

# Start Your Semester Off Right

## Join us for a *FREE*

### Pre-Semester Prep Workshop Series

These interactive workshops will review all foundational material leading up to the specified course so you are better equipped to hit the ground running.

Synchronous in-person in the ESS suite  
& virtual via Zoom

*Pre-Calc/Trig Prep	Monday, August 14, 2023	10 AM - 12 PM
*Calc 1 Prep	Tuesday, August 15, 2023	10 AM - 12 PM
*Calc 2 Prep	Wednesday, August 16, 2023	10 AM - 12 PM
Calc 3 Prep	Thursday, August 17, 2023	10 AM - 12 PM
Math working session	Thursday, August 17, 2023	1 - 3 PM
Chem 1 Prep	Friday, August 18, 2023	10 AM - 12 PM
*Physics 1 Prep	Friday, August 18, 2023	1 - 3 PM

\*Attend these sessions & give feedback for access to a general knowledge exam.

RSVP is preferred but not required



[ess.unm.edu/events](https://ess.unm.edu/events) > August

or through our web-app - **succESS**



# CHEM 1 Prep

## (for CHEM 1215)

*Presented by:*

Ethan Krammer



# Drop-In Tutoring for Engineering & Computing

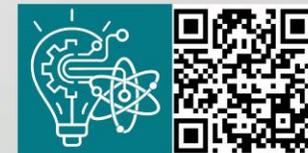
Get help in your core STEM courses, engineering & computing specific classes, software, and coding languages.

ESS suite (CEC 2080) & online via the Penji App (with Zoom)



Tutoring schedule & more info at  
[ess.unm.edu/services/tutoring/](https://ess.unm.edu/services/tutoring/)

or through our app - succESS



# Semester-Long Engagement Opportunities

Many are open to pre- and full majors and have no citizenship or GPA requirements.

<https://goto.unm.edu/mentoring>

## MENTORING

- **BE a mentor**  
...to our incoming students in their transition into the University of New Mexico, the university setting, and Albuquerque.
- **HAVE a mentor\***  
...who is a STEM Professional working in the field to build your network and receive guidance and support.

*\*This program is open to UNM STEM Majors. Priority is given to Freshmen and Sophomores, but all levels are encouraged to apply.*

<https://goto.unm.edu/internships>

## INTERNSHIPS

Getting real-world experiences leads to your satisfaction with your undergraduate journey. Gain valuable hands-on experience while making professional connections.

*These programs are only open to School of Engineering Students.*

<https://goto.unm.edu/research>

## RESEARCH

- **EPICS @UNM**  
...to give back to the community, earn credit, and gain research experience all at the same time!
- **Student Research Experience Program**  
...to get hands-on research experience to understand how your courses fit in to real-world applications.

*These programs are only open to School of Engineering Students.*

 ENGINEERING STUDENT  
SUCCESS CENTER

For more information, or to apply, visit:  
<https://ess.unm.edu/programs/current-students>

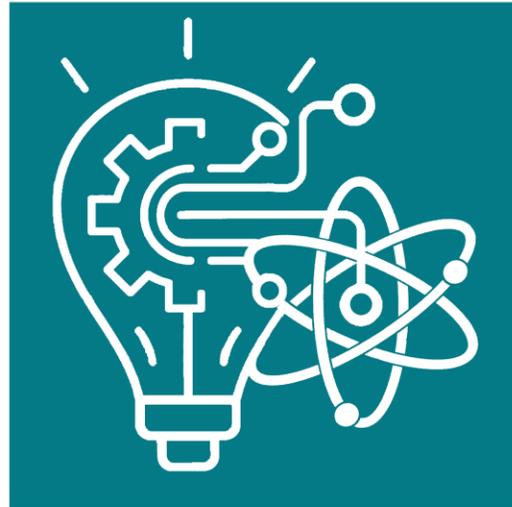


 ENGINEERING STUDENT  
SUCCESS CENTER

A tool for  
engineering your

SUCCESS

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



Put your learning into your own hands.



[success.unm.edu](https://success.unm.edu)

*Includes 1-click RSVP*



You are **WELCOME** to ALL events



# Fall 2023 Events

We are Student Success

## Summer Bridge Series

Covers foundational skills to help you succeed

## Pre-Semester Prep Series

Physics 1, Chem 1, Trig/Pre-Calc through Calc 3

## Semester Long Programs

Mentoring, Internships, Research

## Presentation Prep Series

What is a Conference?  
Designing Effective Presentations  
Data Visualization  
Delivering Presentations

## 1st & 2nd Year Student Events

Find Your Pack & Student Bash  
Study Skills  
Coffee Hour with Faculty - Fall Break  
How to make the most of your learning  
How to re-discover your confidence  
Manage Your Time  
Financial Fundamentals

## Spatial Visualization Series

Orthographic Views & Isometric Drawing  
One-Axis and Two-Axis Rotations  
Incl. Planes & Curved Surfaces, Reflect. Sym., & Write a Rule

## Career and Professional Development Events

Interviewing Basics  
STEM Mixer & Industry Networking Social  
Graduate School Preparation Workshop  
Landing an Internship  
Resume Critique & Mock Interviews  
Leadership in Engineering  
*...and industry site visits...*

## Lab Safety Series

Hazard Communication & Hazard Evaluation  
Hierarchy of Controls & Basics of PPE  
Chemical Waste Management

**WIN** a gift card. **GAIN** experience.  
**BUILD** your skill set. **ENHANCE** your resume.



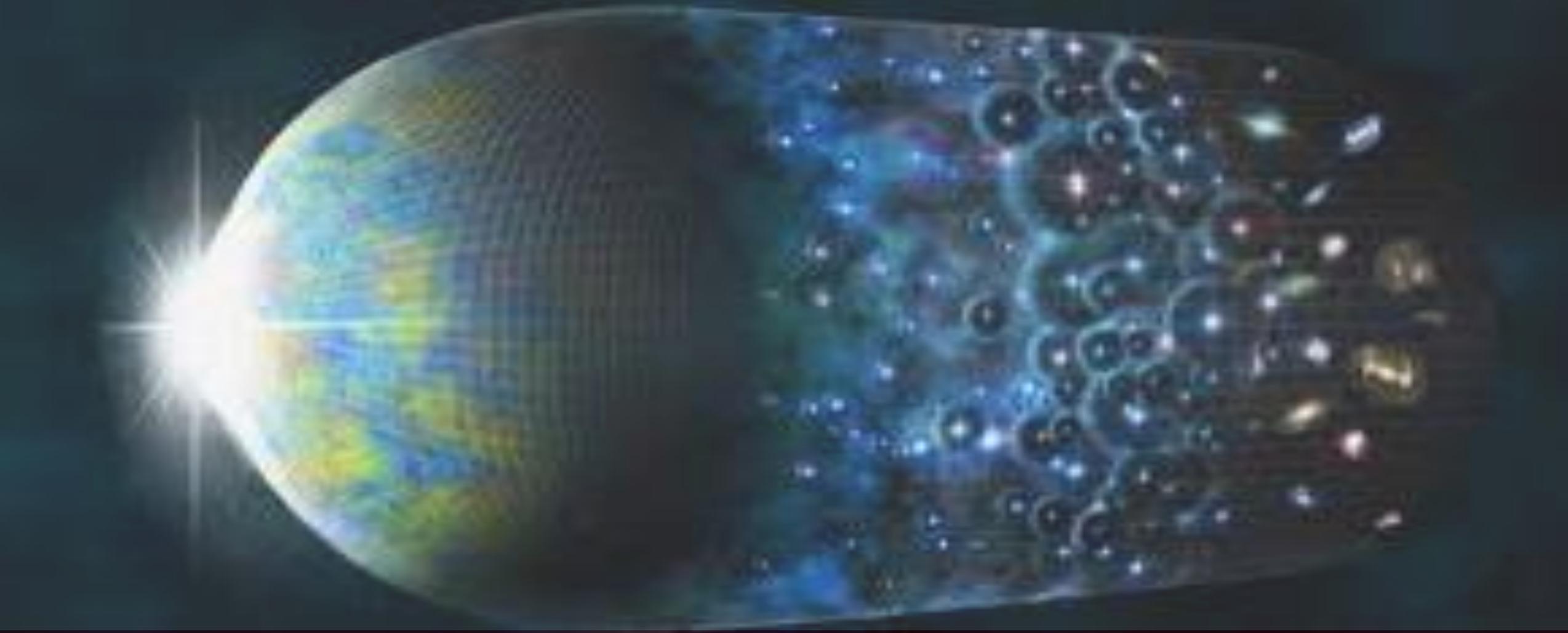
And more! For more details, visit:  
[ess.unm.edu/events](https://ess.unm.edu/events) OR through our web-app - success



