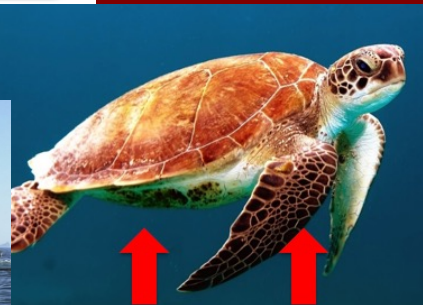
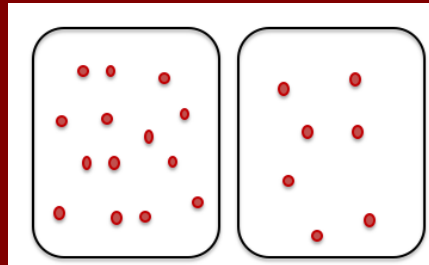
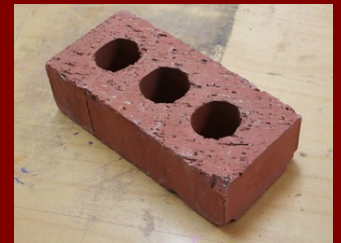
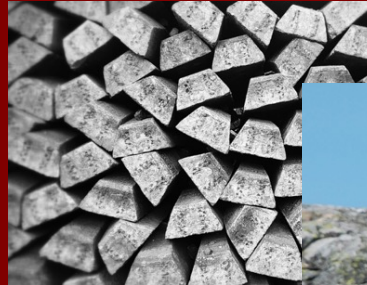


Density & Buoyancy

- Mass and Volume
- What is density?
- $D = m/V$
- Solving Density Problems
- Archimedes
- Buoyancy
- Applications
- Floating
- Oil Spills



Preview File

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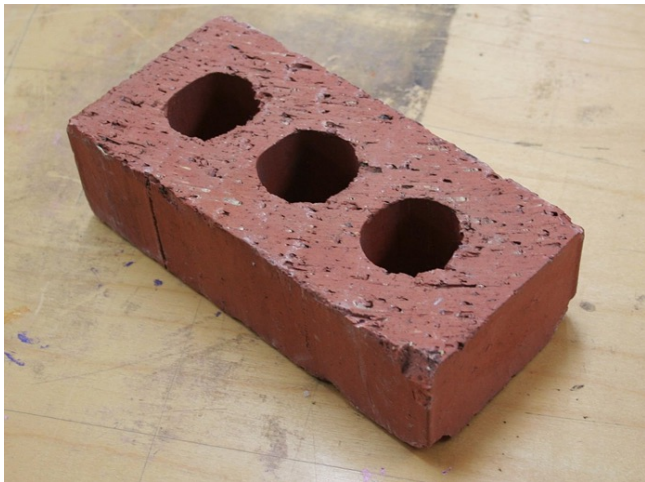
- Some slides appear blank because they have been removed
- Student versions have portions of the text removed which is given in the teacher version and appear as _____ which the students are to fill in
- Other slides may have on them, this represents writing that has been removed on this sample

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Density - A Property of Matter

- Density is a property of matter. This means that all matter has a specific density that is different from the density of a different type of matter
- Based on what has



Brick → lots of stuff per volume = high density



Sponge → less stuff per volume = low density

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Mass

Mass

- A physical property that represents the amount of matter (stuff) an object contains
- Measured in:

—

—

Volume

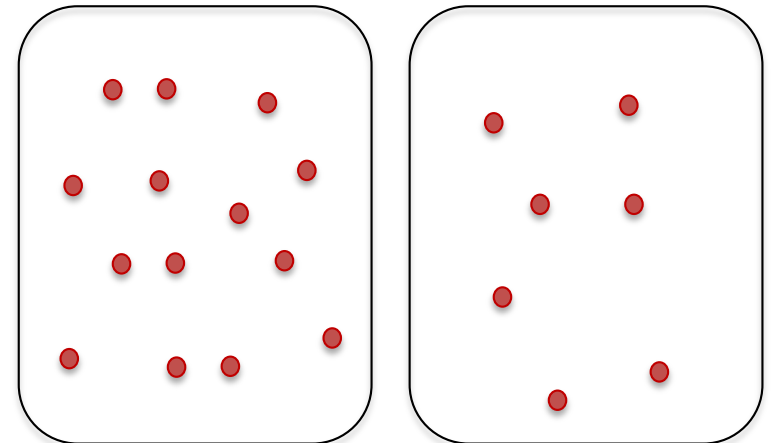
Volume

- _____

- Measured in:
 - millilitres (mL)
 - litres (L)
 - centimetres cubed (cm³)

What is Density?

