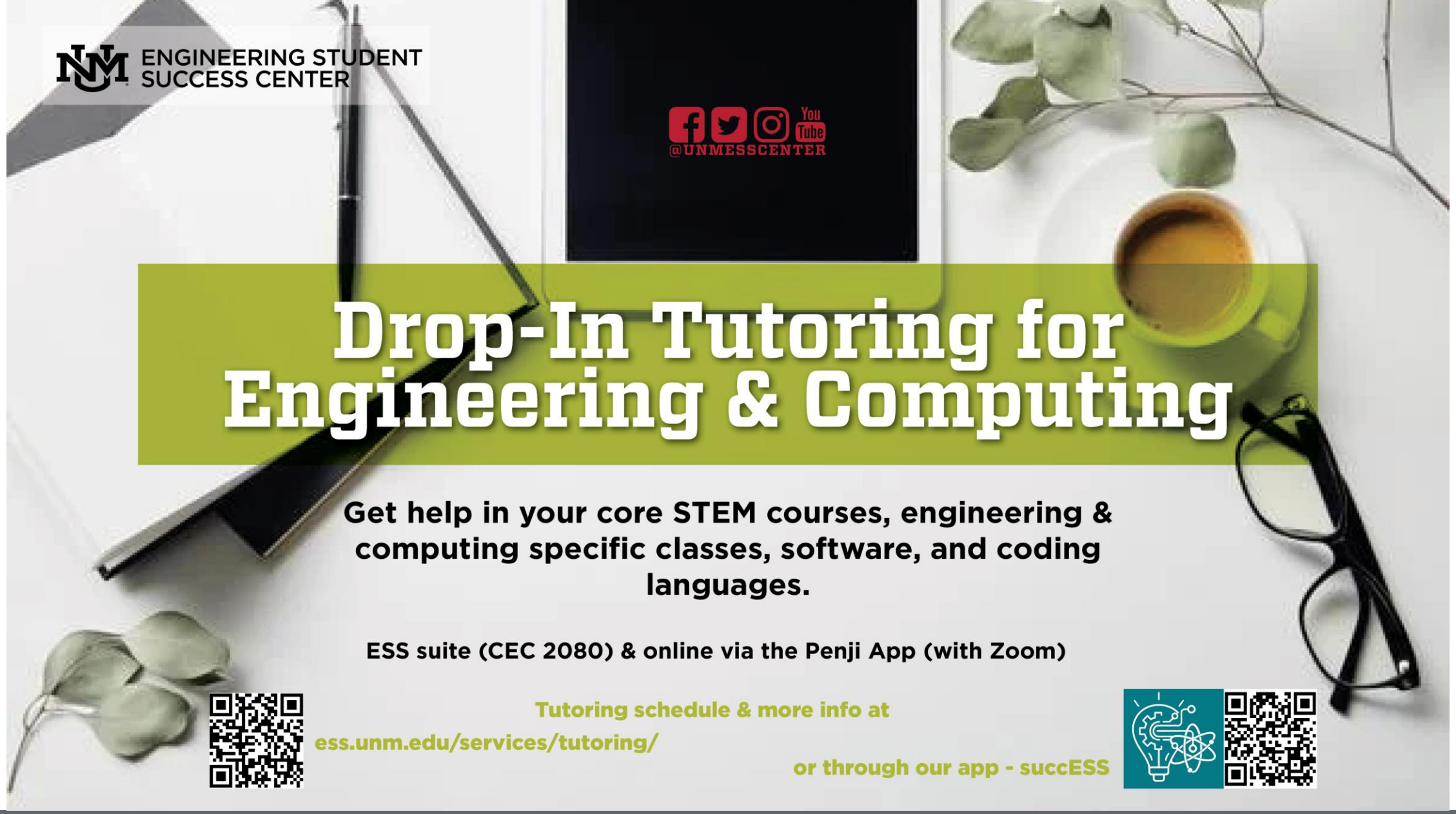
CHEM 1 Prep
(for CHEM 1215)

Presented by:

Ethan Krammer

ENGINEERING STUDENT SUCCESS CENTER

Welcome!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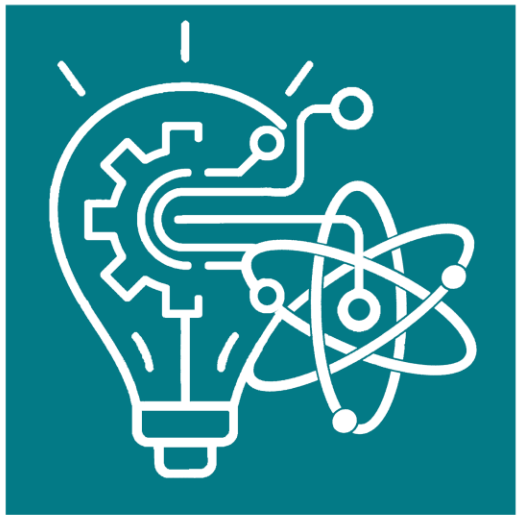
This web **APP** allows you to keep up to date on all we have to offer.



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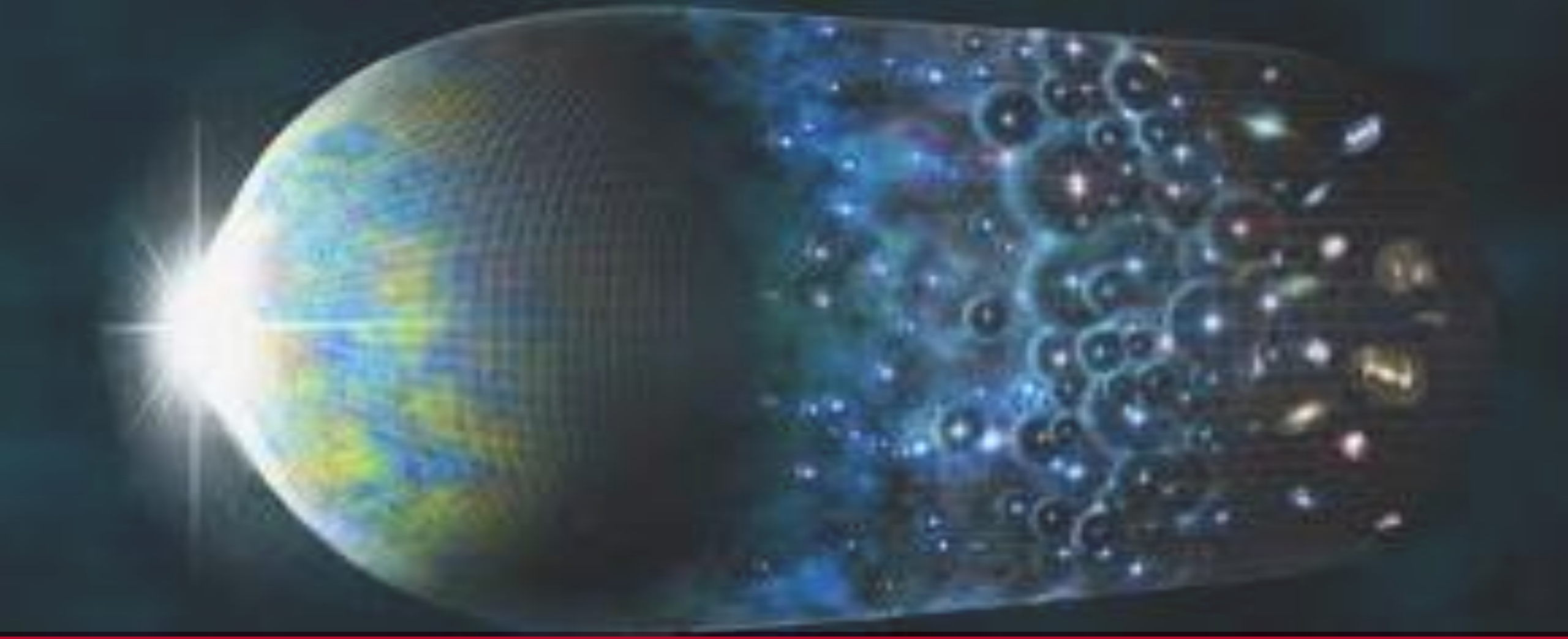
ENGINEERING STUDENT SUCCESS CENTER

Outline

- What is Chemistry
- Definitions
- Discuss Atoms, Matter, and Why they Matter.
- Physical Properties
- Units
- Accuracy & Precision
- Calculators in Chemistry



What is Chemistry?

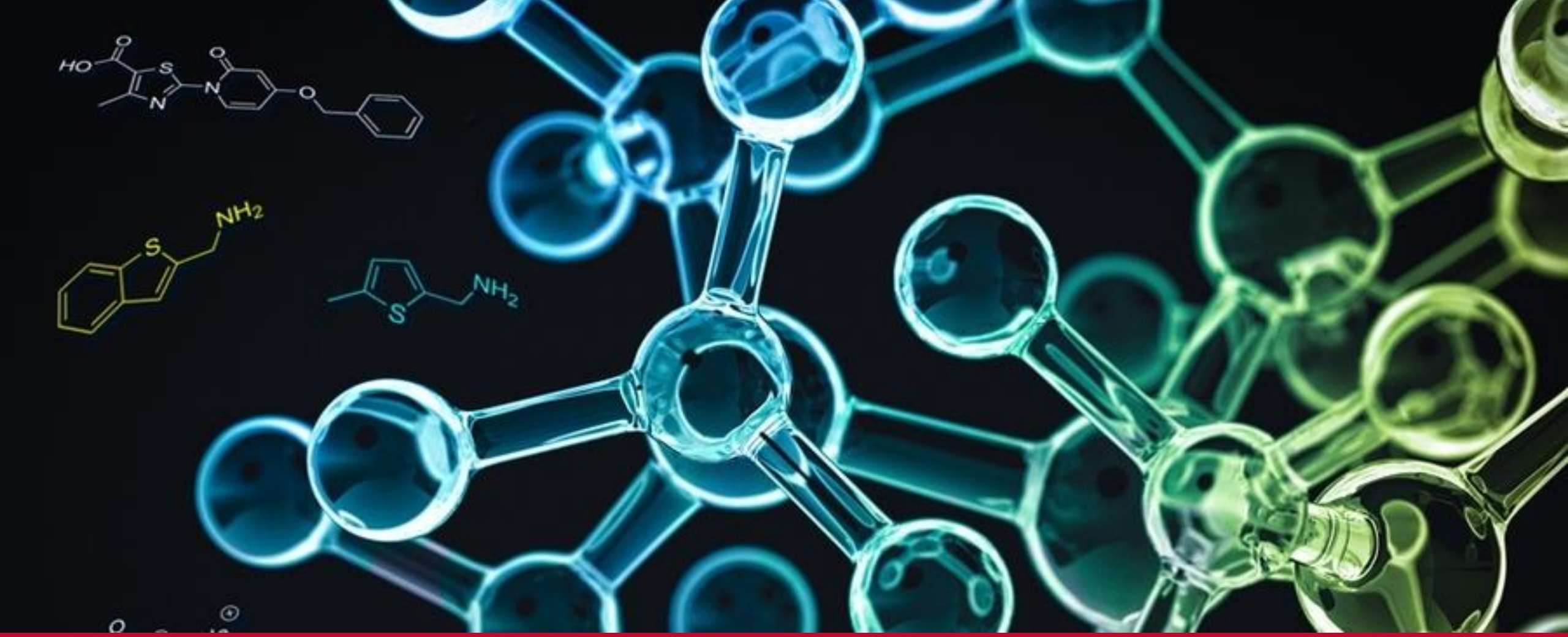
Was it any of these?

