

## **ACTIVITY - Classification of materials-Dia-, Para-, Ferromagnetism**

|                           |                                                              |
|---------------------------|--------------------------------------------------------------|
| <b>Subject</b>            | <b>PHYSICS</b>                                               |
| <b>Class</b>              | <b>XII</b>                                                   |
| <b>Chapter/Unit</b>       | <b>Magnetism</b>                                             |
| <b>Topic</b>              | <b>Classification of materials-Dia-,Para-,Ferromagnetism</b> |
| <b>Time</b>               | <b>20min</b>                                                 |
| <b>Nature of Activity</b> | <b>Individual</b>                                            |

### **What will I learn (Learning Outcome)?**

Classification of materials as per their behavior in magnetic field-Dia-,Para-,Ferromagnetism

### **Skills:**

Experimenting, observing, analyzing, interpreting

### **What I have to do?**

To observe the behavior of dia-,para- and ferromagnetic materials in magnetic field

### **What do I require?**

A small disposable glass filled with water and mounted on a piece of thermocol, Aluminum foil circular disc mounted vertically on a piece of thermocol, a small iron nail placed on a piece of thermocol, A small wooden cylindrical piece mounted on a piece of thermocol, A rectangular tray filled with water, a strong magnet,

### **What do I need to know?**

Classification of materials as per their behavior in magnetic field as dia, para , ferromagnetic materials

### **➤ Teacher's Activity**

Teacher will

- Make students recall the behavior of materials in magnetic field and the reason for the same and based on it they are classified as- dia-, para- , ferromagnetic materials.
- facilitate students to perform a simple activity to make them observe the materials (dia-, para- and ferro-) responding differently to the magnetic field as per their nature

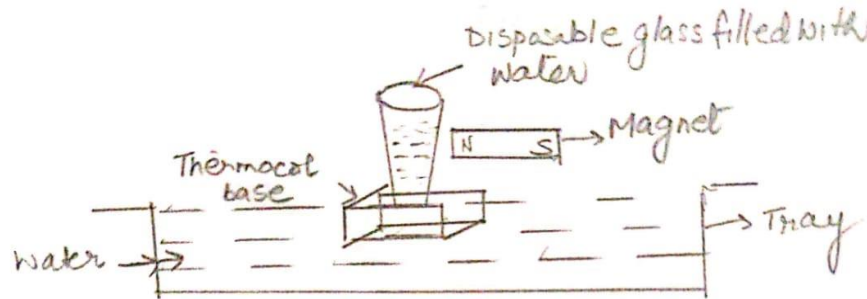
### How will I proceed?

#### ➤ Student's Activity

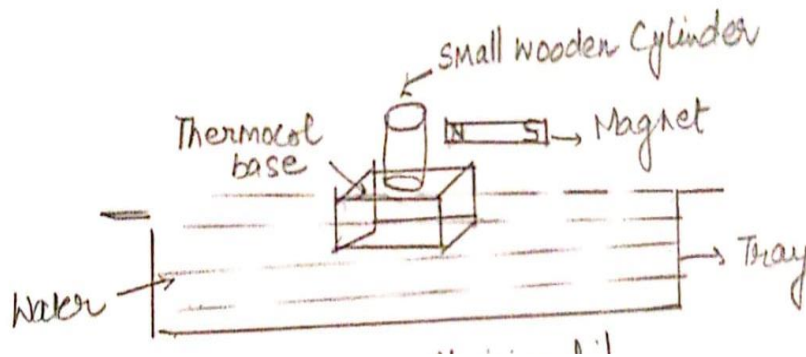
Students will

- Place a tray filled with water on a flat surface and place one after the other (in turn) the following on the surface of water and observe their behavior in the magnetic field by bringing a strong magnet close to them

