



# **Chapter 17**

# **Properties of Matter**

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## **Section 17.1**

## **Properties of Solids**

# Properties of Solids include:

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- Density
  - Hardness
  - Elasticity
  - Brittleness
  - Malleability
  - Tensile strength
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# What is density?

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- Density is a physical property that describes the relationship between mass and volume.

The units for density  
are grams per cubic  
centimeter ( $\text{g/cm}^3$ )

*Density*

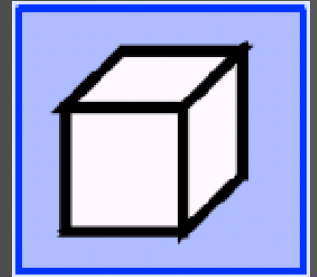
Density ( $\text{g/cm}^3$ )

$$D = \frac{m}{V}$$

Mass (g)

Volume ( $\text{cm}^3$ )

# How big is a cubic centimeter?



- Volume of a cube =  $l \times w \times h$
- If the sides are in cm, then the volume is in  $\text{cm}^3$ .
- $1 \text{ cm}^3 = 1 \text{ milliliter}$

Because density is a  
ratio, it will stay  
the same for a  
*homogeneous*  
substance no matter  
how large or how small  
the sample.

# Examples:



The density of a  
copper penny

is the  
same as



the density of a  
copper pot.