Chemistry is everywhere

chemistry

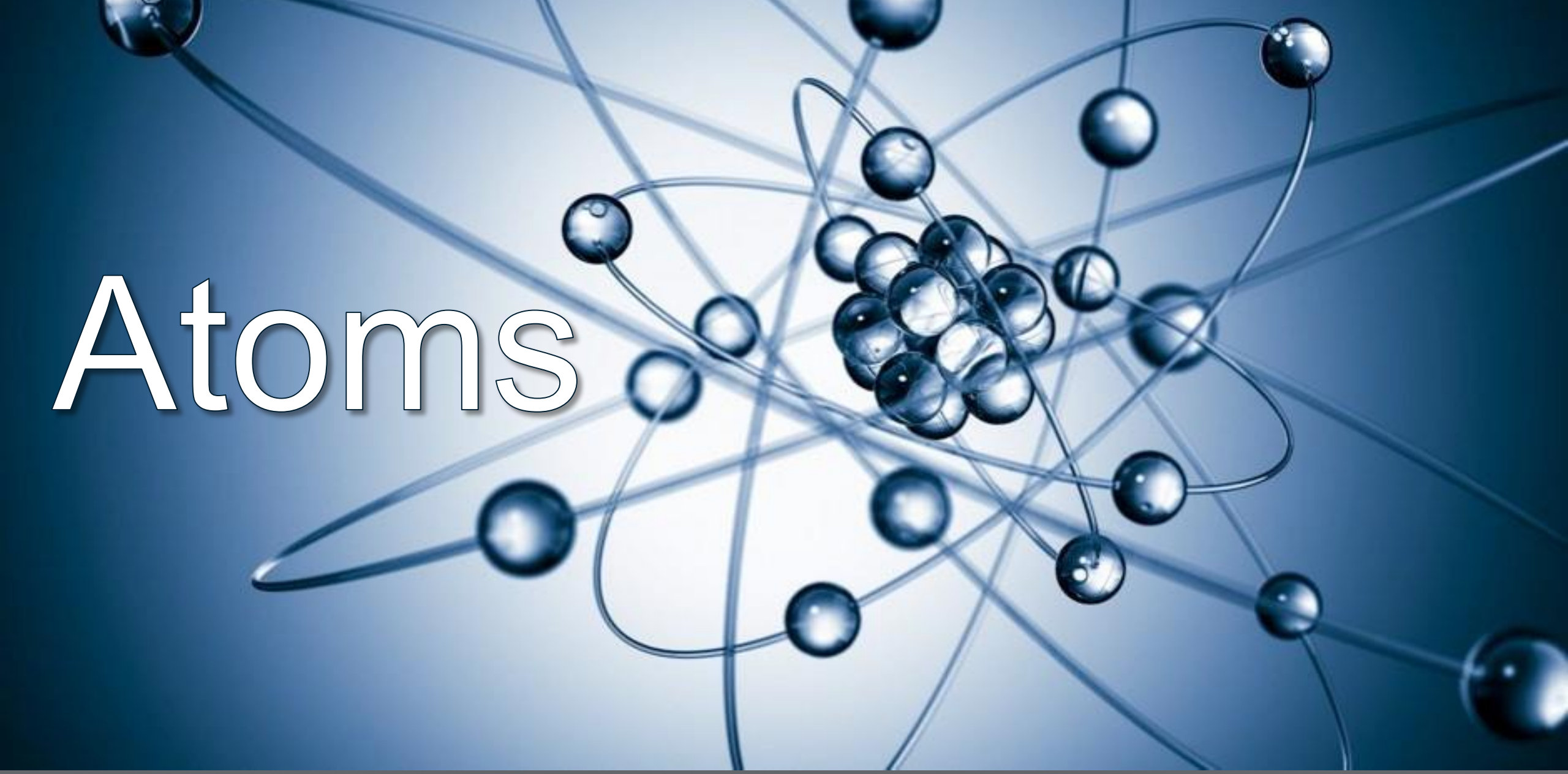
/ˈkem.ə.stri/

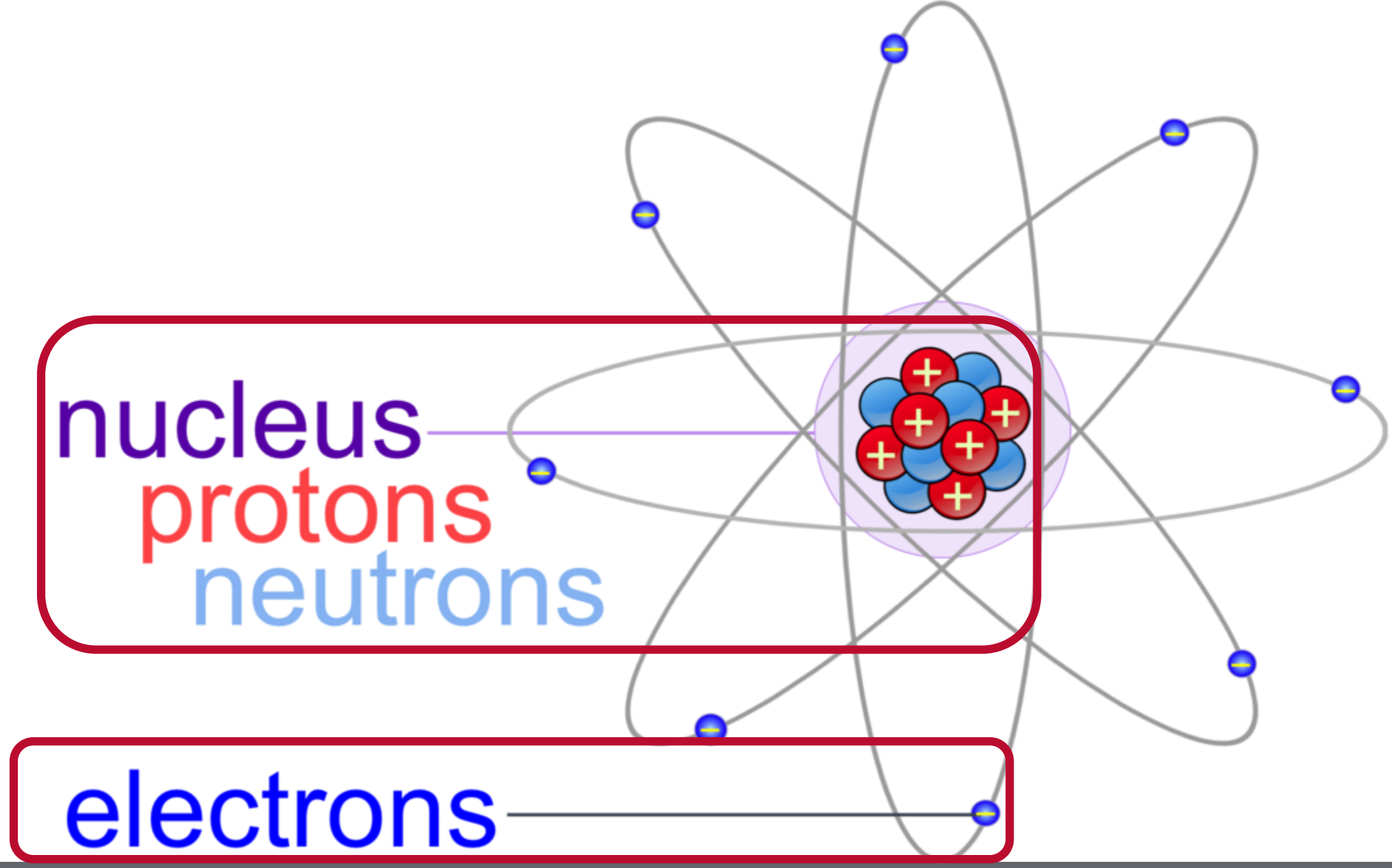
From the word alchemy, the scientific study of the basic characteristics of substances and the ways in which they react or combine.



