

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

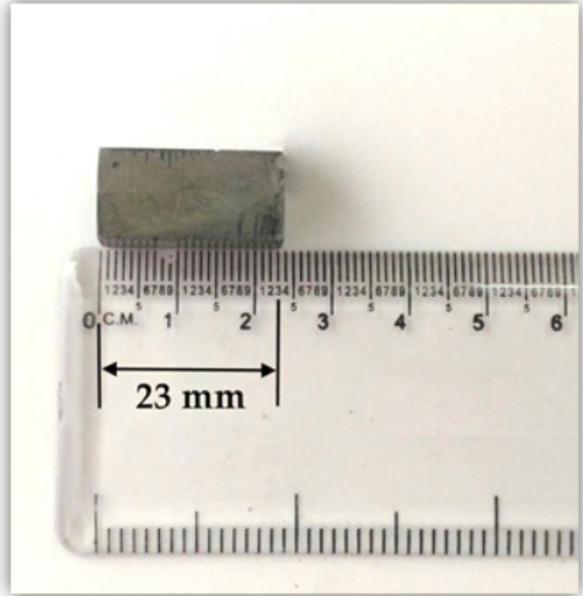
- ▶ Density is the measure of amount of substance present in unit volume
- ▶ Density = mass/volume
- ▶ The SI unit of density is kg/m^3



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	<i>l</i>					
		<i>b</i>					
		<i>h</i>					



Observation table

Metal	Shape	Dimension and Reading		Volume in cc	Mass in g	Density g/cm^3	Density kg/m^3
			mm				
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				
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**

