC

B) Glass

C) Rubber

D) Silicone

Answer: A) PVC

11. Which of the following is NOT an application of plastic insulating materials?

A) Electrical wires

B) Insulation for buildings

C) Cooking utensils

D) Automotive parts

Answer: C) Cooking utensils

12. Which of the following is a commercial name of plastic insulating materials commonly used in industries?

A) Nylon

B) Metal

C) Paper

D) Cotton

Answer: A) Nylon