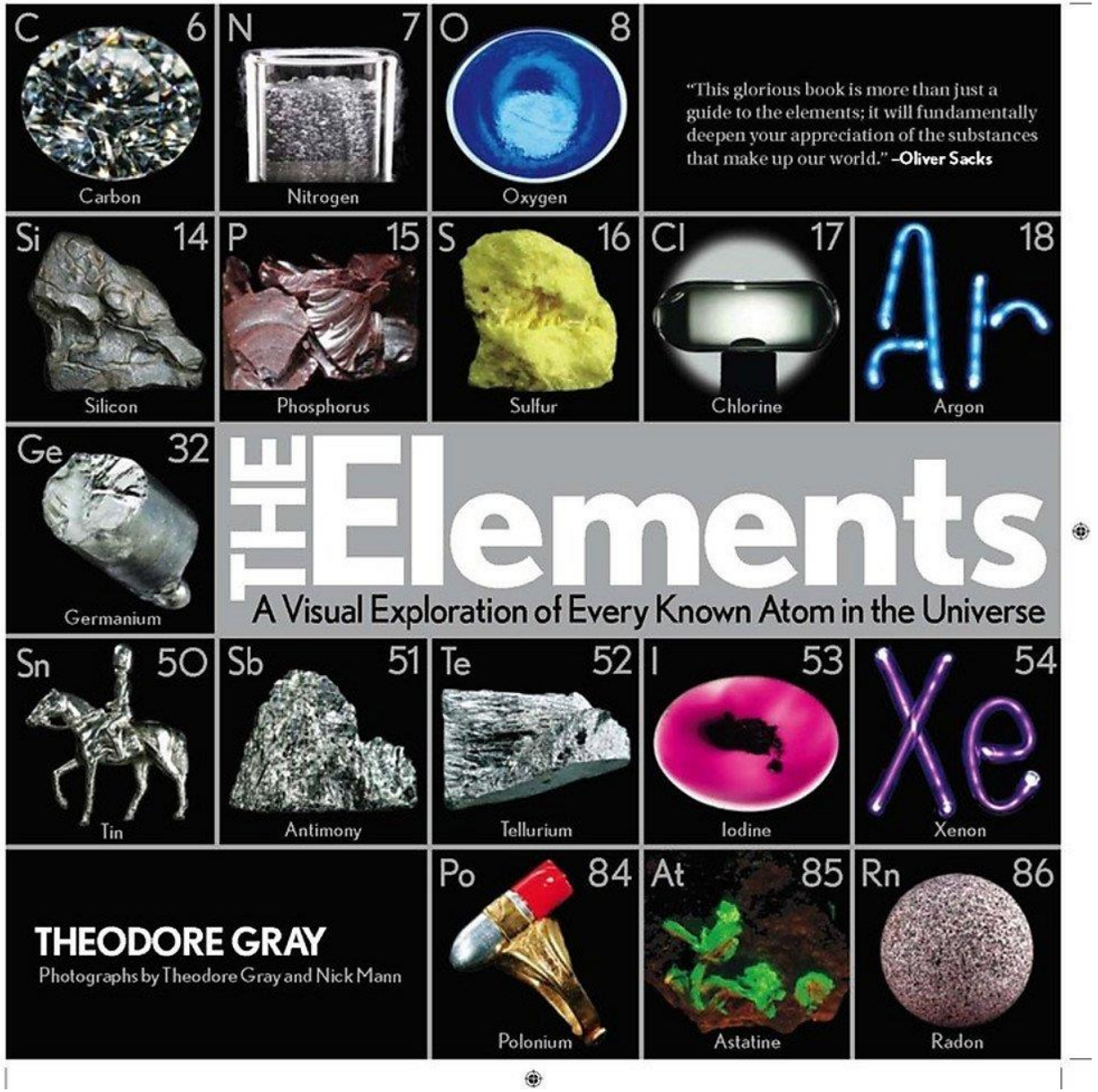
Terms & Definitions

Atoms

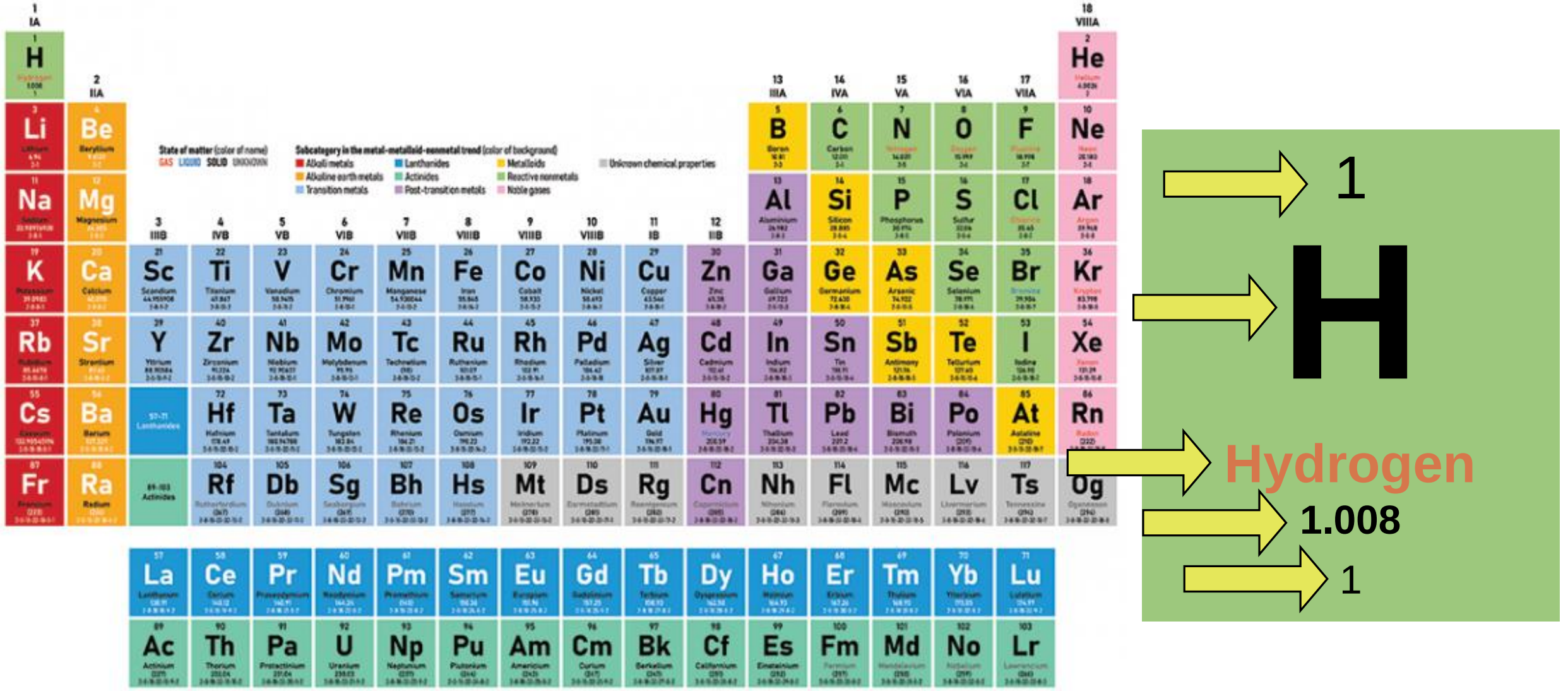




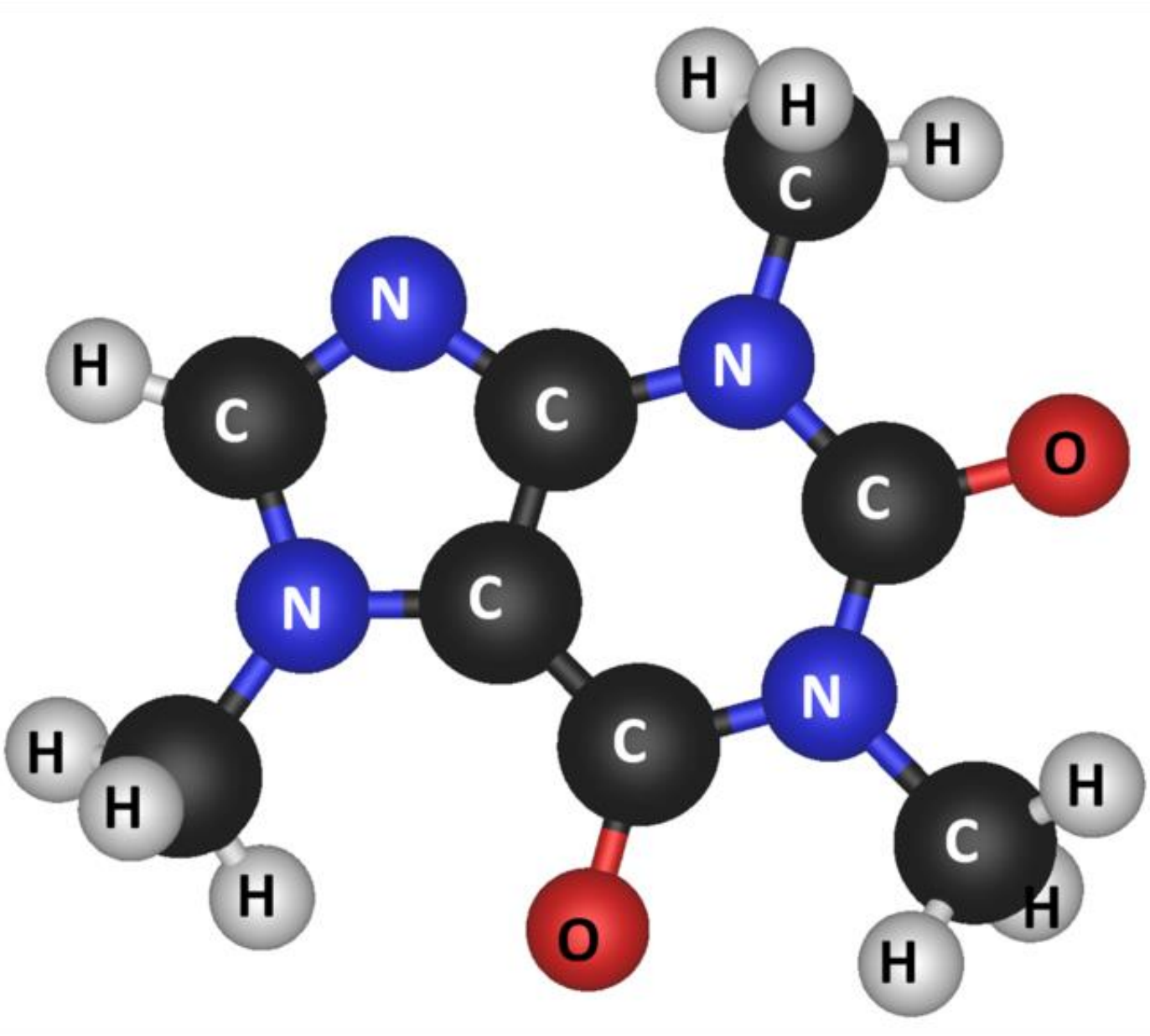
Subatomic Particles


C 6
Carbon
N 7
Nitrogen
O 8
Oxygen
"This glorious book is more than just a guide to the elements; it will fundamentally deepen your appreciation of the substances that make up our world." –Oliver Sacks
Si 14
Silicon
P 15
Phosphorus
S 16
Sulfur
Cl 17
Chlorine
Ar 18
Argon
Ge 32
Germanium
THE Elements
A Visual Exploration of Every Known Atom in the Universe
Sn 50
Tin
Sb 51
Antimony
Te 52
Tellurium
I 53
Iodine
Xe 54
Xenon
THEODORE GRAY
Photographs by Theodore Gray and Nick Mann
Po 84
Polonium
At 85
Astatine
Rn 86
Radon

Elements



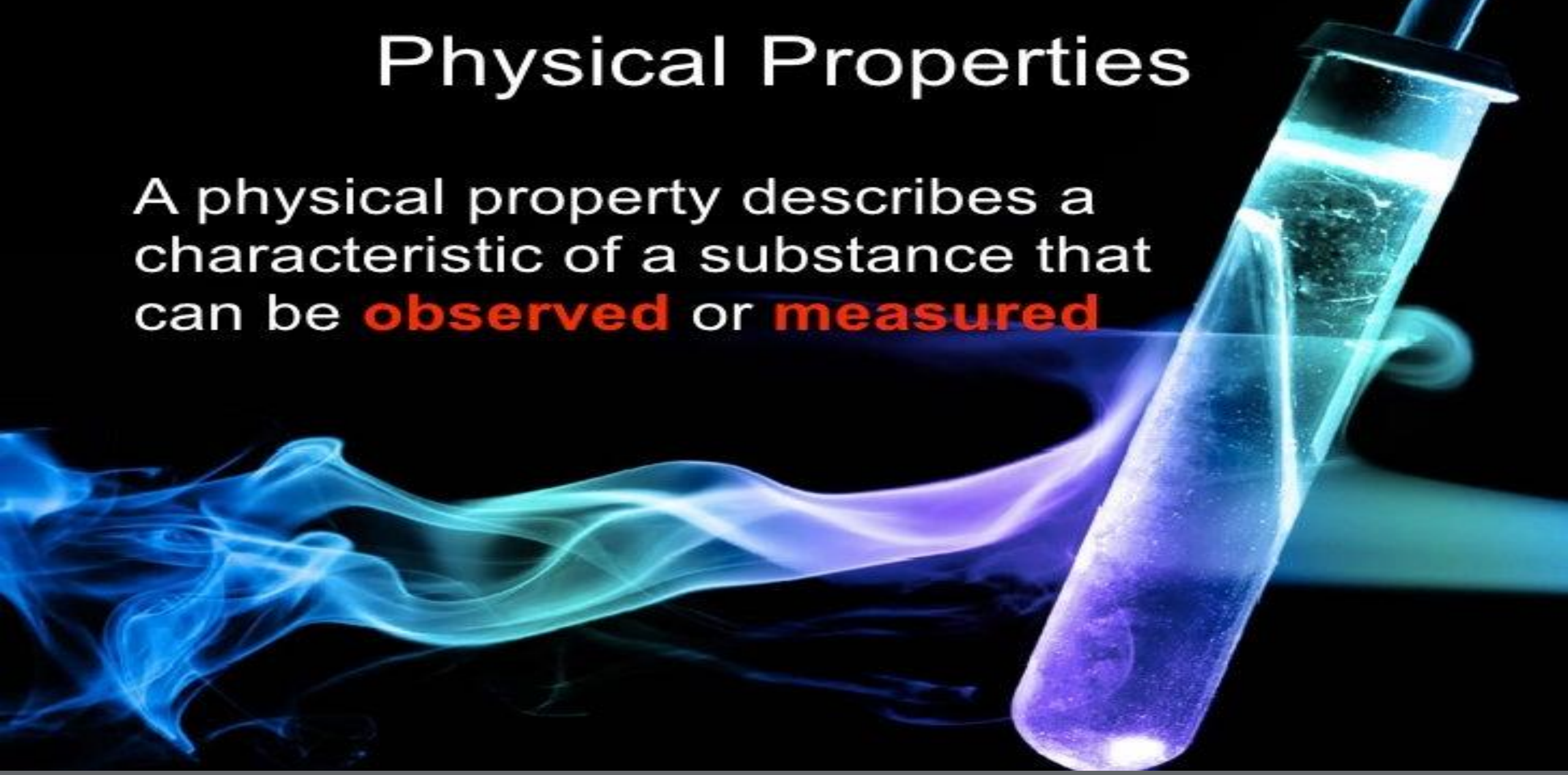
Periodic Table of Elements



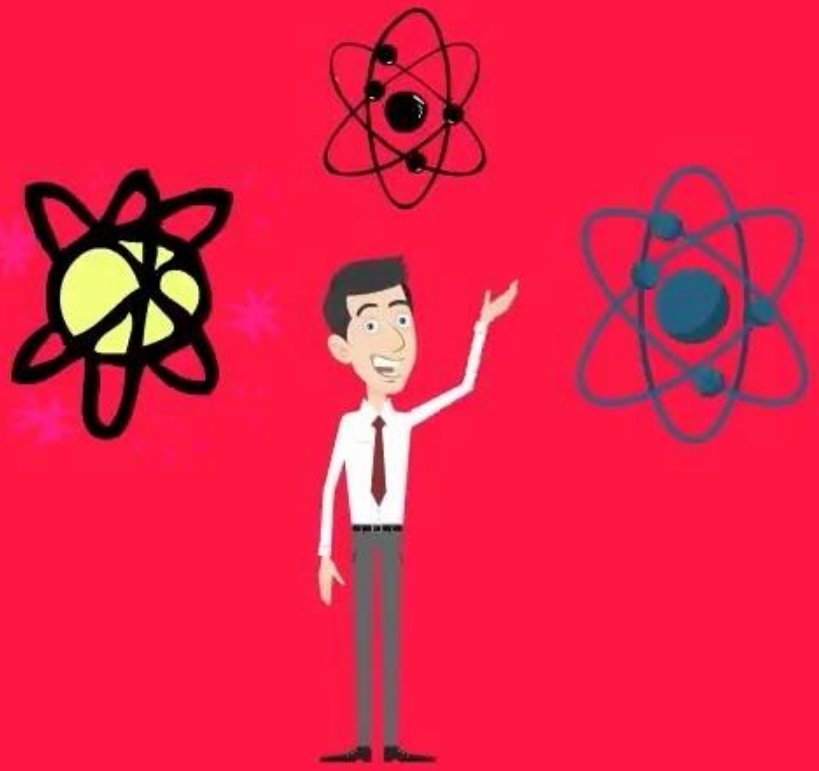
Molecules

Physical Properties

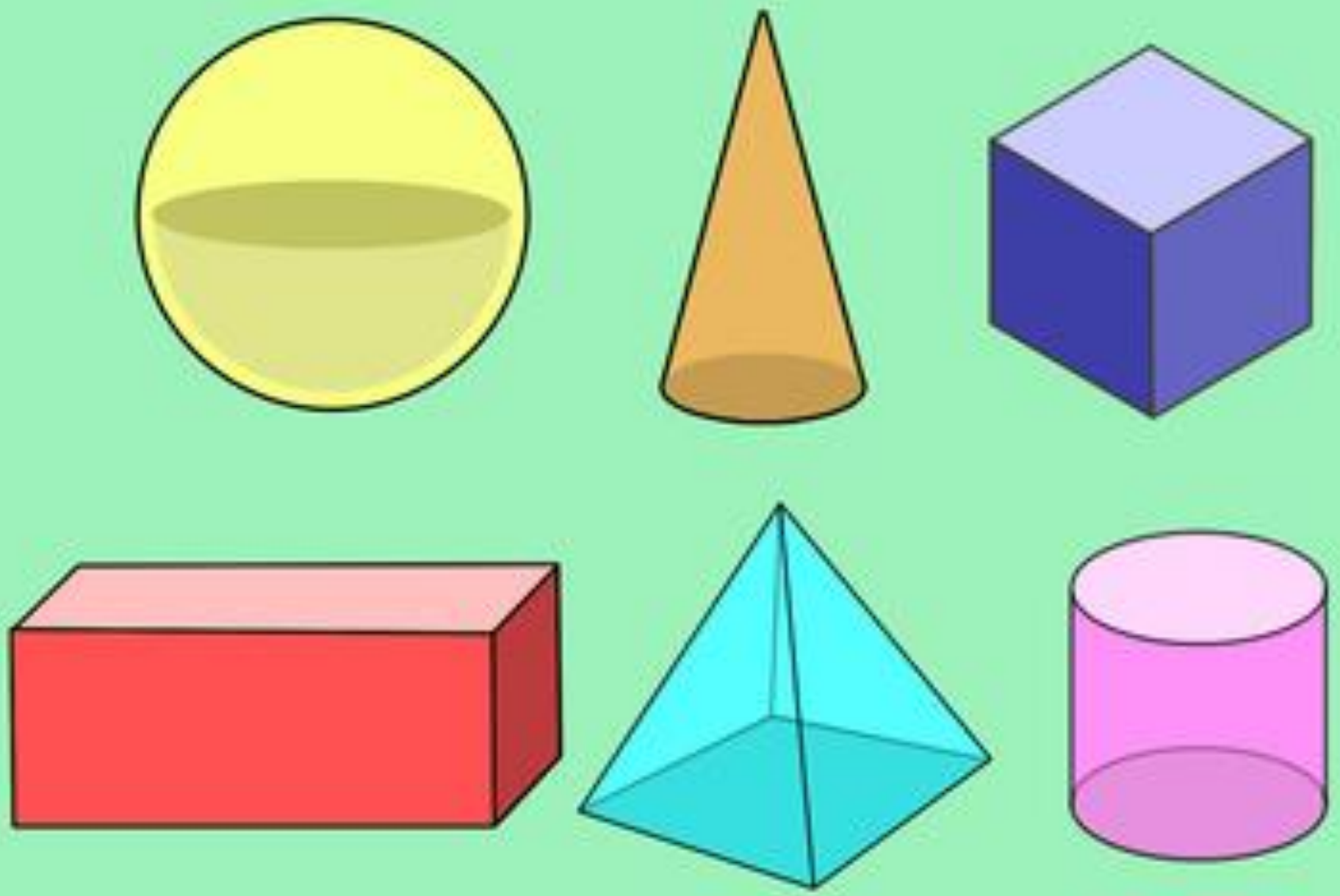
A physical property describes a characteristic of a substance that can be **observed** or **measured**