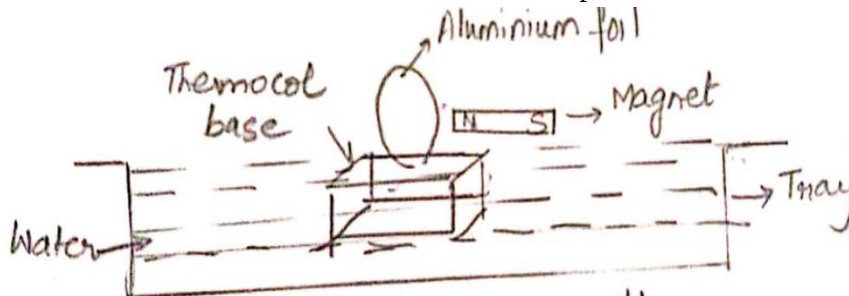
(a) a small disposable glass filled with water and mounted on a piece of thermocol



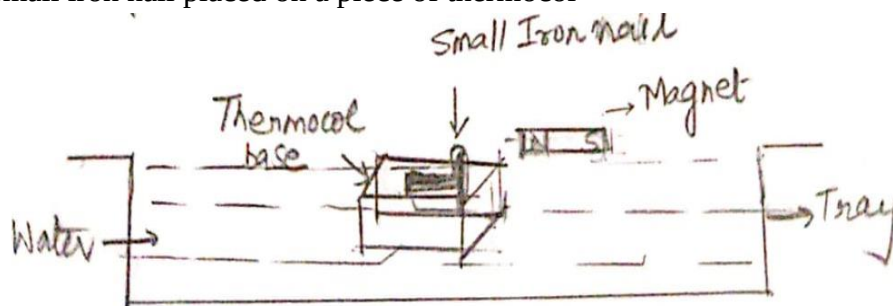
(b) A small wooden cylindrical piece mounted on a piece of thermocol



(c) Aluminum foil circular disc mounted on a piece of thermocol



- (d) a small iron nail placed on a piece of thermocol



- enter your observations in the following table

**What have I observed?**

| S. No. | When the following are placed on the surface of water in the tray, in the magnetic field produced by a strong magnet | Observation-The piece of thermocol with the object placed on it | Nature of material placed on the thermocol (Dia/Para/Ferromagnetic) |
|--------|----------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------|---------------------------------------------------------------------|
| 1      | (a) a small disposable glass filled with water and mounted on a piece of thermocol                                   | moves-----<br>(away/towards) the magnet                         |                                                                     |
| 2      | (b) A small wooden cylindrical piece mounted on a piece of thermocol                                                 | moves-----<br>(away/towards) the magnet                         |                                                                     |
| 3      | (c) Aluminum foil circular disc mounted on a piece of thermocol                                                      | moves-----<br>(away/towards) the magnet                         |                                                                     |
| 4      | (d) a small iron nail placed on a piece of thermocol                                                                 | moves-----<br>(away/towards) the magnet                         |                                                                     |

### **What have I learnt?**

All materials around us are diamagnetic by nature, however the materials which display para/ferromagnetism, in them the diamagnetic behaviour is dominated by para/ferromagnetism

----- (Dia/Para/Ferromagnetic) materials are feebly repelled by the magnet due to the presence of ----- (paired/unpaired) valence electrons

----- (Dia/Para/Ferromagnetic) materials are feebly attracted by the magnet due to presence of ----- (paired/unpaired) valence electrons in their constituent atoms

----- (Dia/Para/Ferromagnetic) materials are strongly attracted by the magnet, due to presence of ----- (paired/unpaired) valence electrons in their constituent atoms

### **What am I curious to learn?**

Why is ferromagnetism a rare phenomenon?

### **Let me evaluate myself**

**Q1** Why are all pieces of iron not magnet even though iron is a ferromagnetic material

**Q2** Distinguish between diamagnetic and ferromagnetic substances in respect of (i) intensity of magnetization (ii) behavior in a non-uniform magnetic field (iii) susceptibility

**Q3** Draw diagrams to depict the behavior of magnetic field lines near a 'bar' of (i) copper (ii) aluminum (iii) mercury cooled to a very low temperature (4.2K)

**Q4** To which of the two – a polar dielectric or non-polar dielectric – does a paramagnetic material correspond? Justify your answer

**Q5** Magnetic field lines show direction at every point which a small magnetized needle takes up at that point? Is it justified to call them lines of force?