# 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?



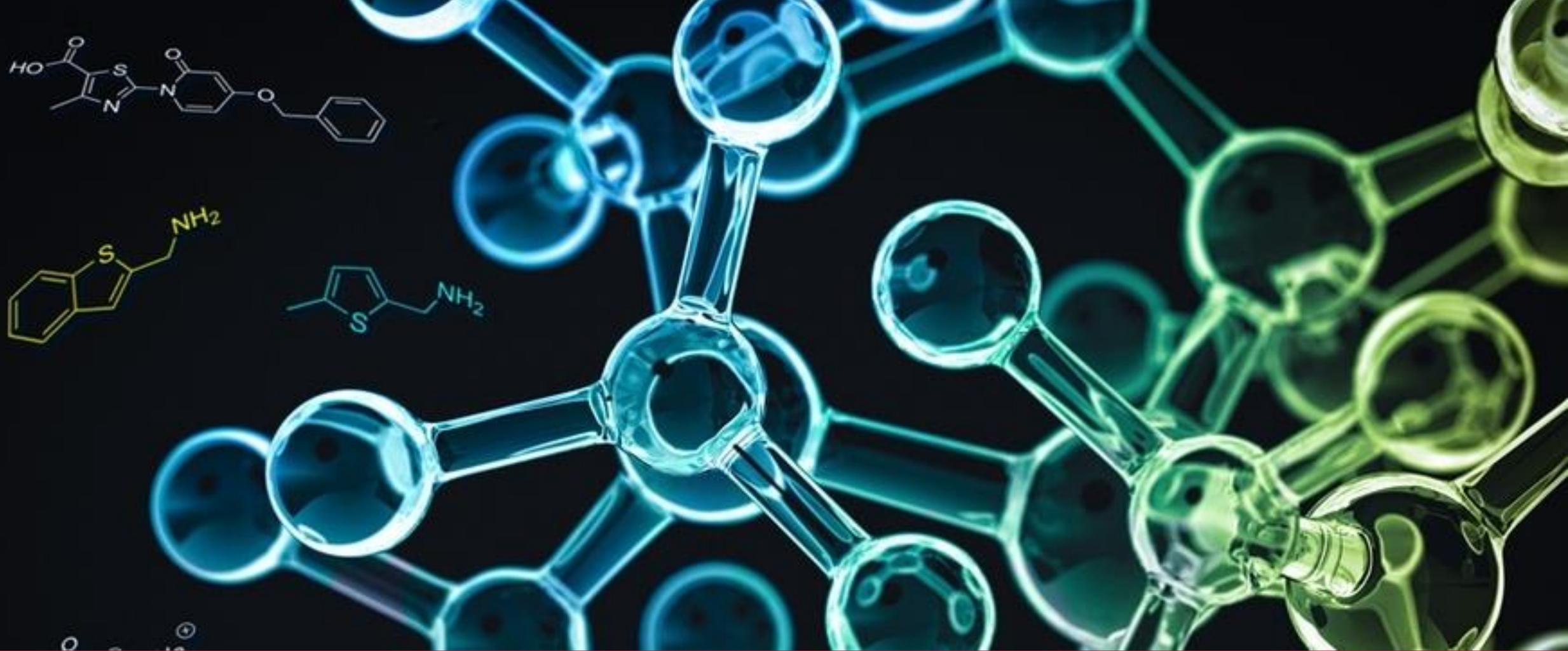
*Chemistry is everywhere*



# chemistry

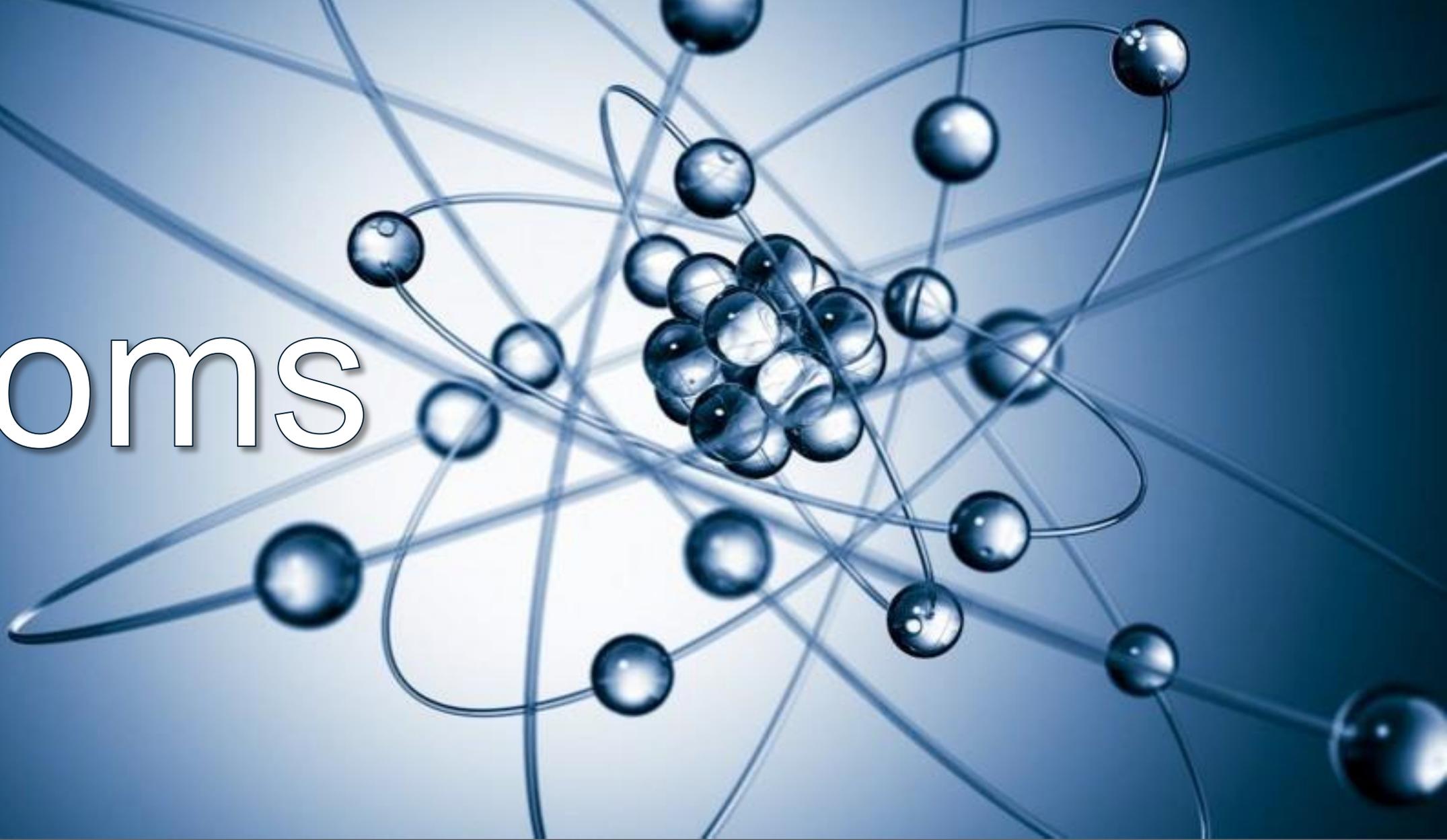
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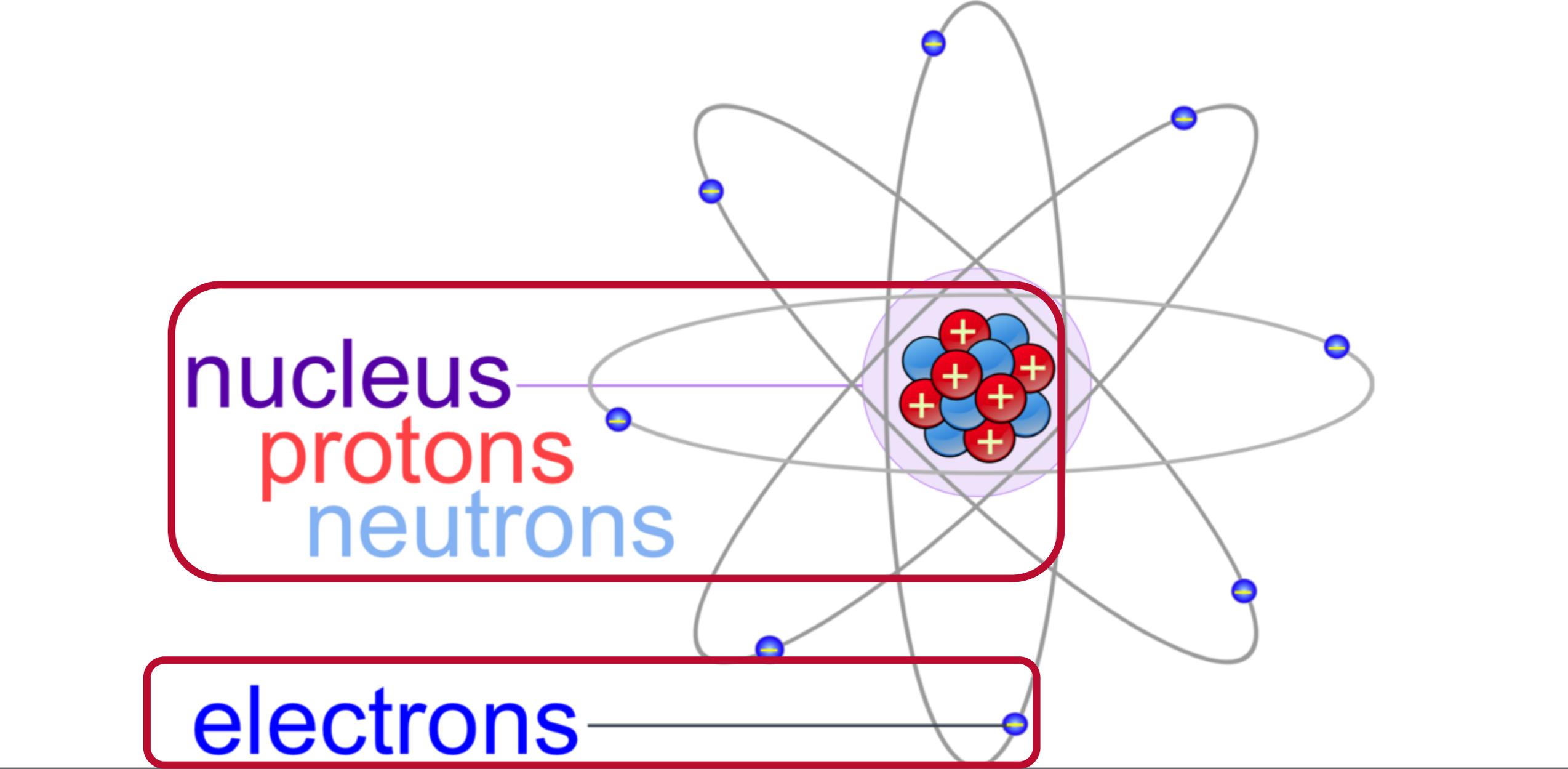
From the word alchemy, the scientific study of the basic characteristics of substances and the ways in which they react or combine.