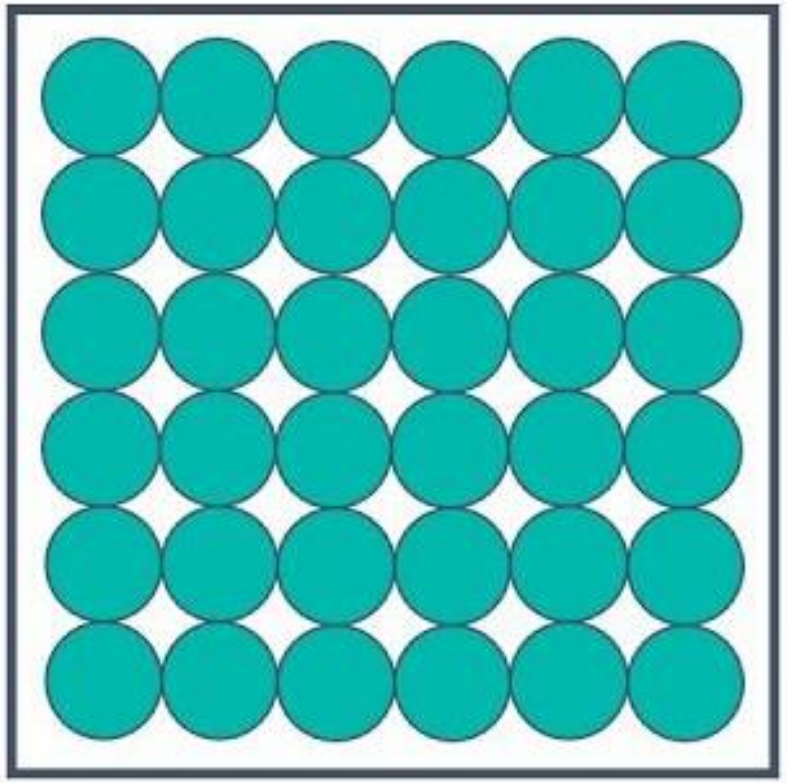
Mass

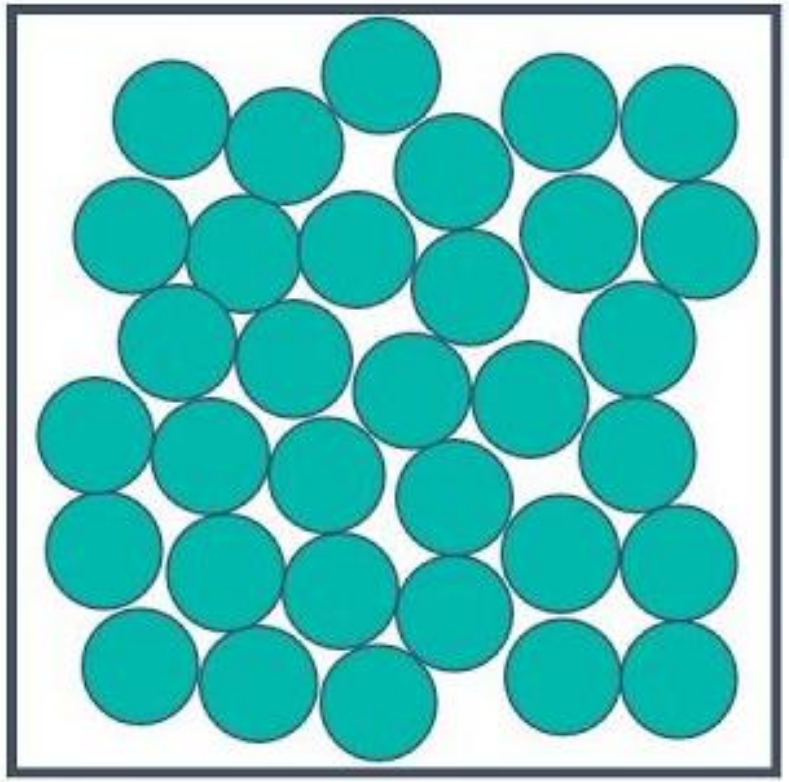


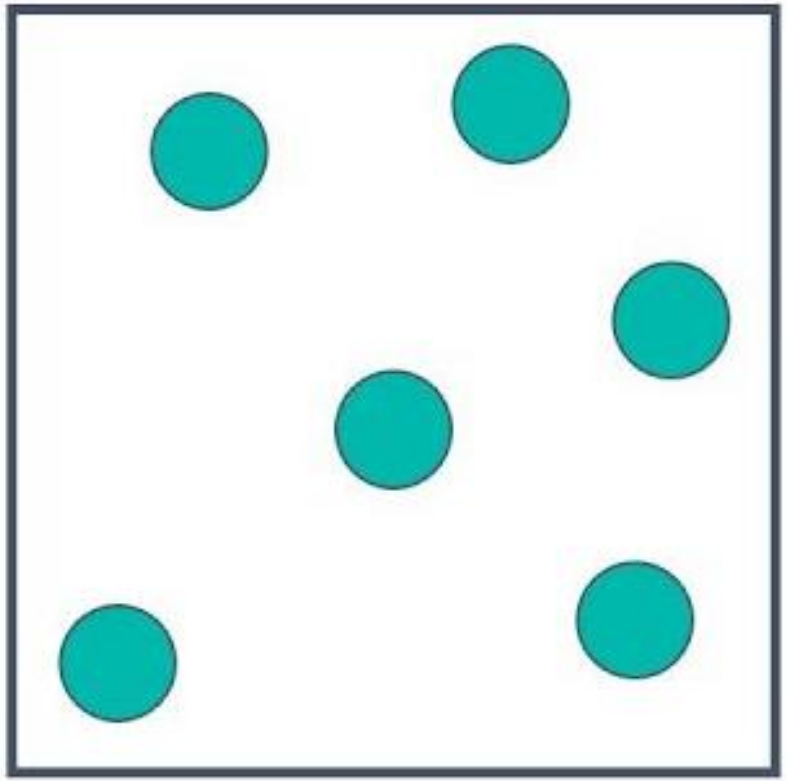
Weight



Volume







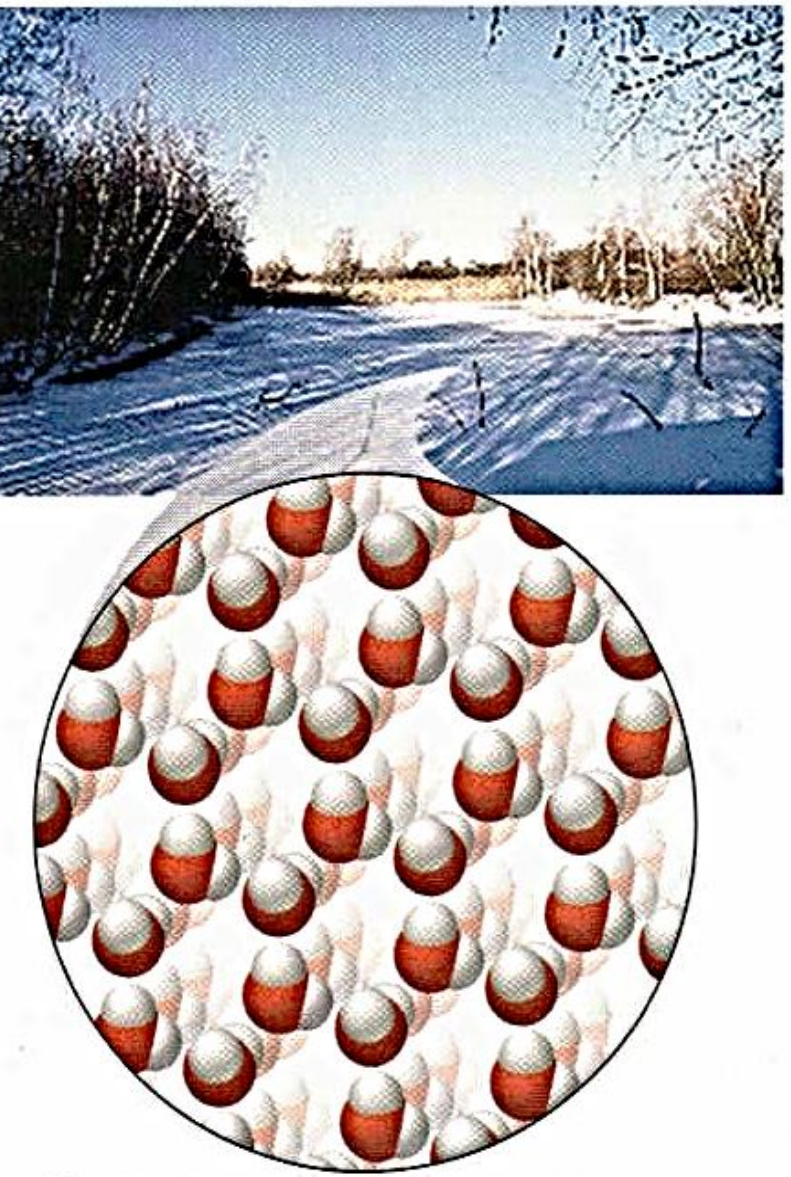
Density

Solid

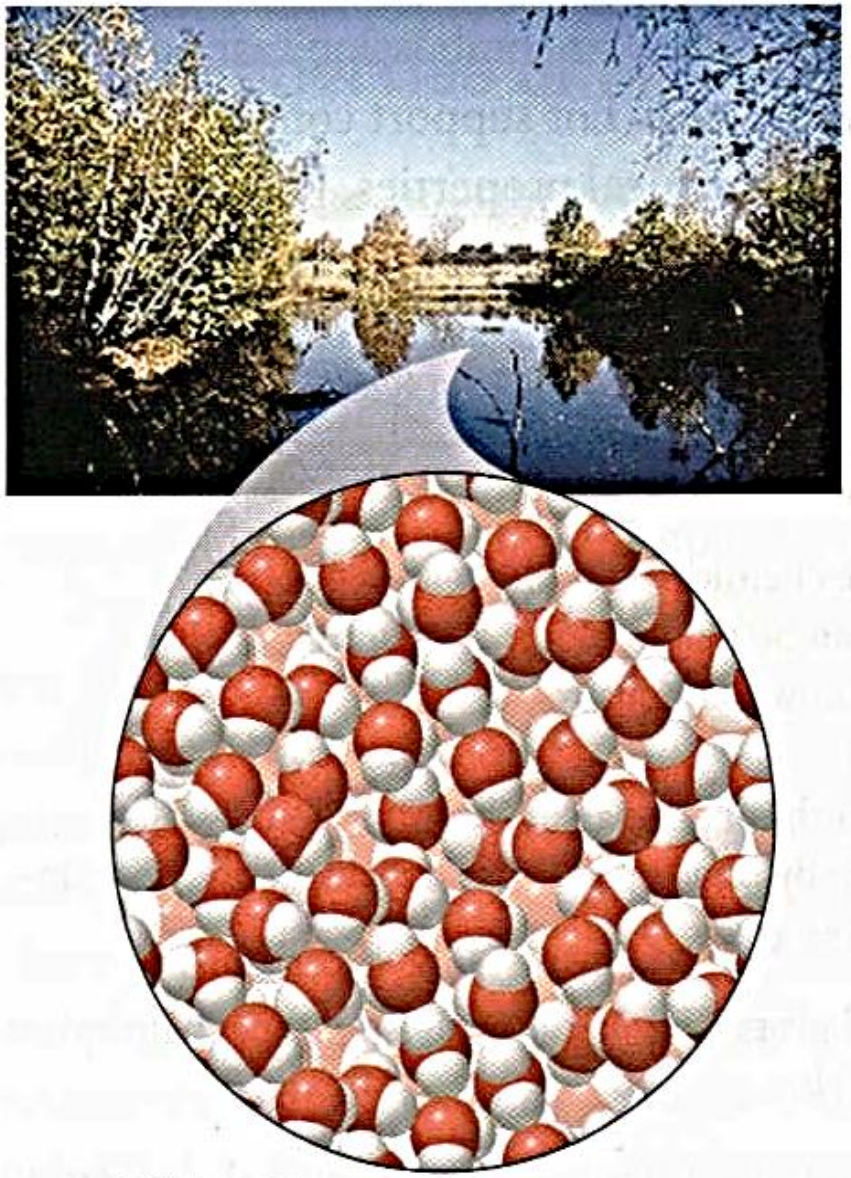
Gas

Liquid

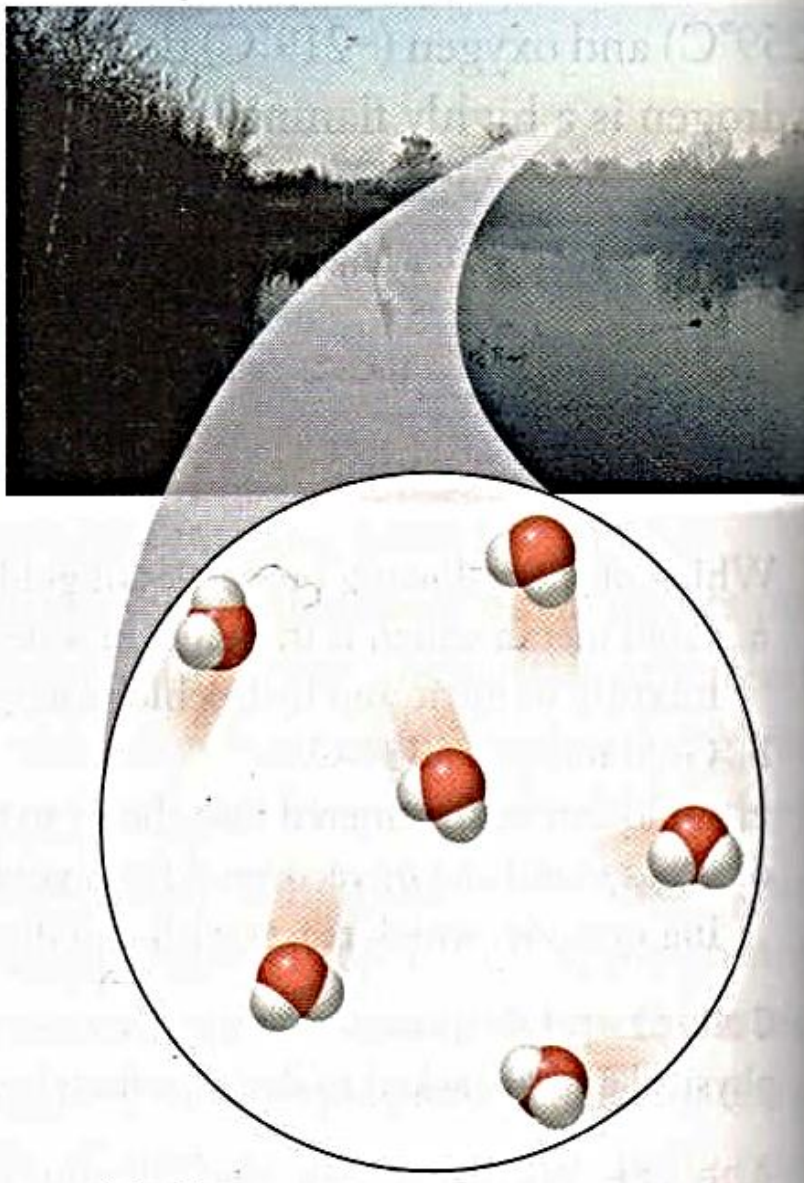
What's the Matter?