The density of a  
steel paper clip

is the  
same as

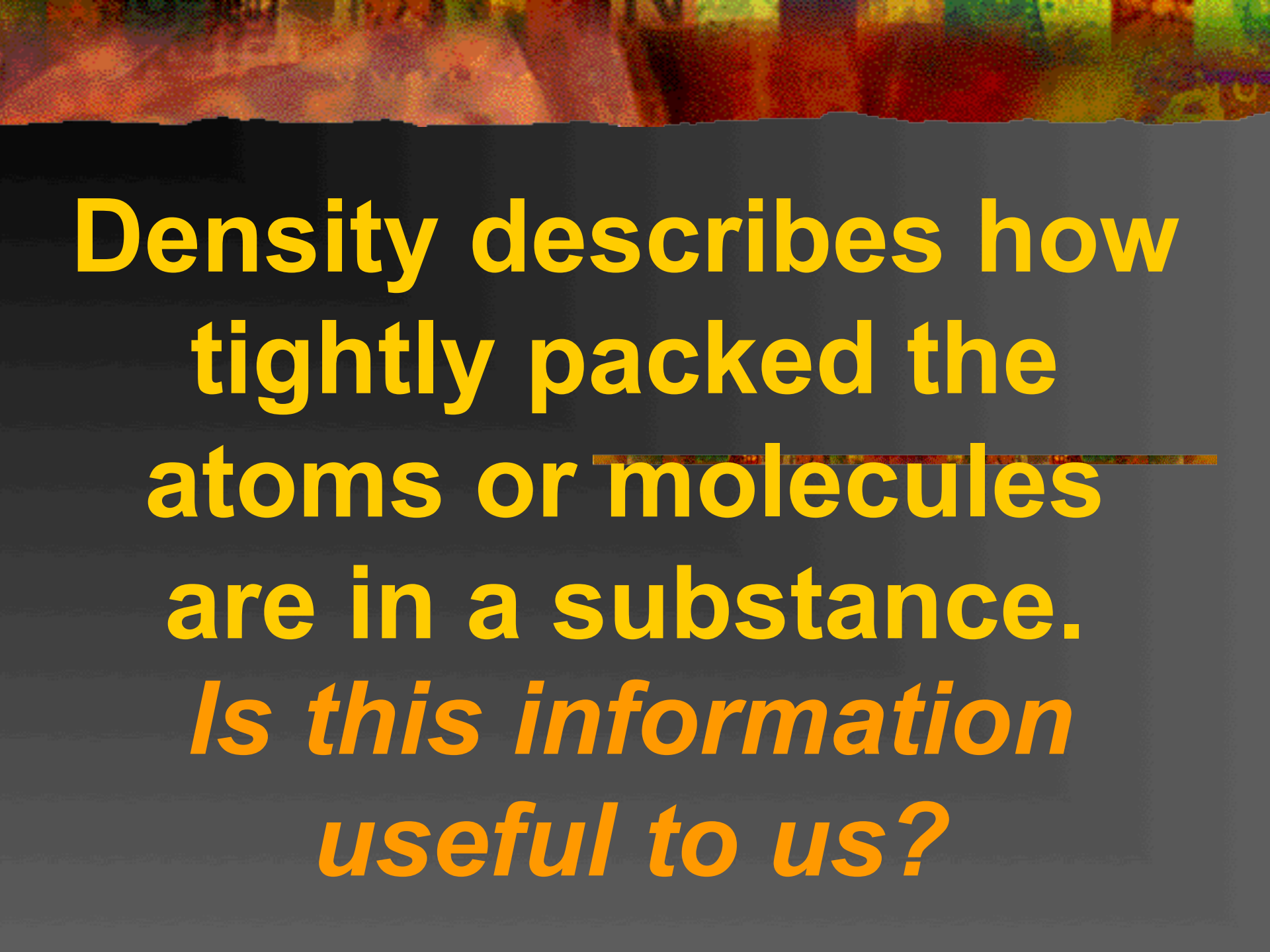


the density of a  
steel screw

# What about the density of *heterogeneous* materials?

- Are the densities of these pieces of cookie the same?
- Which has the greatest density?



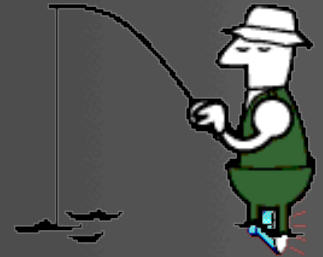


**Density describes how  
tightly packed the  
atoms or molecules  
are in a substance.**

***Is this information  
useful to us?***

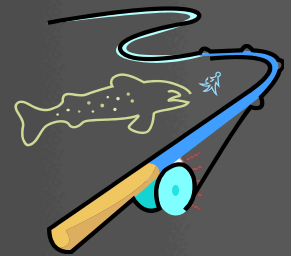
# Useful densities when fishing:

■ Lead       $D = 11.3 \text{ g/cm}^3$



Depth fishing

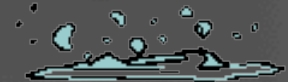
■ Wax       $D = 0.87 \text{ g/cm}^3$



Fly fishing

■ Plastic       $D = 0.95 \text{ g/cm}^3$

■ Water       $D = 1.0 \text{ g/cm}^3$



Fish laughing

# What is Hardness?

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- Hardness measures a solid's resistance to scratching.
- What is the hardest natural substance?

**Diamond**



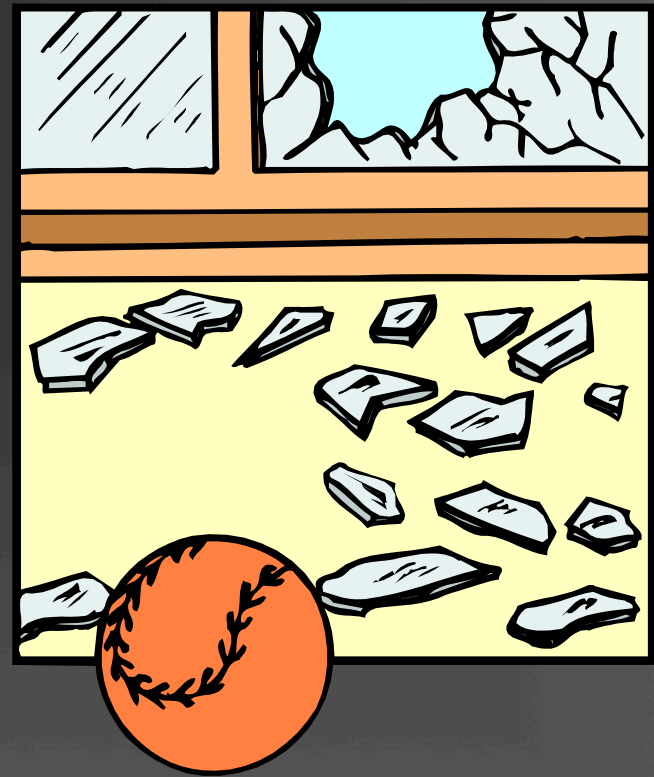
# What is Elasticity?

- Elasticity is the measure of a solid's ability to be stretched and then return to its original size.
- It also gives objects the ability to bounce and to withstand impact.



# What is brittleness?

- Brittleness measures a material's tendency to shatter upon impact.



# What is Malleability?

- Malleability measures a solid's ability to be pounded into thin sheets.



Examples of malleable substances

# What is Tensile Strength?

- Tensile strength is a measure of how much pulling, or tension, a material can stand before breaking.
- It's an important property of fibers, cables, and girders.