# Terms & Definitions

# Atoms



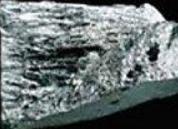
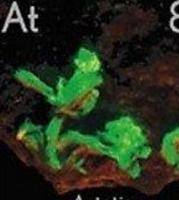


nucleus  
protons  
neutrons

The diagram shows a central nucleus composed of red spheres with '+' signs (protons) and blue spheres with '-' signs (neutrons). Surrounding the nucleus are several elliptical orbits with small blue spheres containing '-' signs (electrons) at various points along the paths.

electrons

Subatomic Particles

<p>C 6</p>  <p>Carbon</p>	<p>N 7</p>  <p>Nitrogen</p>	<p>O 8</p>  <p>Oxygen</p>	<p>"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." —<b>Oliver Sacks</b></p>	
<p>Si 14</p>  <p>Silicon</p>	<p>P 15</p>  <p>Phosphorus</p>	<p>S 16</p>  <p>Sulfur</p>	<p>Cl 17</p>  <p>Chlorine</p>	<p>18</p>  <p>Argon</p>
<p>Ge 32</p>  <p>Germanium</p>	 <h1>Elements</h1> <p>A Visual Exploration of Every Known Atom in the Universe</p>			
<p>Sn 50</p>  <p>Tin</p>	<p>Sb 51</p>  <p>Antimony</p>	<p>Te 52</p>  <p>Tellurium</p>	<p>I 53</p>  <p>Iodine</p>	<p>54</p>  <p>Xenon</p>
<p><b>THEODORE GRAY</b> Photographs by Theodore Gray and Nick Mann</p>		<p>Po 84</p>  <p>Polonium</p>	<p>At 85</p>  <p>Astatine</p>	<p>Rn 86</p>  <p>Radon</p>

# Elements

1 IA <b>H</b> Hydrogen 1.008 1																	18 VIIIA <b>He</b> Helium 4.0026 2	
3 <b>Li</b> Lithium 6.941 3	4 IIA <b>Be</b> Beryllium 9.0122 4																	10 <b>Ne</b> Neon 20.180 10
11 <b>Na</b> Sodium 22.98976928 11	12 <b>Mg</b> Magnesium 24.304 12	3 IIIB <b>Sc</b> Scandium 44.955908 21	4 IVB <b>Ti</b> Titanium 47.88 22	5 VB <b>V</b> Vanadium 50.9415 23	6 VIB <b>Cr</b> Chromium 51.9961 24	7 VIIB <b>Mn</b> Manganese 54.938044 25	8 VIIIB <b>Fe</b> Iron 55.845 26	9 VIIIB <b>Co</b> Cobalt 58.9332 27	10 VIIIB <b>Ni</b> Nickel 58.6934 28	11 IB <b>Cu</b> Copper 63.546 29	12 IIB <b>Zn</b> Zinc 65.38 30	13 <b>Al</b> Aluminum 26.9815385 13	14 <b>Si</b> Silicon 28.0855 14	15 <b>P</b> Phosphorus 30.973761998 15	16 <b>S</b> Sulfur 32.06 16	17 <b>Cl</b> Chlorine 35.45 17	18 <b>Ar</b> Argon 39.948 18	
19 <b>K</b> Potassium 39.0983 19	20 <b>Ca</b> Calcium 40.078 20	21 <b>Sc</b> Scandium 44.955908 21	22 <b>Ti</b> Titanium 47.88 22	23 <b>V</b> Vanadium 50.9415 23	24 <b>Cr</b> Chromium 51.9961 24	25 <b>Mn</b> Manganese 54.938044 25	26 <b>Fe</b> Iron 55.845 26	27 <b>Co</b> Cobalt 58.9332 27	28 <b>Ni</b> Nickel 58.6934 28	29 <b>Cu</b> Copper 63.546 29	30 <b>Zn</b> Zinc 65.38 30	31 <b>Ga</b> Gallium 69.723 31	32 <b>Ge</b> Germanium 72.630 32	33 <b>As</b> Arsenic 74.9216 33	34 <b>Se</b> Selenium 78.96 34	35 <b>Br</b> Bromine 79.904 35	36 <b>Kr</b> Krypton 83.798 36	
37 <b>Rb</b> Rubidium 85.4678 37	38 <b>Sr</b> Strontium 87.62 38	39 <b>Y</b> Yttrium 88.90584 39	40 <b>Zr</b> Zirconium 91.224 40	41 <b>Nb</b> Niobium 92.90638 41	42 <b>Mo</b> Molybdenum 95.94 42	43 <b>Tc</b> Technetium (98) 43	44 <b>Ru</b> Ruthenium 101.07 44	45 <b>Rh</b> Rhodium 102.9055 45	46 <b>Pd</b> Palladium 106.42 46	47 <b>Ag</b> Silver 107.8682 47	48 <b>Cd</b> Cadmium 112.411 48	49 <b>In</b> Indium 114.818 49	50 <b>Sn</b> Tin 118.710 50	51 <b>Sb</b> Antimony 121.757 51	52 <b>Te</b> Tellurium 127.603 52	53 <b>I</b> Iodine 126.905 53	54 <b>Xe</b> Xenon 131.29 54	
55 <b>Cs</b> Cesium 132.90545196 55	56 <b>Ba</b> Barium 137.327 56	57-71 Lanthanides	72 <b>Hf</b> Hafnium 178.49 72	73 <b>Ta</b> Tantalum 180.94788 73	74 <b>W</b> Tungsten 183.84 74	75 <b>Re</b> Rhenium 186.207 75	76 <b>Os</b> Osmium 190.23 76	77 <b>Ir</b> Iridium 192.22 77	78 <b>Pt</b> Platinum 195.084 78	79 <b>Au</b> Gold 196.96657 79	80 <b>Hg</b> Mercury 200.59 80	81 <b>Tl</b> Thallium 204.38 81	82 <b>Pb</b> Lead 207.2 82	83 <b>Bi</b> Bismuth 208.9804 83	84 <b>Po</b> Polonium (209) 84	85 <b>At</b> Astatine (210) 85	86 <b>Rn</b> Radon (222) 86	
87 <b>Fr</b> Francium (223) 87	88 <b>Ra</b> Radium (226) 88	89-103 Actinides	104 <b>Rf</b> Rutherfordium (261) 104	105 <b>Db</b> Dubnium (262) 105	106 <b>Sg</b> Seaborgium (263) 106	107 <b>Bh</b> Bohrium (264) 107	108 <b>Hs</b> Hassium (265) 108	109 <b>Mt</b> Meitnerium (266) 109	110 <b>Ds</b> Darmstadtium (267) 110	111 <b>Rg</b> Roentgenium (268) 111	112 <b>Cn</b> Copernicium (269) 112	113 <b>Nh</b> Nihonium (270) 113	114 <b>Fl</b> Flerovium (277) 114	115 <b>Mc</b> Moscovium (288) 115	116 <b>Lv</b> Livermorium (293) 116	117 <b>Ts</b> Tennessine (294) 117	118 <b>Og</b> Oganesson (294) 118	
57 <b>La</b> Lanthanum (138.90547) 57	58 <b>Ce</b> Cerium (140.12) 58	59 <b>Pr</b> Praseodymium (140.90766) 59	60 <b>Nd</b> Neodymium (144.24) 60	61 <b>Pm</b> Promethium (144.91262) 61	62 <b>Sm</b> Samarium (150.36) 62	63 <b>Eu</b> Europium (151.964) 63	64 <b>Gd</b> Gadolinium (157.25) 64	65 <b>Tb</b> Terbium (158.92532) 65	66 <b>Dy</b> Dysprosium (162.50052) 66	67 <b>Ho</b> Holmium (164.93032) 67	68 <b>Er</b> Erbium (167.2593) 68	69 <b>Tm</b> Thulium (168.93402) 69	70 <b>Yb</b> Ytterbium (173.05468) 70	71 <b>Lu</b> Lutetium (174.973) 71				
89 <b>Ac</b> Actinium (227) 89	90 <b>Th</b> Thorium (232.0377) 90	91 <b>Pa</b> Protactinium (231.036888) 91	92 <b>U</b> Uranium (238.02891) 92	93 <b>Np</b> Neptunium (237) 93	94 <b>Pu</b> Plutonium (244) 94	95 <b>Am</b> Americium (243) 95	96 <b>Cm</b> Curium (247) 96	97 <b>Bk</b> Berkelium (247) 97	98 <b>Cf</b> Californium (251) 98	99 <b>Es</b> Einsteinium (252) 99	100 <b>Fm</b> Fermium (257) 100	101 <b>Md</b> Mendelevium (258) 101	102 <b>No</b> Nobelium (259) 102	103 <b>Lr</b> Lawrencium (260) 103				