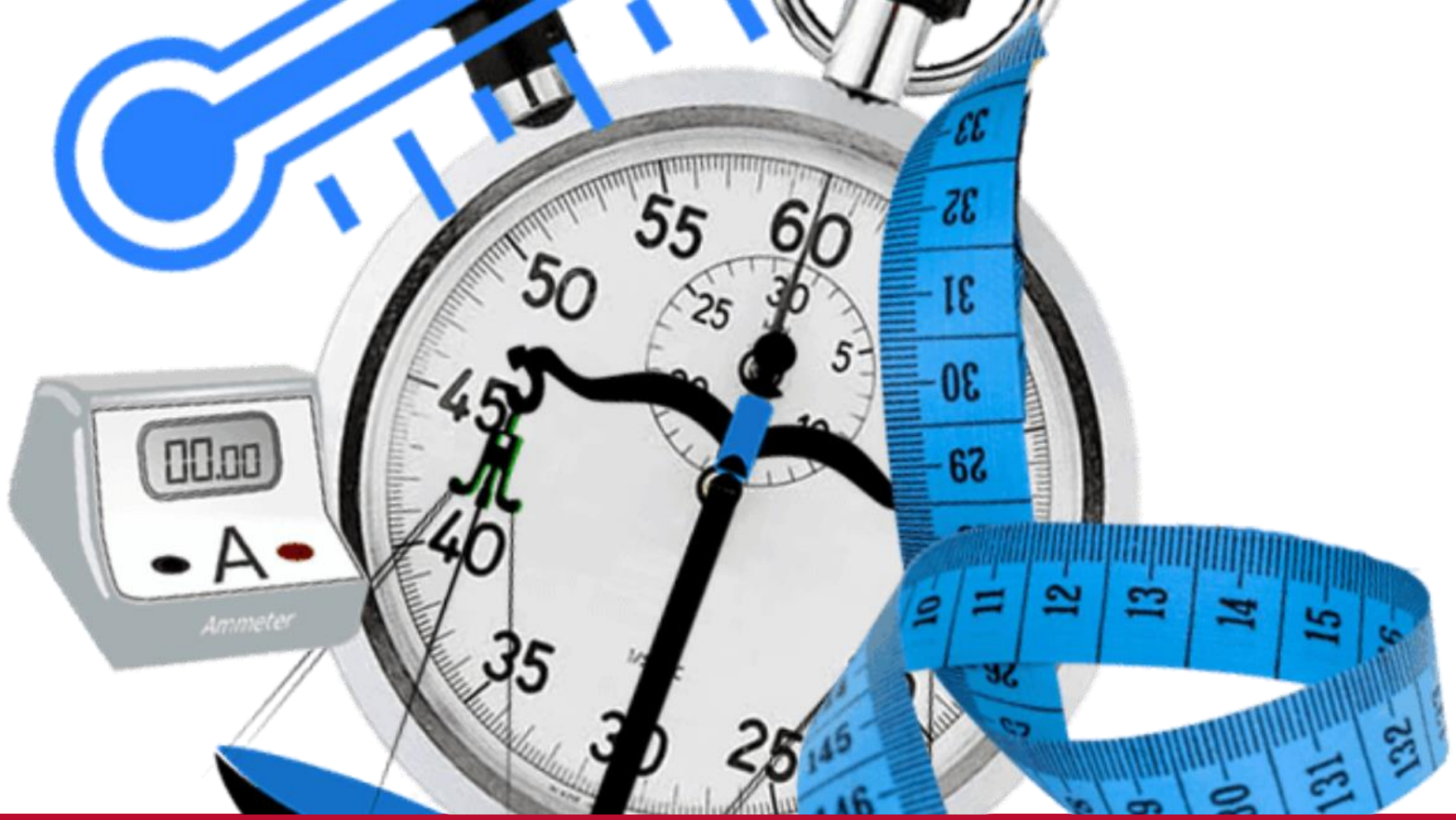
(a) Solid



(b) Liquid



(c) Gas



Units

A standard of measurement of physical quantities

What are Units?

Physical Quantities

Base Quantity	Name	Symbol
Length	Meter	m
Mass	Kilogram	kg
Time	Second	s
Electric Current	Ampere	A
Temperature	Kelvin	K
Amount of Substance	Mole	mol
Luminous Intensity	candela	cd

Helpful Website: National Institute of Standards and Technology
https://physics.nist.gov/cuu/Units/units.html

What is a mole?

1 mol

$= 6.022 \times 10^{23}$ items (e.g. atoms)

Important Conversion Factors for Chemistry

Accuracy VS Precision

100%
ACCURACY
Guarantee

Accuracy

Must have a STANDARD or KNOWN values for reference.