- _____
- It is a measure of how much mass there is in a specific amount of space.
- Which container is more dense?
 - Explain your answer

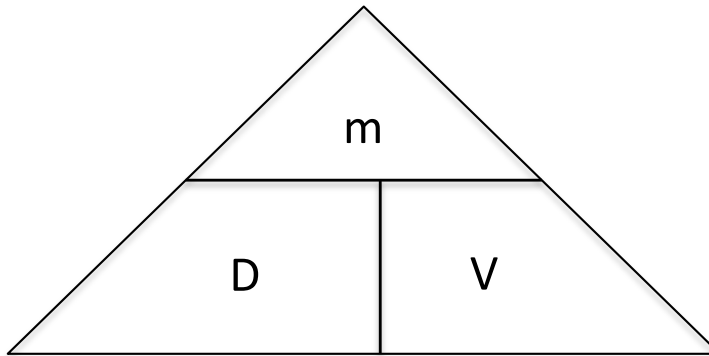


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Density Formula

- _____
- Where, D =density m =mass V =volume

A good way to remember is:



$D=m/V$; $m=DV$; $V=m/D$ (cover each side of the triangle to show these relationships)

Components of Density

Name (unit symbol)	Meaning	Common Units	Equipment used for measurement
Mass (m)	Amount of material inside an object	Grams (g), kilograms (kg)	Electronic balance
Volume (V)	Amount of space the object takes up	L, mL, cc, cm^3 , m^3 $1\text{mL} = 1\text{cc} = 1\text{cm}^3$	Graduated cylinder, pipette, overflow can, ruler
Density (D)	The amount of matter per unit volume	Mass/Volume $\rightarrow$ g/mL , g/cc , g/cm^3	Combination of Mass and Volume

Solving Density Problems

When solving density problems use the GUESSS method

G: _____

U: _____

E: _____

S: _____

S: _____

S: _____

Example

What is the density of a 5 g cube with one side having a length of 2 cm?

G: _____

U: _____

E: _____

S: _____

S: _____

S: _____

Volume Formulas

These will be provided

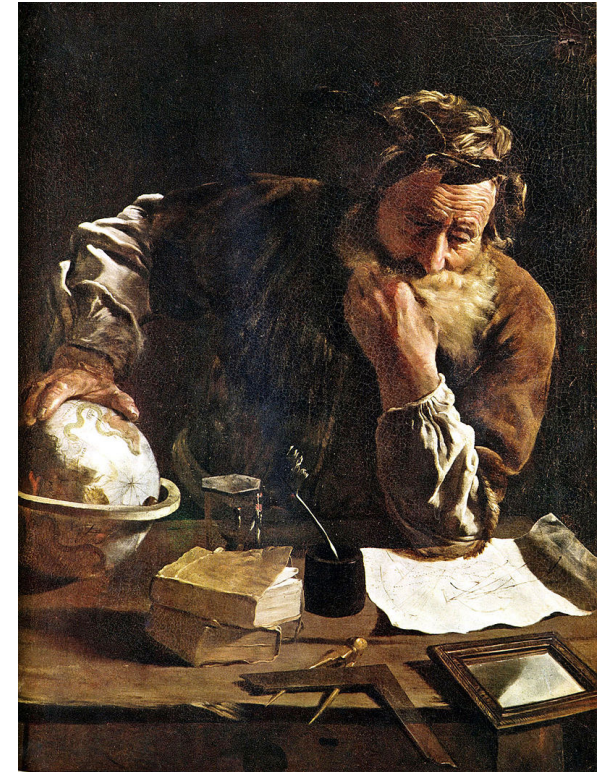
$$V = \pi r^2 h \text{ (cylinder)}$$

$$V = \frac{4}{3} \pi r^3 \text{ (Sphere)}$$

Irregularly shaped objects: Use the method of displacing water

Archimedes

- Famous Greek mathematician
- Much of Archimedes' fame comes from his relationship with Hiero, the king of Syracuse, as he performed a number of favors using his intellect.



Archimedes



- The most famous of these favors for the king was that of the gold crown
- Watch the following video

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After sinking it in water, he observed that it displaced 45 cm^3 of water. Is it authentic?

$$\text{Density} = \frac{\text{mass}}{\text{volume}}$$

$$\text{Density} = \frac{730\text{g}}{45\text{cm}^3}$$
$$= \underline{\hspace{2cm}}$$

Check Your Understanding

Density of gold = 19.34 g/cm^3

Density of silver = 10.5 g/cm^3

Which one of the following has a density closest to gold?