State of matter (color of name)  
 GAS LIQUID SOLID UNKNOWN

Subcategory in the metal-metalloid-nonmetal trend (color of background)  
 Alkali metals Lanthanides Metalloids Unknown chemical properties  
 Alkaline earth metals Actinides Reactive nonmetals  
 Transition metals Post-transition metals Noble gases

1

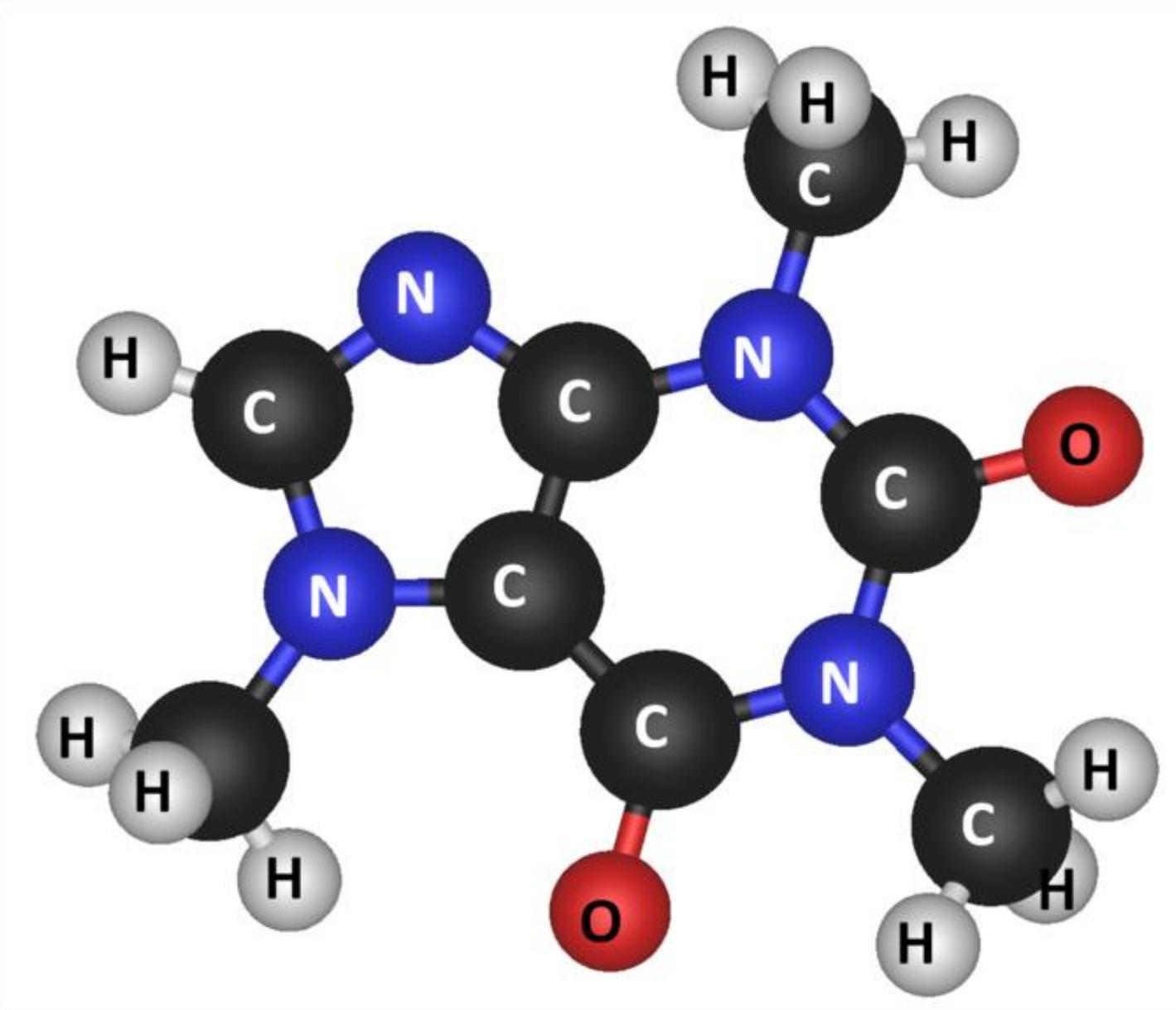
**H**

Hydrogen

1.008

1

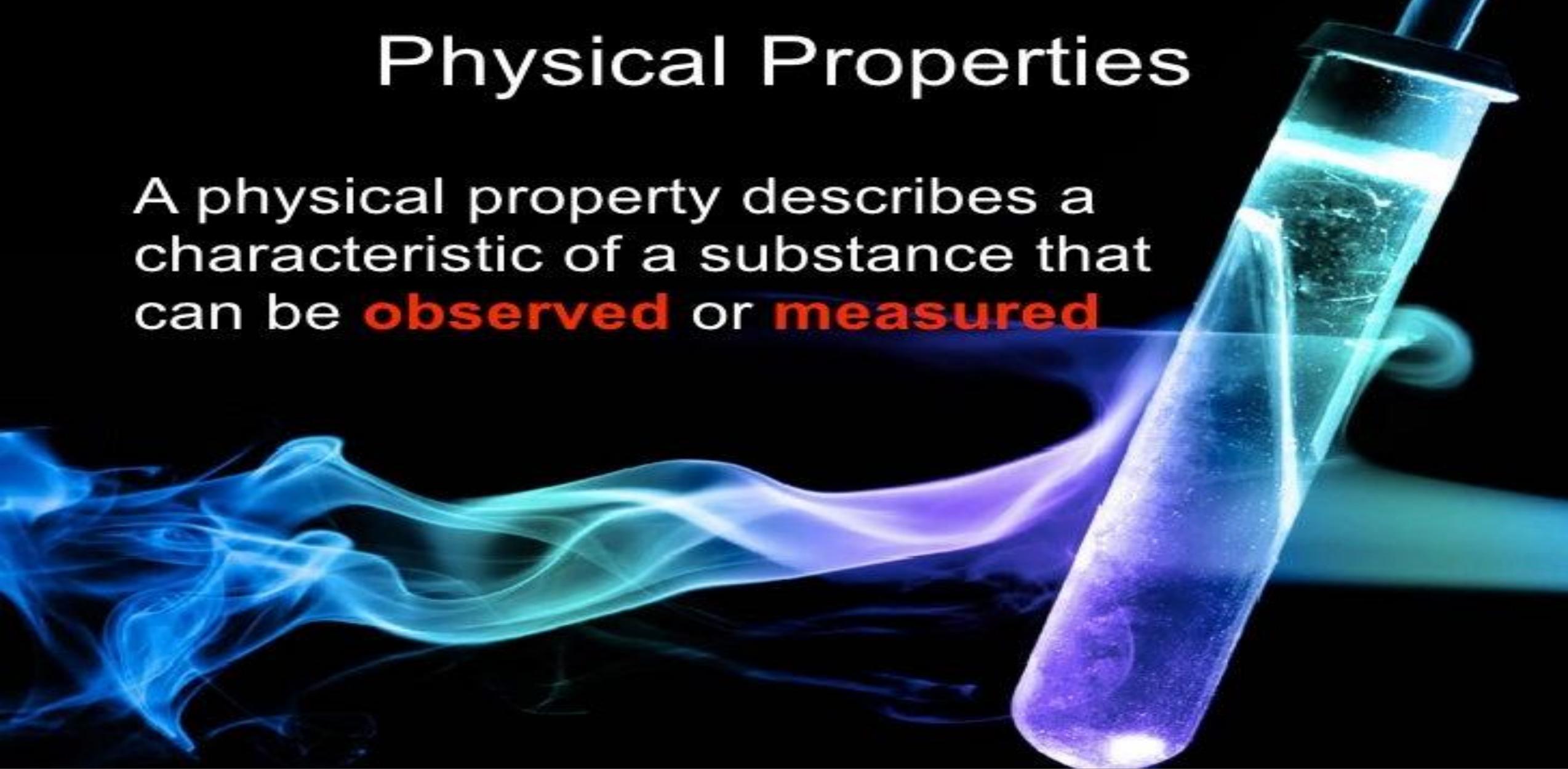