Precision

High Accuracy
High Precision

Low Accuracy
High Precision

1

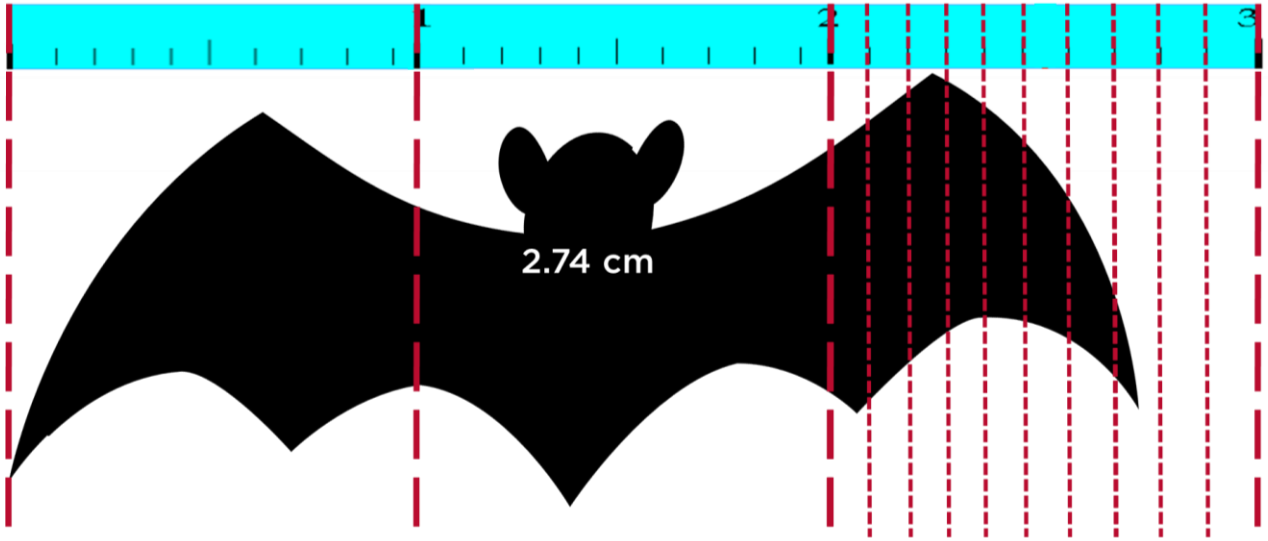
High Accuracy
Low Precision

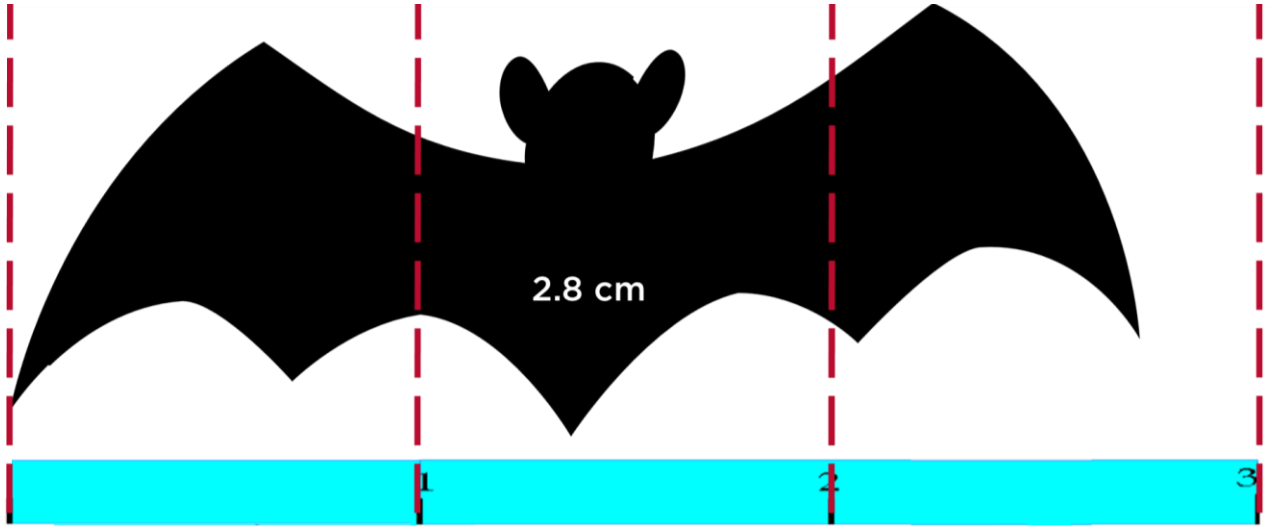
2

Low Accuracy
Low Precision

3

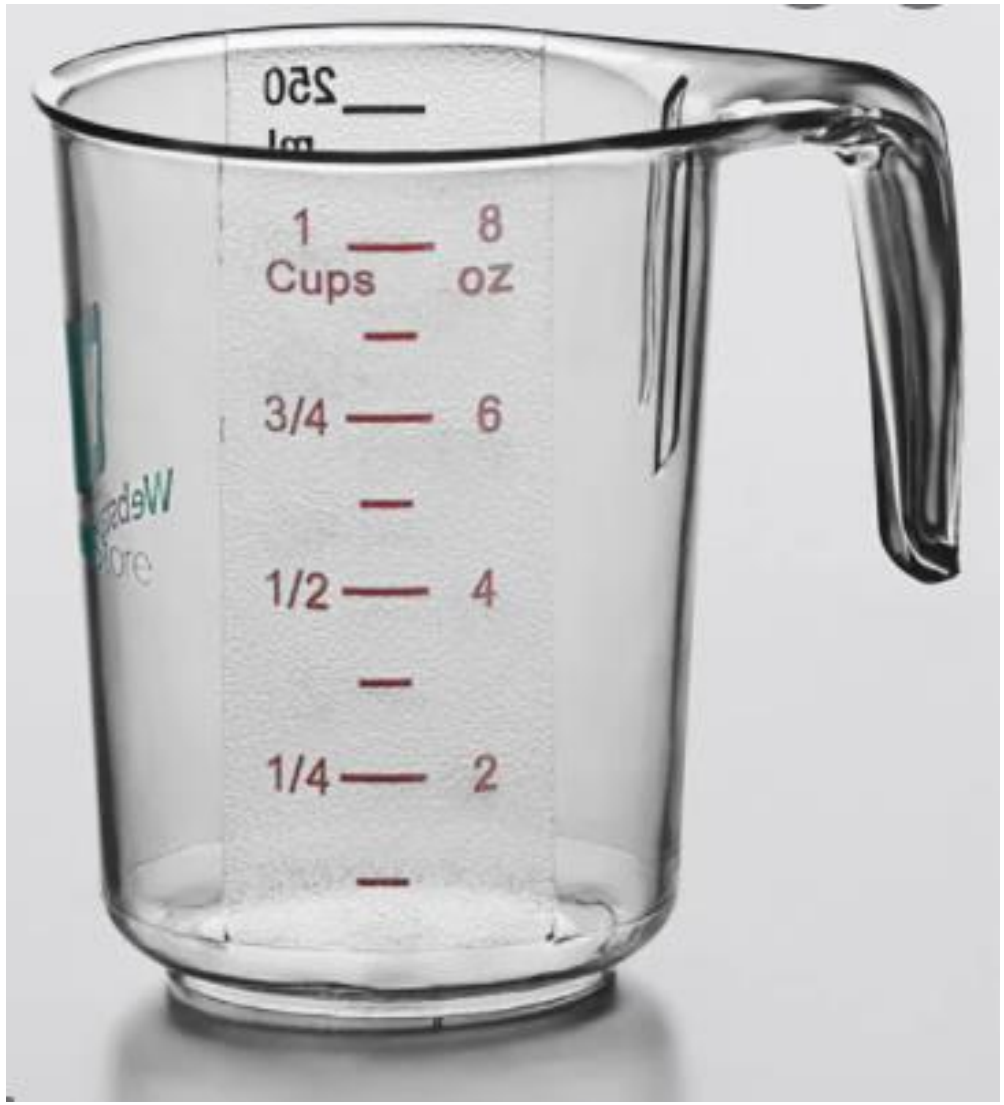
Accuracy and Precision

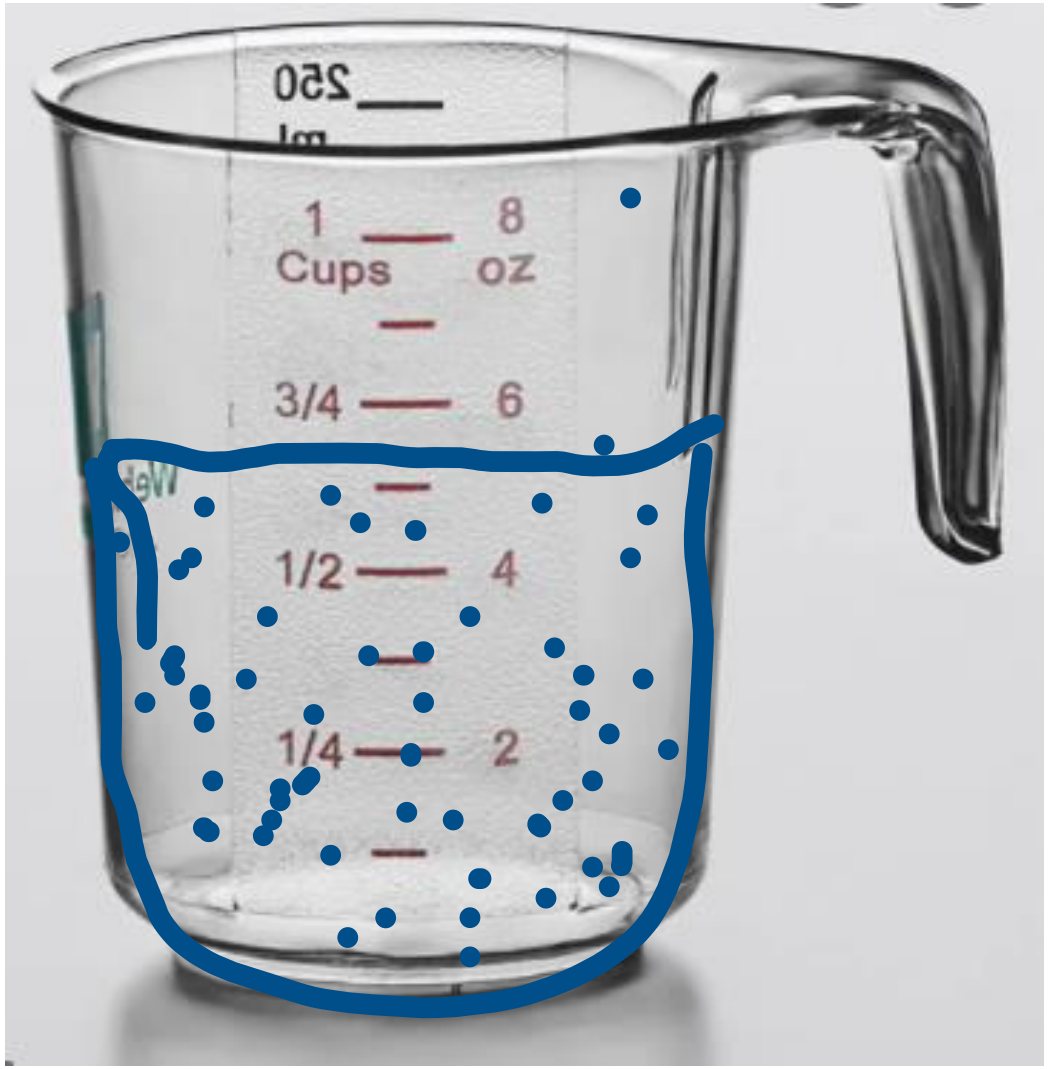




Significant Digits

ERROR


250
1
Cups
8
oz
3/4
6
1/2
4
1/4
2


250
1
Cups
8
oz
3/4
6
1/2
4
1/4
2

All nonzero digits are significant

1.234 g = 4 sig. fig.

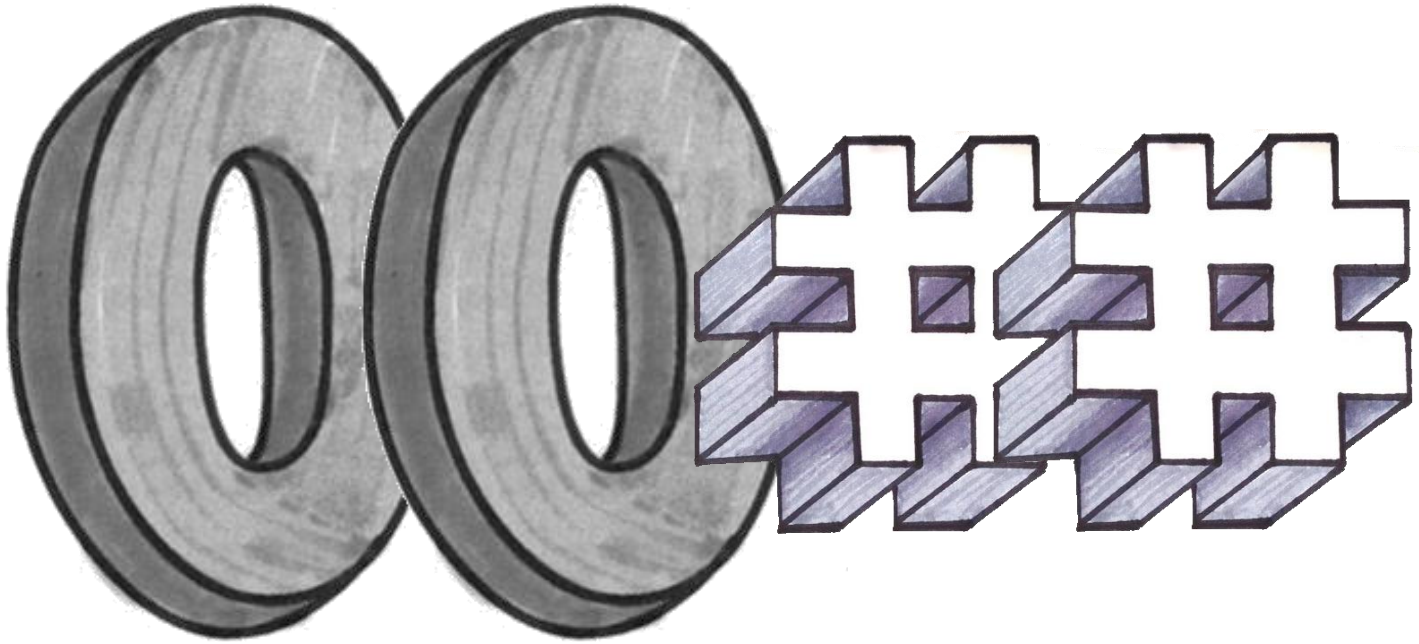
1.2 g = 2 sig. fig.

What about zero?

Zeros between non-zeros are always significant

1002 kg = 4 sig. fig.

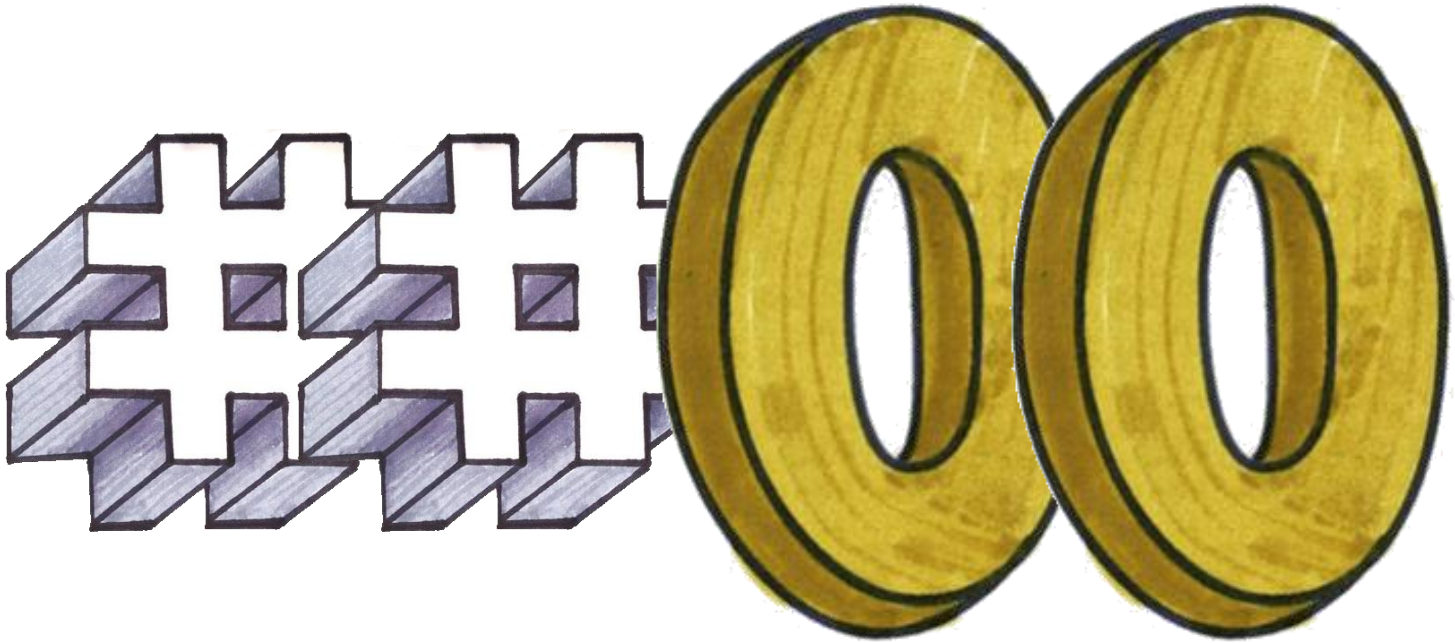
3.01 mL = 3 sig. fig.



Leading zeros are NOT significant

0.001 ^{o}C = 1 sig. fig.

0.012 g = 2 sig. fig.



Trailing zeros (when decimals are present) ARE significant

0.0230 mL = 3 sig. fig.

0.20 g = 2 sig. fig.

50,600 calories

= 3, 4, or 5 sig. fig.?

190 miles

= 2 or 3 sig. fig.?

Uncertainty and Decimals

How many Significant Digits are in each number?

a) 0.0035 — 2 sig fig

b) 1.080 — 4 sig fig

c) 2371 — 4 sig fig or more, depending on what adding a decimal will tell us

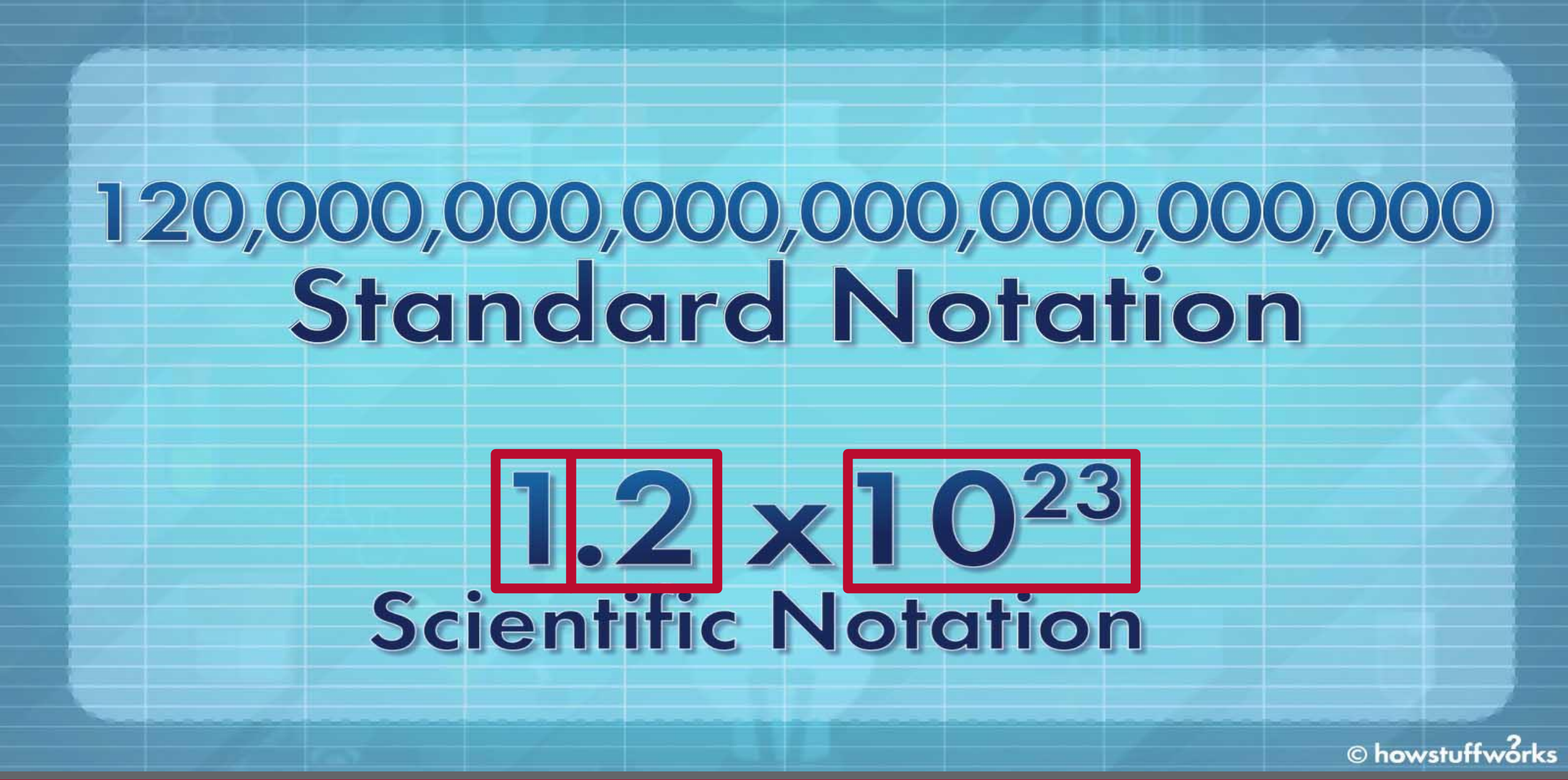
d) 2.97×10^5 — 3 sig fig

e) 100.00 — 5 sig fig

f) 100,000 — Ambiguous

Significant Digits Practice

SCIENTIFIC NOTATION


120,000,000,000,000,000,000,000,000
Standard Notation
1.2 x 10^23
Scientific Notation
© howstuffworks

A POSITIVE exponent means the original number was large.

