

Determination of Density of Solids

**Pandit Madan Mohan Malaviya
National Mission on Teachers and Teaching
<http://mhrd.gov.in/pmmmntt>**

**IIT Bombay
TDC, IISc, Challakere Campus, Karnataka**

**TDC Team
12 March 2018**



Aim of the Experiment



Aim of the Experiment

- ▶ Measure the dimensions of **Iron Cuboid** using Vernier caliper



Aim of the Experiment

- ▶ Measure the dimensions of **Iron Cuboid** using Vernier caliper
- ▶ Determine mass by using digital weighing balance



Aim of the Experiment

- ▶ Measure the dimensions of **Iron Cuboid** using Vernier caliper
- ▶ Determine mass by using digital weighing balance
- ▶ Determine density in g/cm^3 and kg/m^3



Apparatus



Apparatus



About the Experiment



About the Experiment

- ▶ **Density is the measure of amount of substance present in unit volume**



About the Experiment

- ▶ **Density is the measure of amount of substance present in unit volume**
- ▶ **Density = mass/volume**



About the Experiment

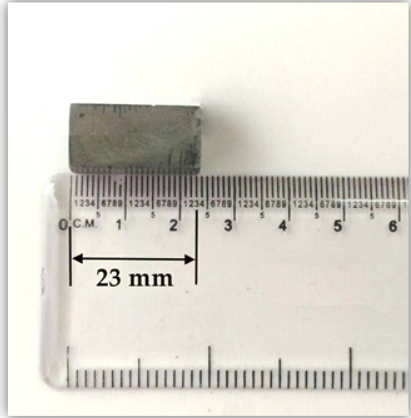
- ▶ Density is the measure of amount of substance present in unit volume
- ▶ Density = mass/volume
- ▶ The SI unit of density is kg/m^3



Vernier Caliper



Vernier Caliper



Regular Objects



Cuboid



Cylinder



Sphere



Cylinder



Observation table

| Metal | Shape | Dimension and Reading | | Volume in cc | Mass in g | Density g/cm^3 | Density kg/m^3 |
|-------|--------|-----------------------|----|--------------|-----------|-------------------------|-------------------------|
| | | | mm | cm | | | |
| Iron | cuboid | l | | | | | |
| | | b | | | | | |
| | | h | | | | | |



Observation table

| Metal | Shape | Dimension and Reading | | | Volume in cc | Mass in g | Density g/cm^3 | Density kg/m^3 |
|-------|--------|-----------------------|-------|----|--------------|-----------|-------------------------|-------------------------|
| | | | mm | cm | | | | |
| Iron | cuboid | <i>l</i> | 23.45 | | | | | |
| | | <i>b</i> | 11.24 | | | | | |
| | | <i>h</i> | 14.60 | | | | | |



Observation table

| Metal | Shape | Dimension and Reading | | | Volume in cc | Mass in g | Density g/cm^3 | Density kg/m^3 |
|-------|--------|-----------------------|-------|-------|--------------|-----------|-------------------------|-------------------------|
| | | | mm | cm | | | | |
| Iron | cuboid | <i>l</i> | 23.45 | 2.345 | | | | |
| | | <i>b</i> | 11.24 | 1.124 | | | | |
| | | <i>h</i> | 14.60 | 1.460 | | | | |



Volume of Iron Cuboid

**volume of
iron cuboid** $= l \times b \times h$

$$= 2.345\text{cm} \times 1.124\text{cm} \times 1.460\text{cm}$$

$$= 3.848\text{cm}^3$$



Density of Iron

$$\begin{aligned}\text{Density} &= \frac{\text{mass}}{\text{volume}} \\ &= \frac{29.338 \text{ g}}{3.848 \text{ cm}^3} \\ &= 7.6242 \text{ g/cm}^3 \\ &= 7.6242 \times 1000 \\ &= 7624.2 \text{ kg/m}^3\end{aligned}$$



Tabulated Table

| Metal | Shape | Dimension and Reading | | | Volume in cc | Mass in g | Density g/cm^3 | Density kg/m^3 |
|-------|--------|-----------------------|-------|-------|--------------|-----------|-------------------------|-------------------------|
| | | | mm | cm | | | | |
| Iron | cuboid | <i>l</i> | 23.45 | 2.345 | 3.848 | 29.338 | 7.6242 | 7624.2 |
| | | <i>b</i> | 11.24 | 1.124 | | | | |
| | | <i>h</i> | 14.60 | 1.460 | | | | |



Reported value

Density (at 20°C)

| | | |
|-------------|-------|--------------|
| Aluminium | 2710 | $kg\ m^{-3}$ |
| Brass | 8500 | $kg\ m^{-3}$ |
| Copper | 8930 | $kg\ m^{-3}$ |
| Diamond | 3300 | $kg\ m^{-3}$ |
| Gold | 19300 | $kg\ m^{-3}$ |
| Iron, pure | 7870 | $kg\ m^{-3}$ |
| Lead | 11340 | $kg\ m^{-3}$ |
| Platinum | 21450 | $kg\ m^{-3}$ |
| Silver | 10500 | $kg\ m^{-3}$ |
| Steel, mild | 7860 | $kg\ m^{-3}$ |
| Teflon | 2200 | $kg\ m^{-3}$ |



Summary

We have learnt to,



Summary

We have learnt to,

- ▶ **Measure the dimensions of iron cuboid using vernier caliper**



Summary

We have learnt to,

- ▶ **Measure the dimensions of iron cuboid using vernier caliper**
- ▶ **Determine mass by using a digital balance and**



Summary

We have learnt to,

- ▶ Measure the dimensions of iron cuboid using vernier caliper
- ▶ Determine mass by using a digital balance and
- ▶ Determine density in g/cm^3 and kg/m^3



Assignment

As an assignment,



Assignment

As an assignment,

- ▶ **Measure radius and height of the Aluminium cylinder**



Assignment

As an assignment,

- ▶ **Measure radius and height of the Aluminium cylinder**
- ▶ **Calculate the volume using the formula**



Assignment

As an assignment,

- ▶ **Measure radius and height of the Aluminium cylinder**
- ▶ **Calculate the volume using the formula**
- ▶ **Measure the mass of Aluminium cylinder**



Assignment (contd.)

- ▶ **Tabulate the values**



Assignment (contd.)

- ▶ **Tabulate the values**
- ▶ **Calculate the density of Aluminium**
Hint: Volume of cylinder = $\pi r^2 h$



Content Contribution



Content Contribution

**The content for this tutorial is
contributed by
Talent Development Centre
Indian Institute of Science
Challakere campus at Kudapura
Chitradurga, Karnataka**



Acknowledgements

**This project is funded by
Pandit Madan Mohan Malaviya
National Mission on Teachers and
Teaching**