# Periodic Table of Elements



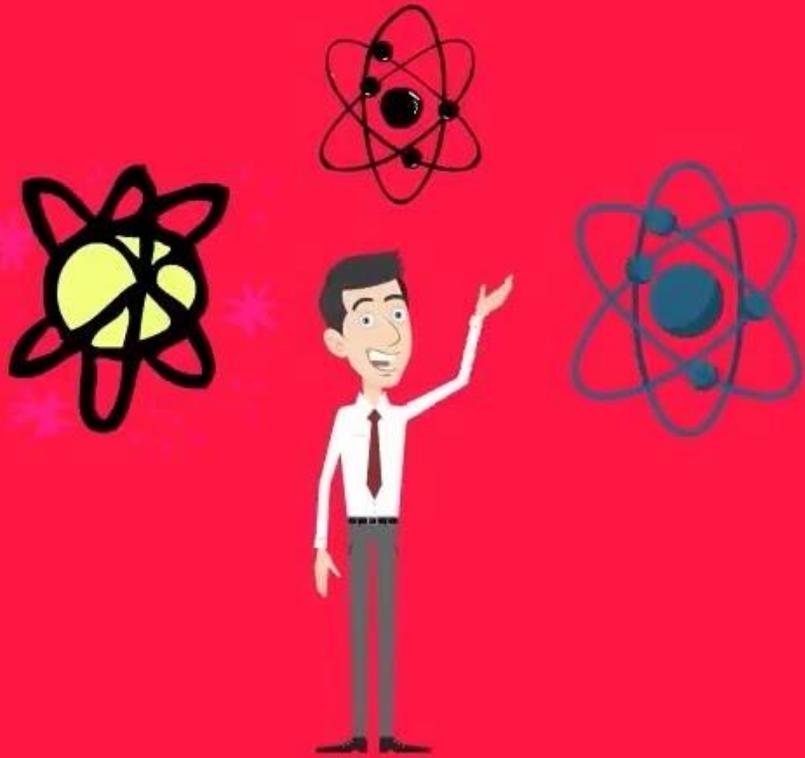
Molecules

# Physical Properties

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

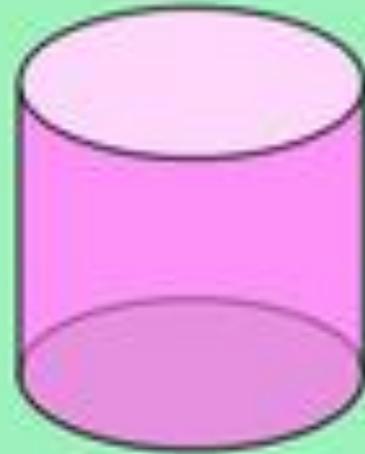
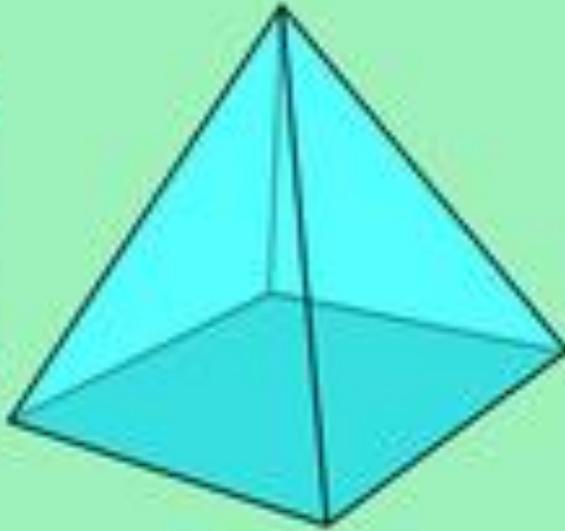
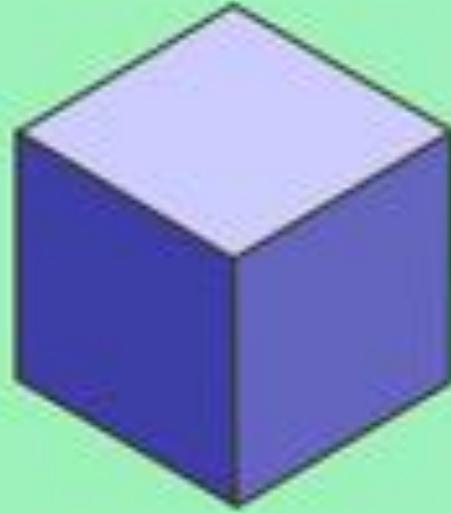
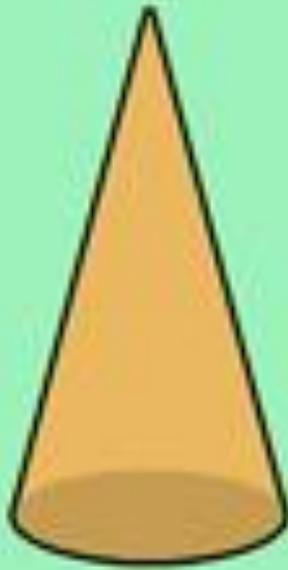


# Mass

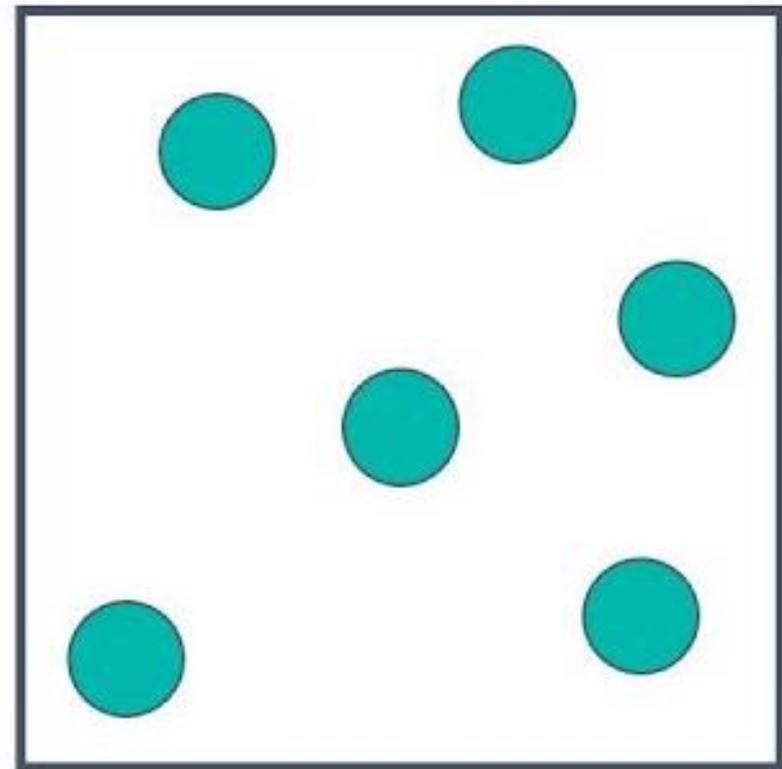
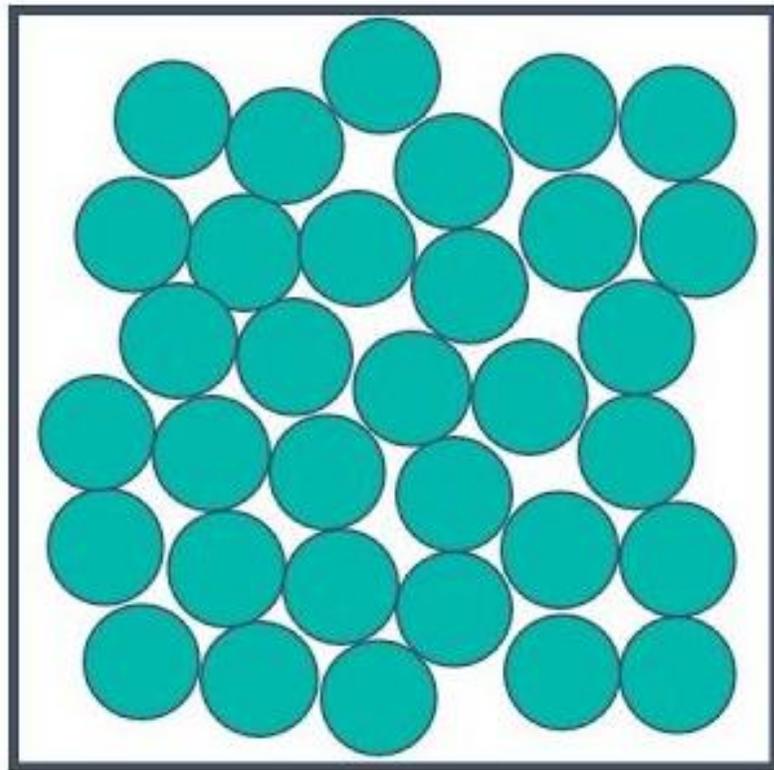
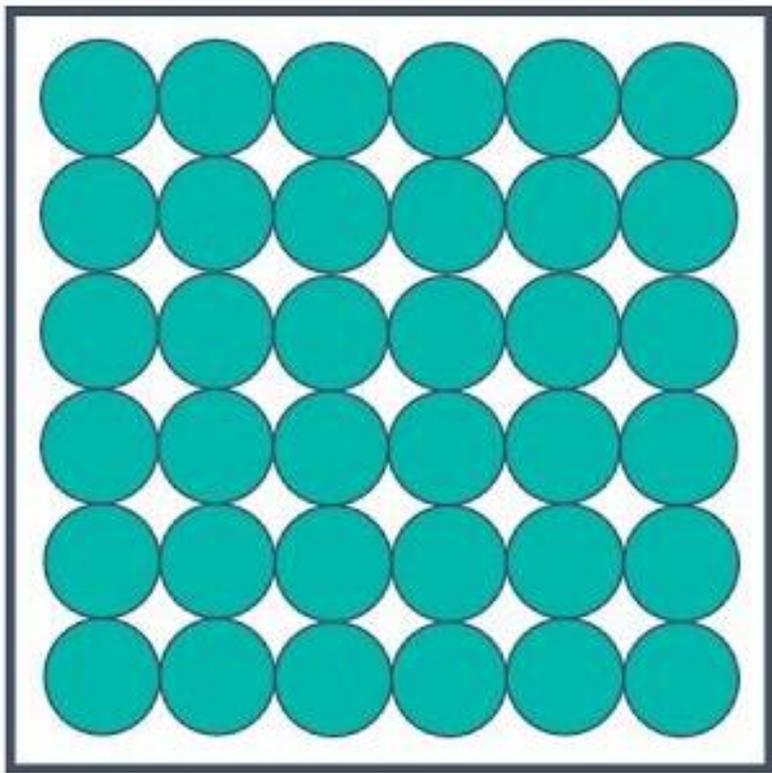