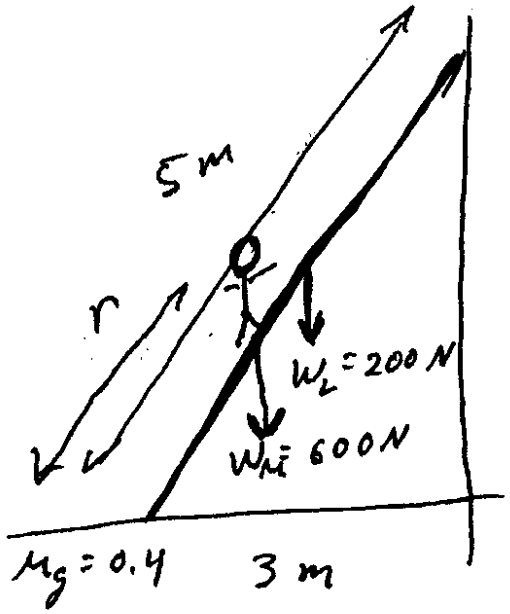
$$46{,}600{,}000 = 4.66 \times 10^{7}$$

A NEGATIVE exponent means the original number was small.

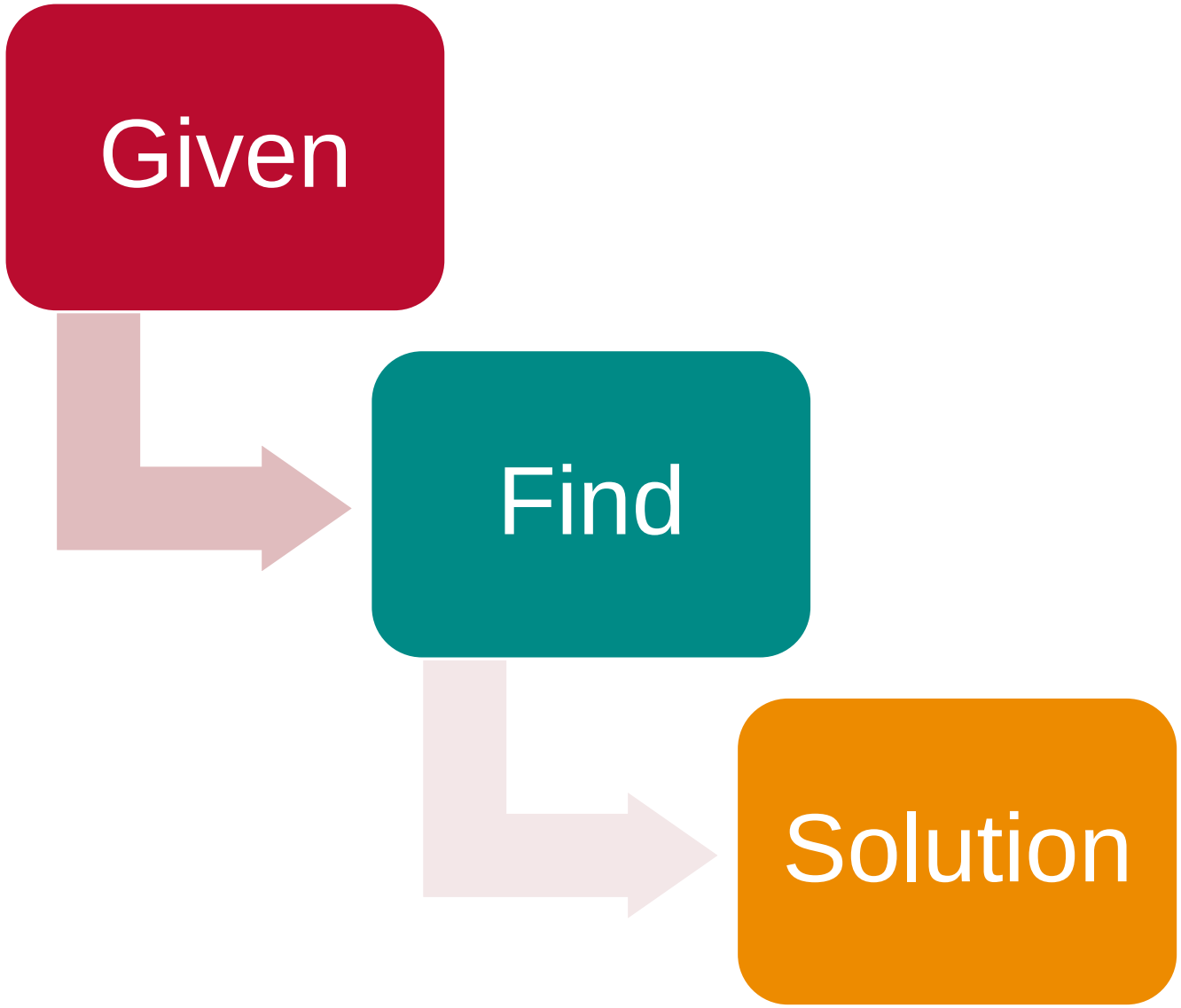
$$0.00053 = 5.3 \times 10^{-4}$$

Prefix	Symbol	Multiply Base Unit by	Example
tera	T	1,000,000,000,000	teragram = Tg = 10^{12} g
giga	G	1,000,000,000	gigaliter = GL = 10^{9}L
mega	M	1,000,000	megagram = Mg = 10^{6} g
kilo	k	1,000	kilogram = kg = 10^{3} g
hecto	h	100	hectogram = hm = 10^{2} m
deka	da	10	decagram = dag = 10 g
deci	d	1/10	deciliter = dL = 10^{-1} L
centi	c	1/100	centimeter = cm = 10^{-2} g
milli	m	1/1000	millimeter = mm = 10^{-3} m
micro	μ	1/1,000,000	microgram = μg = 10^{-6} g
nano	n	1/1,000,000,000	nanoliter = nL = 10^{-9} L
pico	p	1/1,000,000,000,000	picogram = pg = 10^{-12}g
femto	f	1/1,000,000,000,000,000	femtomole = fmol= 10^{-15} mol

A uniform ladder 5 m long weighing 200 N is leaning against a smooth vertical wall with its base 3 m from the wall. The coefficient of static friction between the bottom of the ladder and the ground is 0.4. How far, measured along the ladder, can a 600 N man climb before the ladder starts to slip?



Word Problems


Given
Find
Solution

A bus traveled on a level road for 6 hours at an average speed 20 miles per hour faster than it traveled on a winding road. The time spent on the winding road was 3 hours. Find the average speed on the level road if the entire trip was 462 miles.

$d = rt$

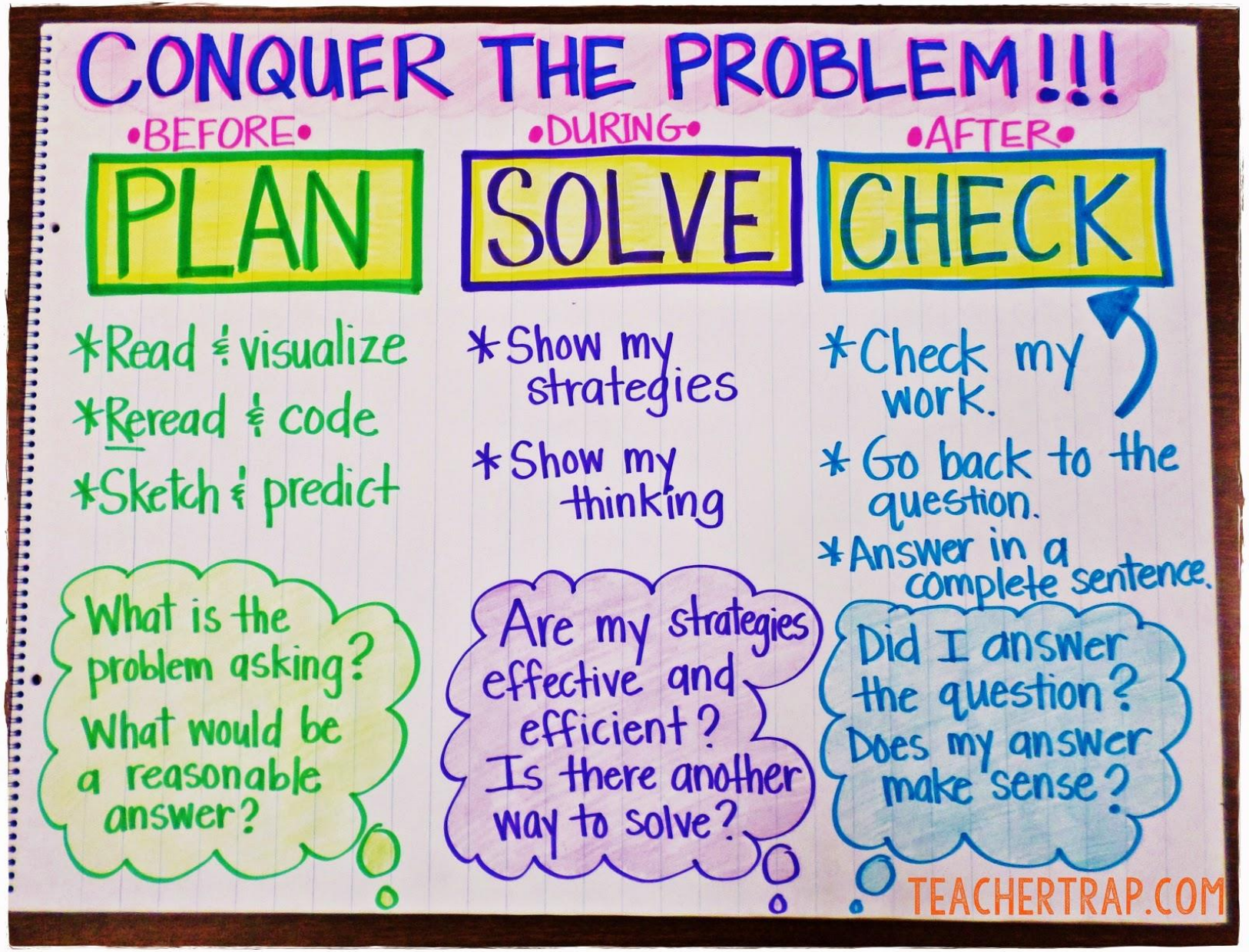
categories	rate	time
level road 6hr	$x+20$	6 hr
winding rd. 3hr	x	3 hr

Step 1: Identify Given Information

Three coffees and two muffins cost a total of 7 dollars. Two coffees and four muffins cost 8 dollars. What is the individual price for a single coffee and a single muffin?

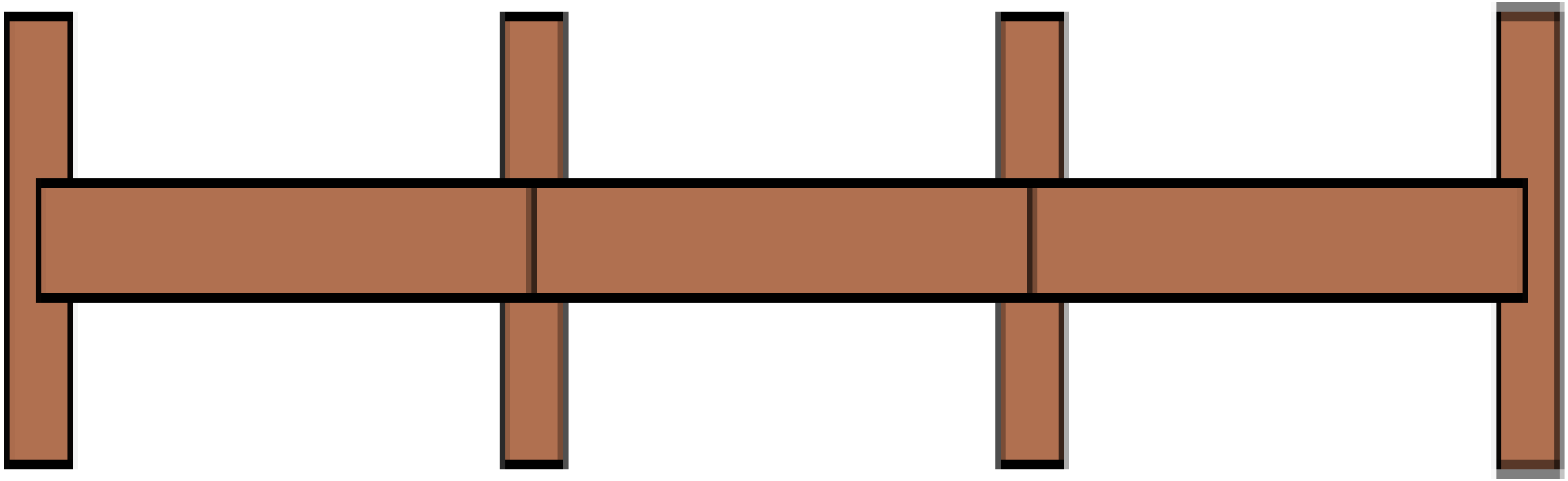
Let x = cost of a single coffee
Let y = cost of a single muffin

Step 2: Identify the unknowns



Step 3: Begin strategizing for the answer based on the given information

Fence Post Method



Dimensional Analysis

Conversion Factors

A relationship in the form of an equality.

$$\frac{7\text{days}}{1\text{wk}} \qquad \frac{60\text{sec}}{1\text{min}} \qquad \frac{12\text{in}}{1\text{ft}}$$

A single $100 bill (large unit) has 100 $1 bills (small unit).