- a) A 1000 g crown that displaces 40 cm^3 of water
- b) A 300g crown that displaces 11 cm^3 water
- c) A 567g crown that displaces 24 cm^3 water

Check Your Understanding

Is a 2200 g crown that displaces 113 cm³ of water, made from pure gold? Density of gold = 19.34 g/cm³

Check Your Understanding

Is 1300 g crown that displaces 124 cm^3 of water
a pure silver crown? Density of silver = 10.5
 g/cm^3

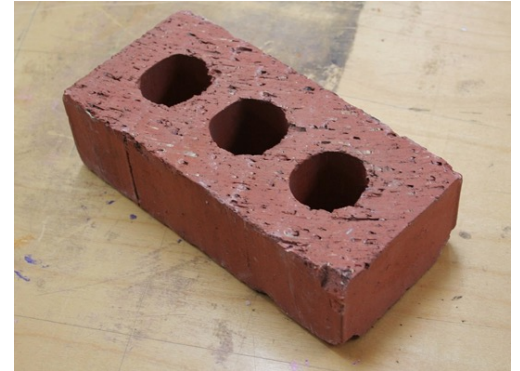
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Check Your Understanding

How much should a gold crown weigh if it displaces 40 cm^3 of water? Density of gold = 19.34 g/cm^3

Terms

- Negatively Buoyant – _____
- Positively Buoyant – _____
- Neutrally Buoyant – _____



Buoyancy

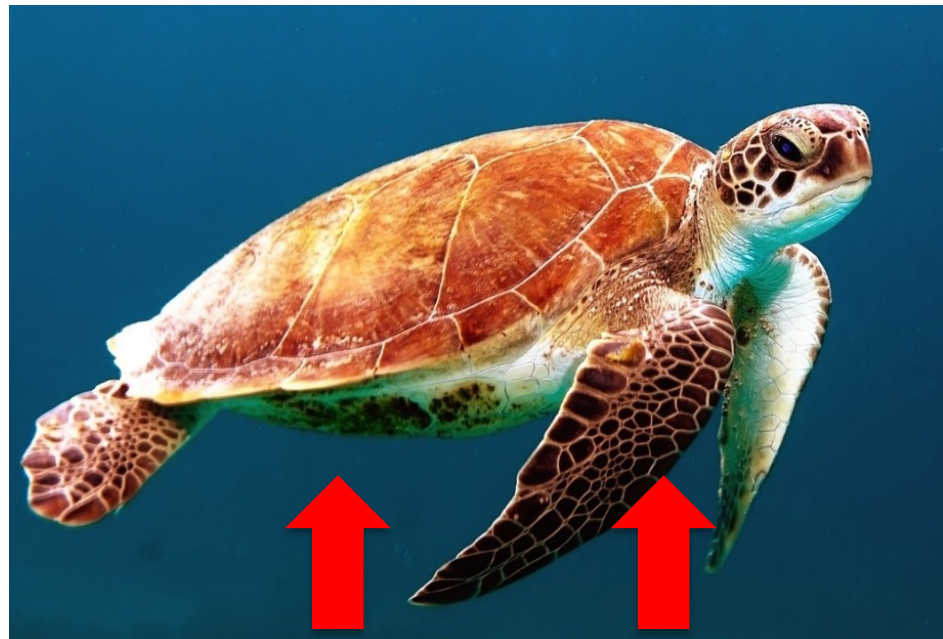
- When an object is placed into a fluid, it takes up room (displaces or moves the fluid away)
 - i.e. the turtle makes room for itself by pushing the water out of the way



- _____

Buoyant Force

- The displaced fluid exerts an upward force on the object
- This fluid has mass
- _____



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Buoyant Force

Since the downward force (gravity) is decreased by the upward force (buoyancy) of water, ...



Example

- If you place an object that weighs 63 lbs into fresh water, the object is displacing 62.4 lbs of water, but weighs 63 lbs
 - This object will be negatively buoyant and will sink.
 - Downward force (63 lbs) is greater than the upward force (62.4 lbs)
- If we put the same object into saltwater, it would still weigh 63 lbs, _____

Buoyancy Simplified

- _____

- If an object is less dense than the fluid, it will float



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If...

- If, however, the boat takes on water, then the part of the boat once filled with air (not very dense) now becomes filled with water (much denser)

- _____



Water

- Water is the most common fluid, but what is the density of water?

- 1.0 g/mL or 1.0 g/cm³



-

Applications

- Life jackets keep you afloat because they are full of air, which makes your (you and the life jacket) density less than water

- _____



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Fat Floats

- _____

- _____

- People who are obese can also float without holding their breath because all the fat makes them less dense than the water.



Oil Spills

- An oil spill can have devastating consequences because oil doesn't dissolve in water and is less dense
- As a result, it floats on the surface
- _____



The Dead Sea

- On average, sea water is 3% denser than fresh water
- _____
- The Dead Sea is located near Jordan
- _____
- People can float without holding their breath