# Weight





Volume



Density

**Solid**



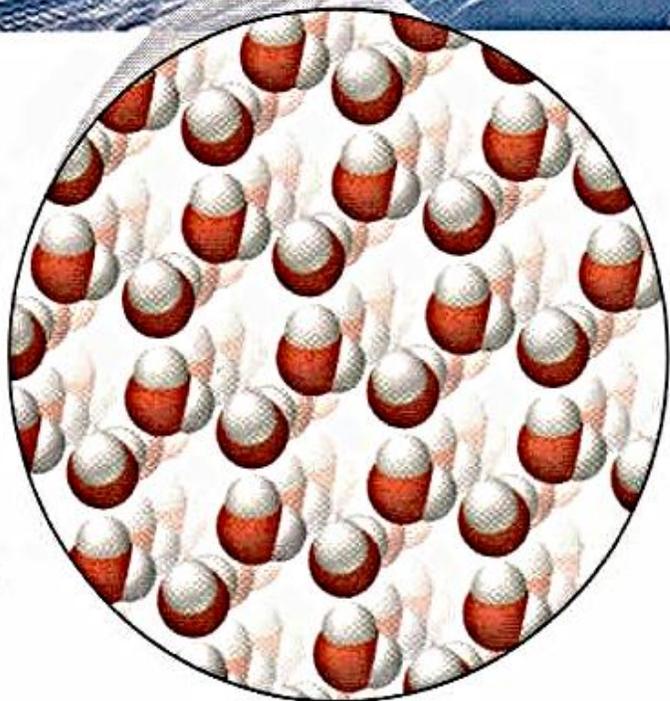
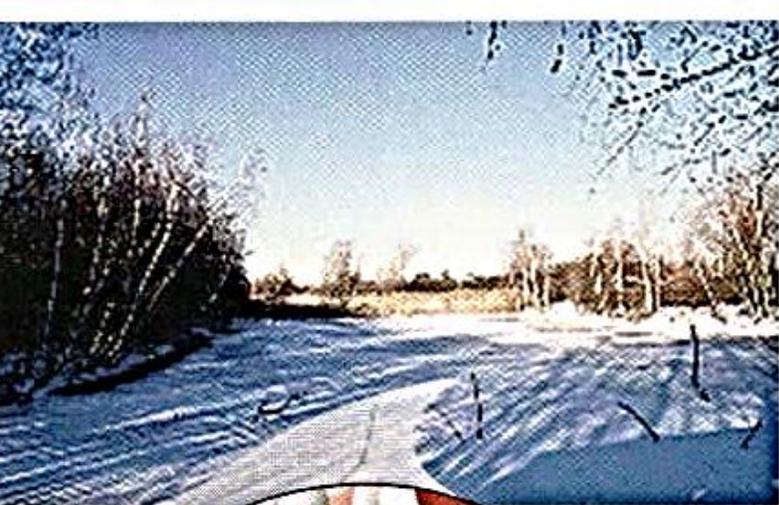
**Gas**



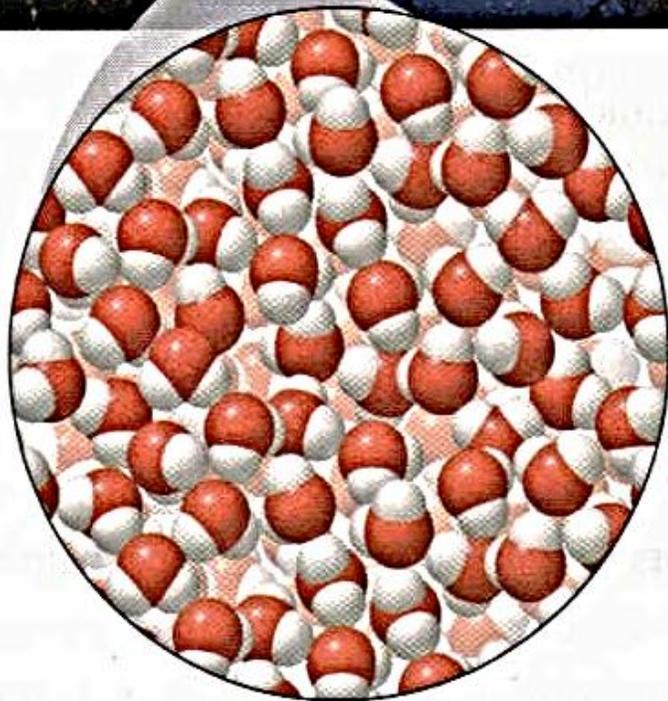
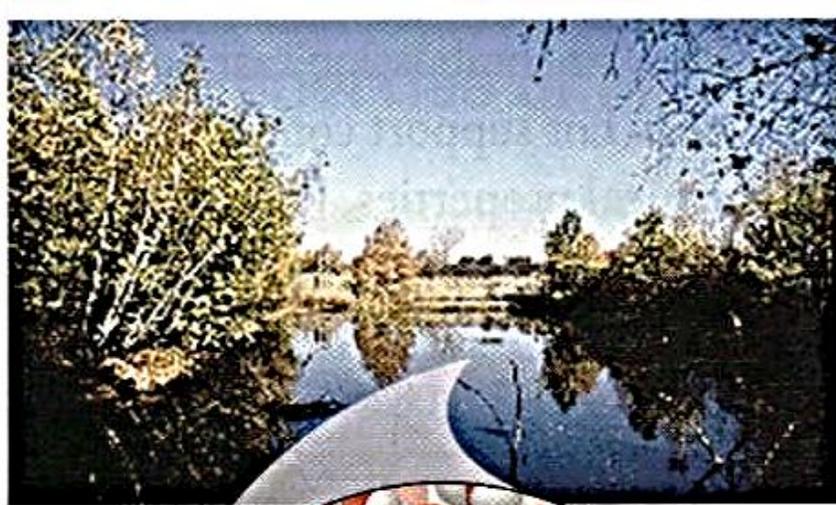
**Liquid**



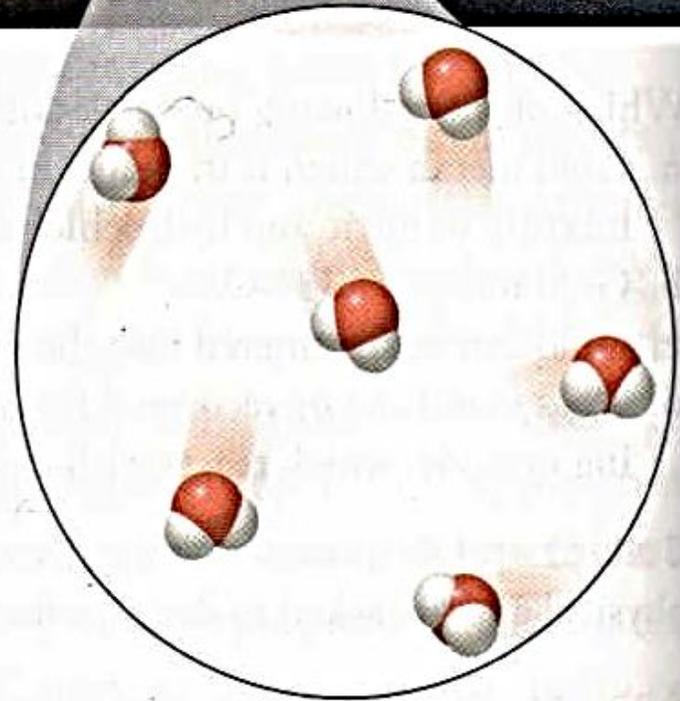
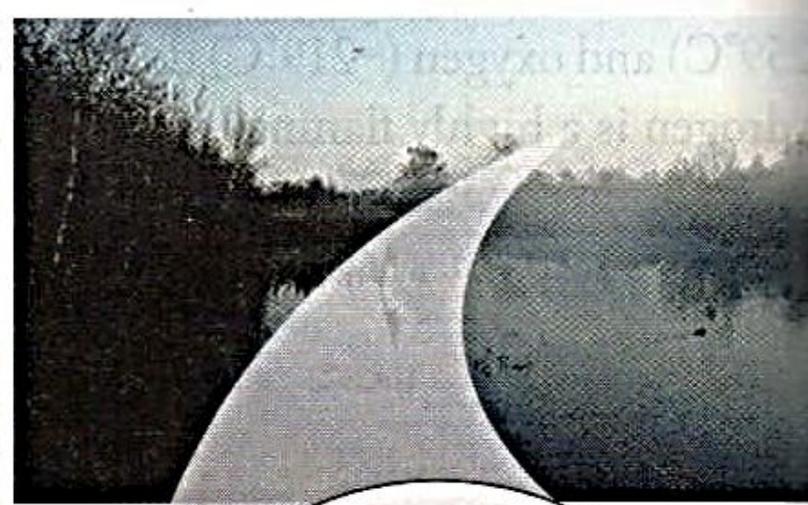
**What's the Matter?**