=

Both have the same value total value.

How many pennies are in 100.00 dollars?

Given:

We have $100.00

We know $1.00 = 100 pennies

Find

Quantity of pennies in $100.00

Solution:

Make a fence post and solve it

$100	100 pennies	10,000 pennies	= Multiply top row straight across and record your answer
	$1	1 unitless	= Multiply bottom row straight across and record your answer

There are 10,000 pennies in $100.00

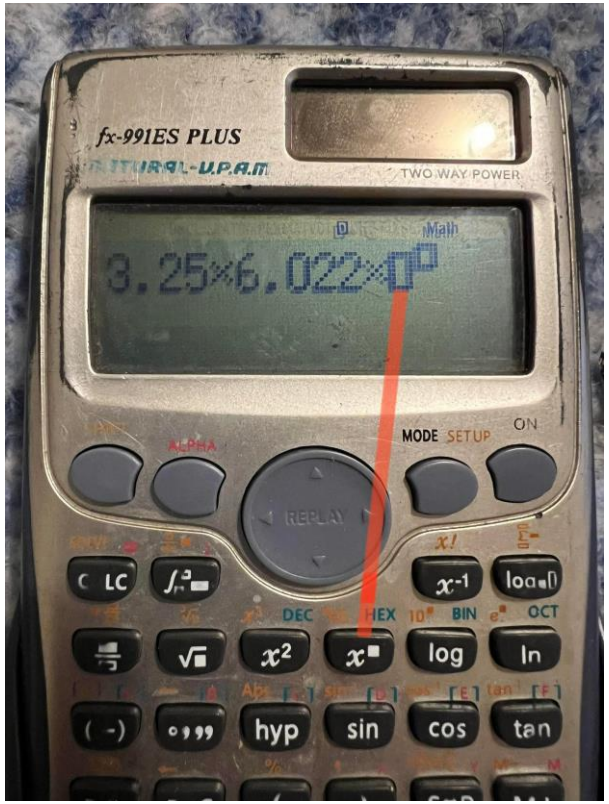
1 mol = 6.022×10^{23} quantity

1. Casio FX115ESPLUS scientific calculator 2. Texas Instruments TI-36X Pro

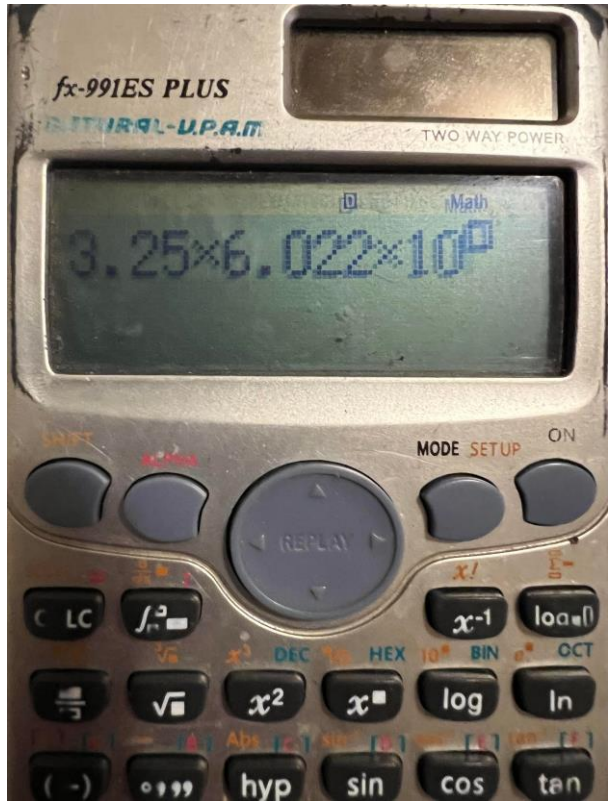
Calculators

Calculate the number of molecules in 3.25 moles of H2O.

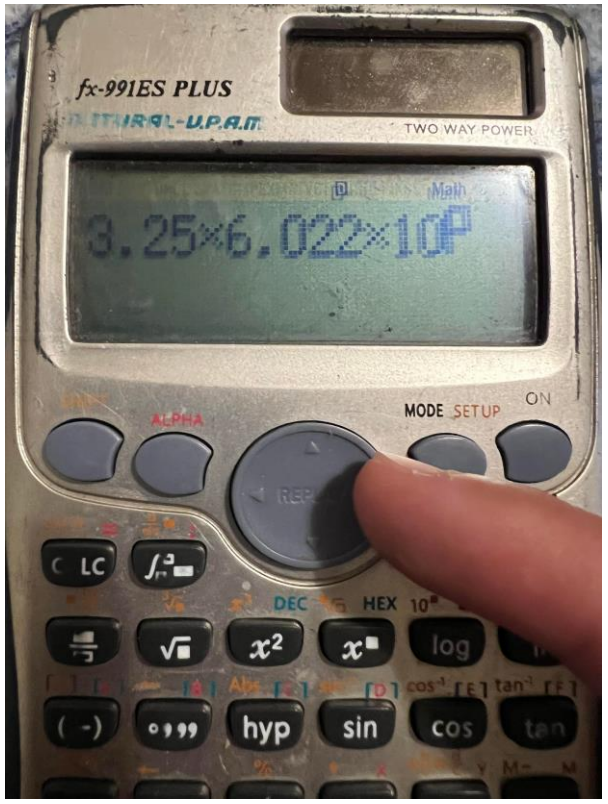
Solution: (3.25 moles) × (6.022 × 10^23 mole^-1) = 1.96 × 10^24 molecules



Press 'x' with an exponent' button



Enter '10'

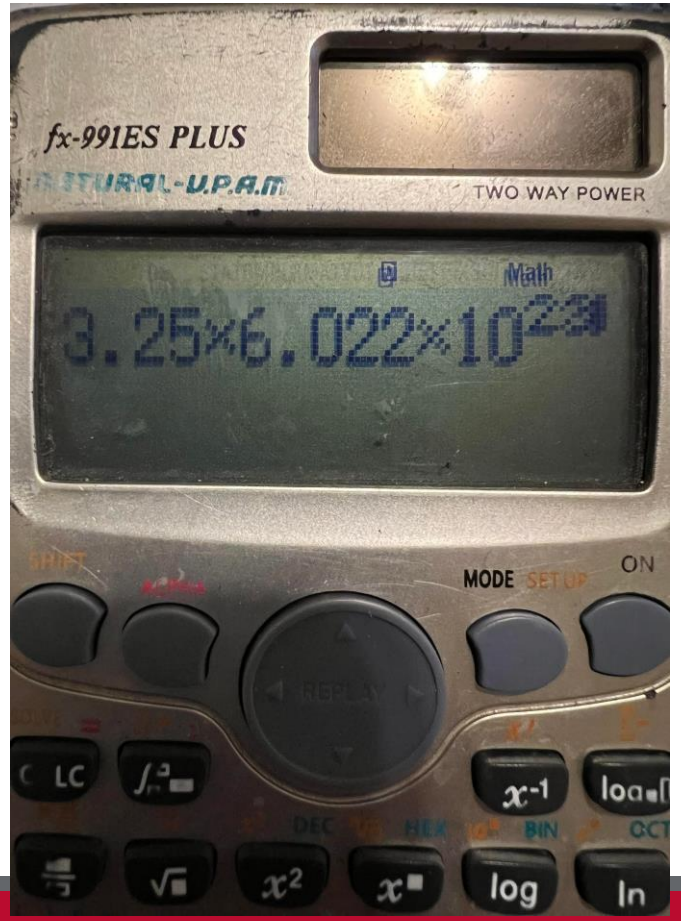


Enter '>' key as shown

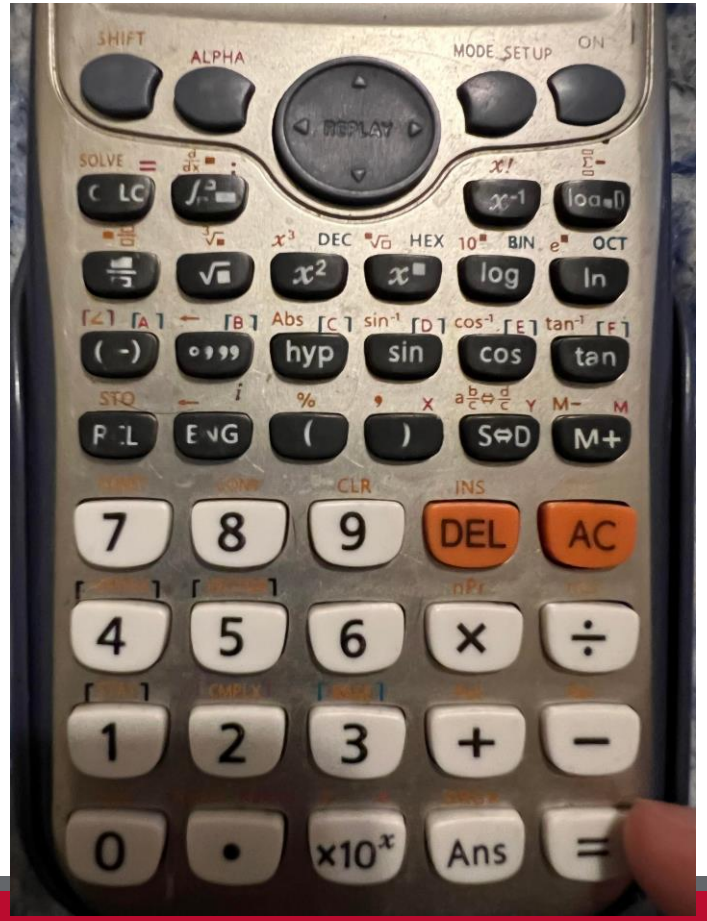
Multistep Dimensional Analysis

Using Your Calculator

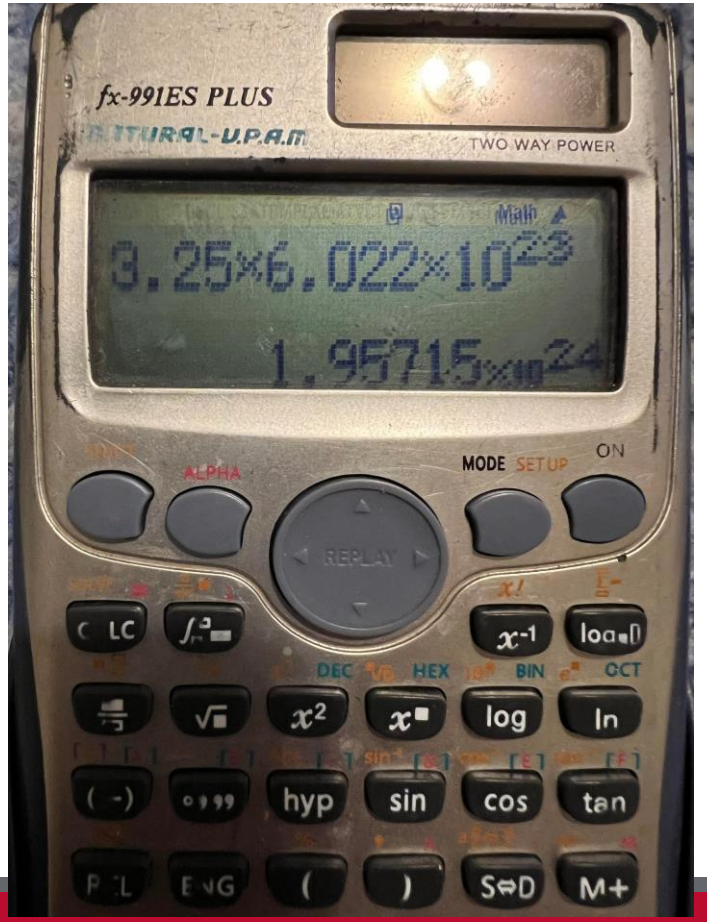
Some calculators have ^ key, and you can enter 10^23.



Enter '23'



Press '=' key



Get your results

A jeweler offers to sell a ring to a person and tells them it is made of pure platinum. The person notices that the ring feels light and decides to perform a density test to determine if the ring is pure platinum. The ring is placed on a scale and found to have a mass of 5.84 x 10^{-3} kg. Then placed in a cup of water the ring displaces 5.56 x 10^{-7} m^3. The density of platinum is 21.4 $\frac{g}{cm^3}$. Is the ring real?

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Given:

m = 5.84 x 10^{-3} kg

V = 5.56 x 10^{-7} m^3

Density of platinum is 21.4 $\frac{g}{cm^3}$

Find: Determine if Density of ring = Density of Platinum

Recall $d = \frac{m}{V}$

Conversion Factors Needed

1 kg = 1000 g

$1\ m = 100\ cm$

$$d = \frac{m}{V} = \frac{5.84x10^{-3}\ kg}{5.56\ x\ 10^{-7}\ m^3} * \frac{1000\ g}{1\ kg} * \frac{1\ m^3}{(100)^3\ cm^3}$$

$$d = \frac{m}{V} = \frac{5.84g}{0.556cm^3} = 10.5\,\frac{g}{cm^3}$$

Recall the Density of pure platinum is 21.4 $\frac{g}{cm^3}$

Thus, the ring is fake!

Tips for Success

It will not be enough to simply read the book, attend lectures, or watch videos on YouTube.

You must PRACTICE!

You must Solve Problems on your own!

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