(a) Solid



(b) Liquid

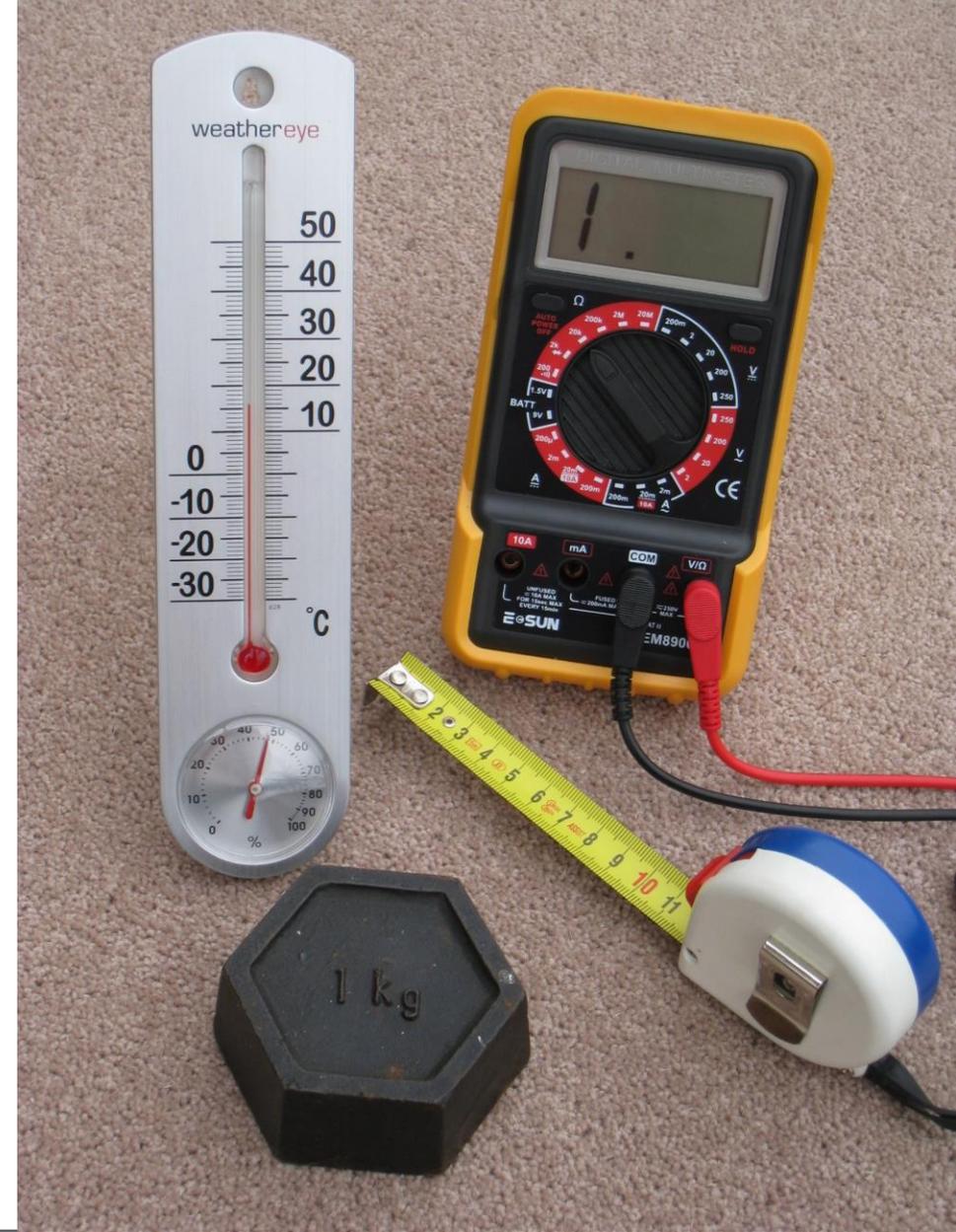


(c) Gas



# Units

A standard of  
measurement of  
physical  
quantities



What are Units?



# Physical Quantities

<b>Base Quantity</b>	<b>Name</b>	<b>Symbol</b>
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>



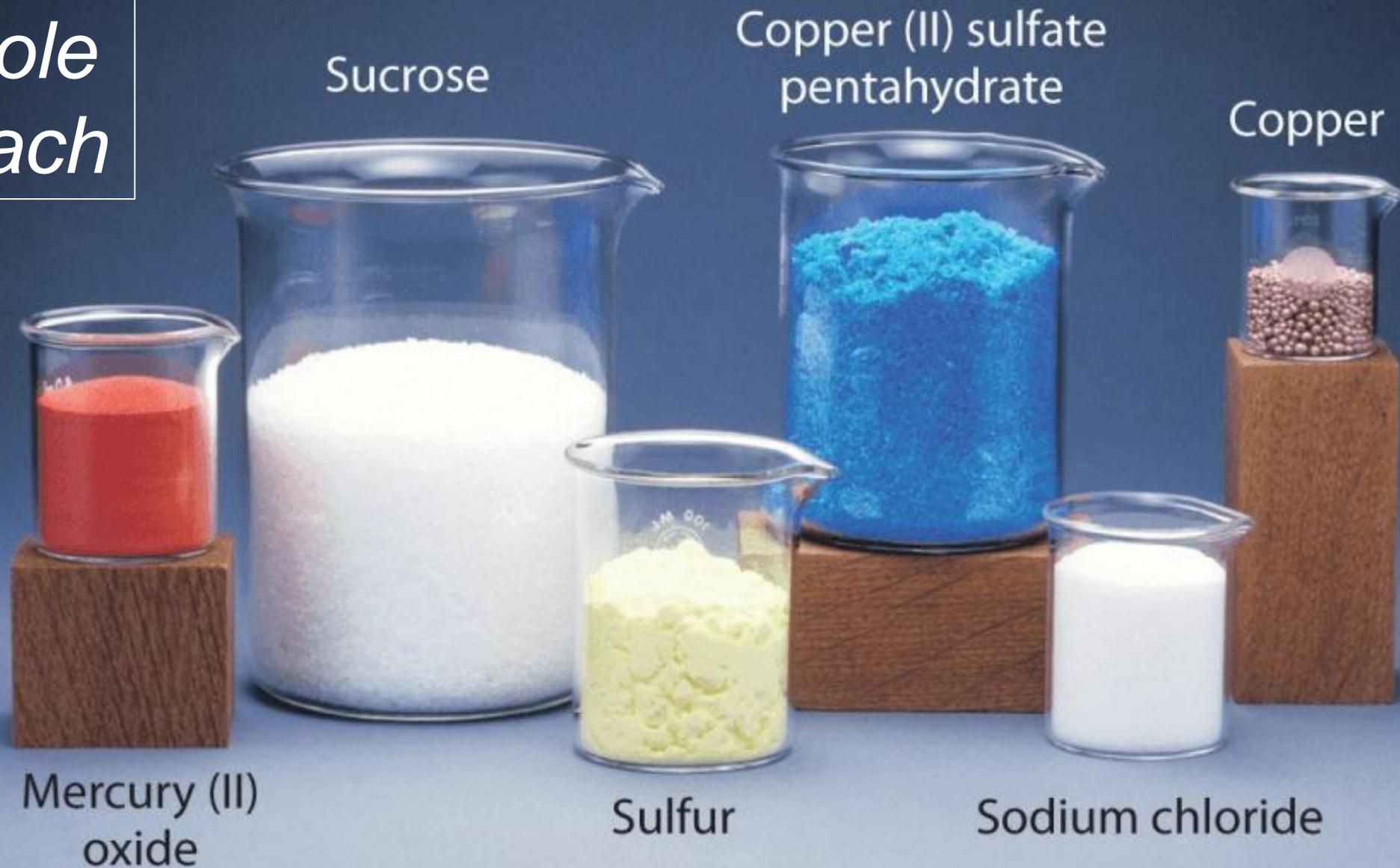
What is a mole?

1 mol



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

*1 mole  
of each*



**Important Conversion Factors for Chemistry**

# Accuracy

VS

# Precision





A large circular seal with a thick black outer border and a white inner border. At the top of the seal, the text "100%" is written in a bold, black, sans-serif font. A blue ribbon with a white outline and pointed ends crosses the center of the seal. On the ribbon, the word "ACCURACY" is written in large, bold, white, sans-serif capital letters. Below the ribbon, the word "Guarantee" is written in a bold, black, sans-serif font. At the bottom of the seal, there are three solid black stars arranged horizontally. The entire seal is set against a white background.





*Accuracy*

Must have a  
**STANDARD** or  
**KNOWN** values  
for reference.



Precision



High Accuracy  
High Precision



Low Accuracy  
High Precision **1**



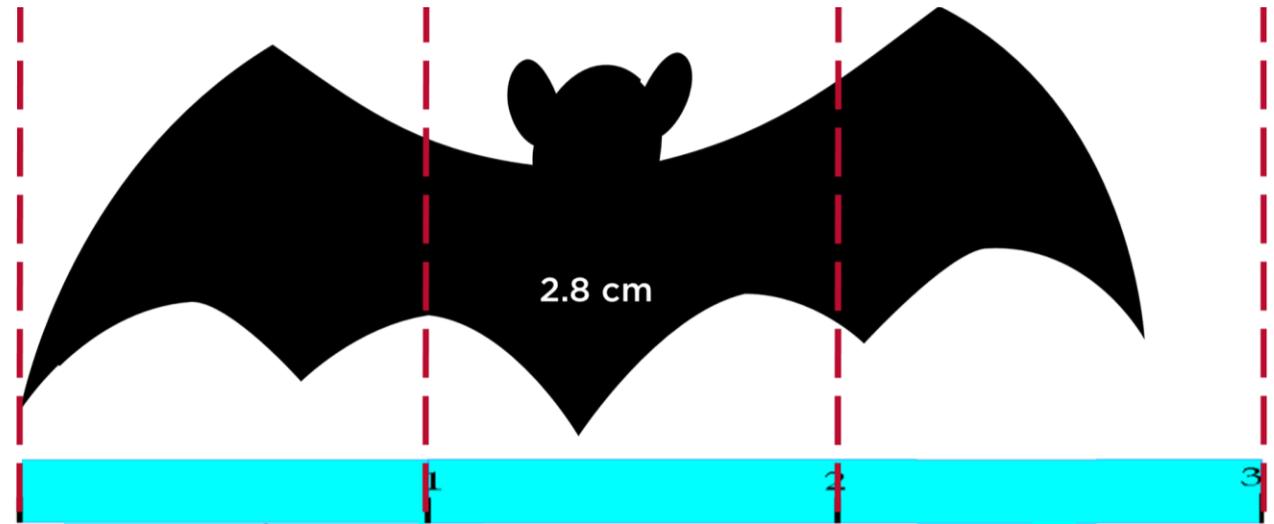
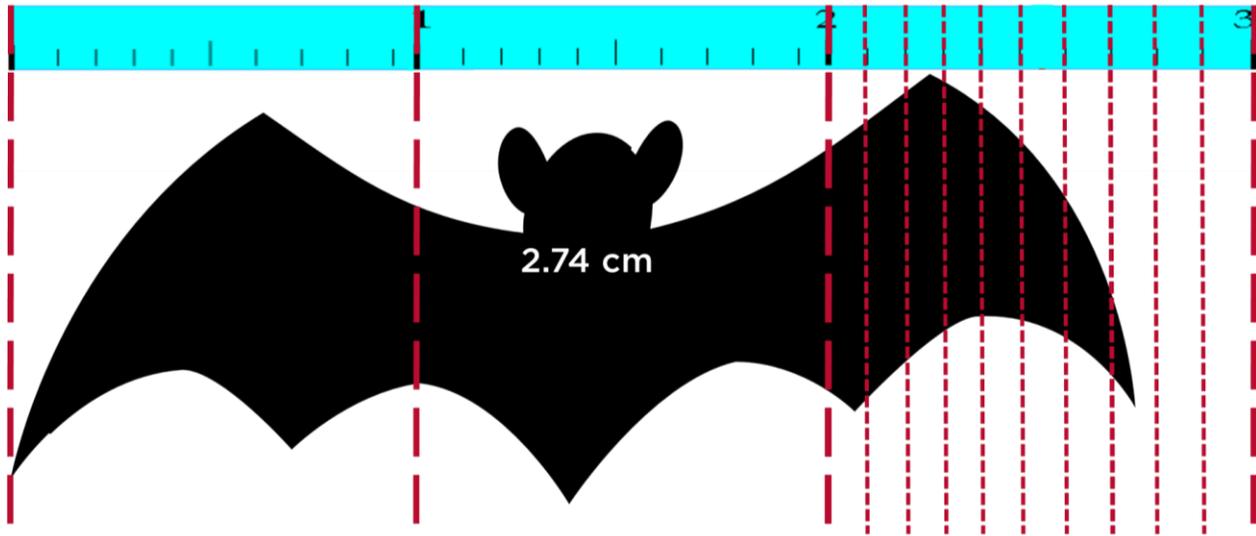
High Accuracy  
Low Precision **2**



Low Accuracy  
Low Precision **3**

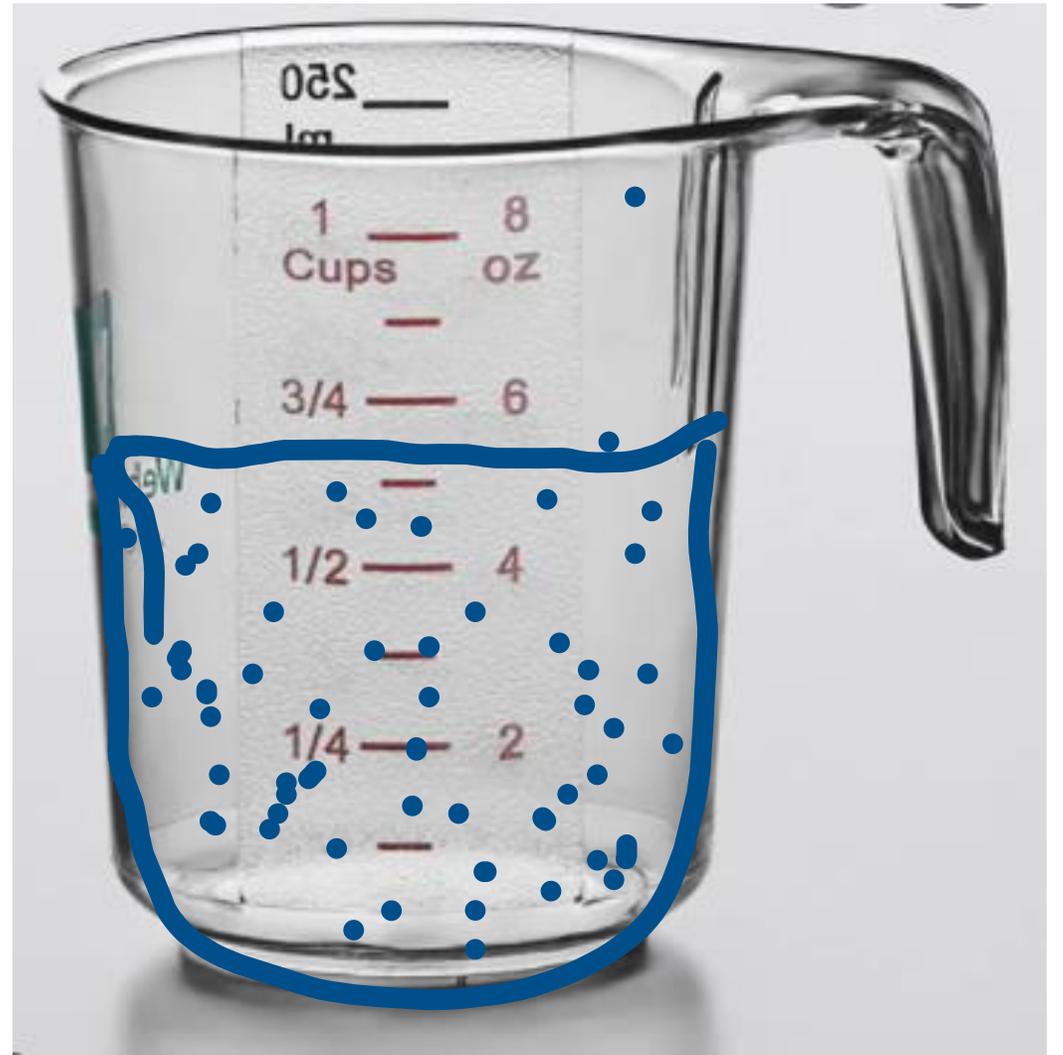


# Accuracy and Precision



Significant Digits

ERROR





*All nonzero digits are significant*

1.234 g = 4 sig. fig.

1.2 g = 2 sig. fig.



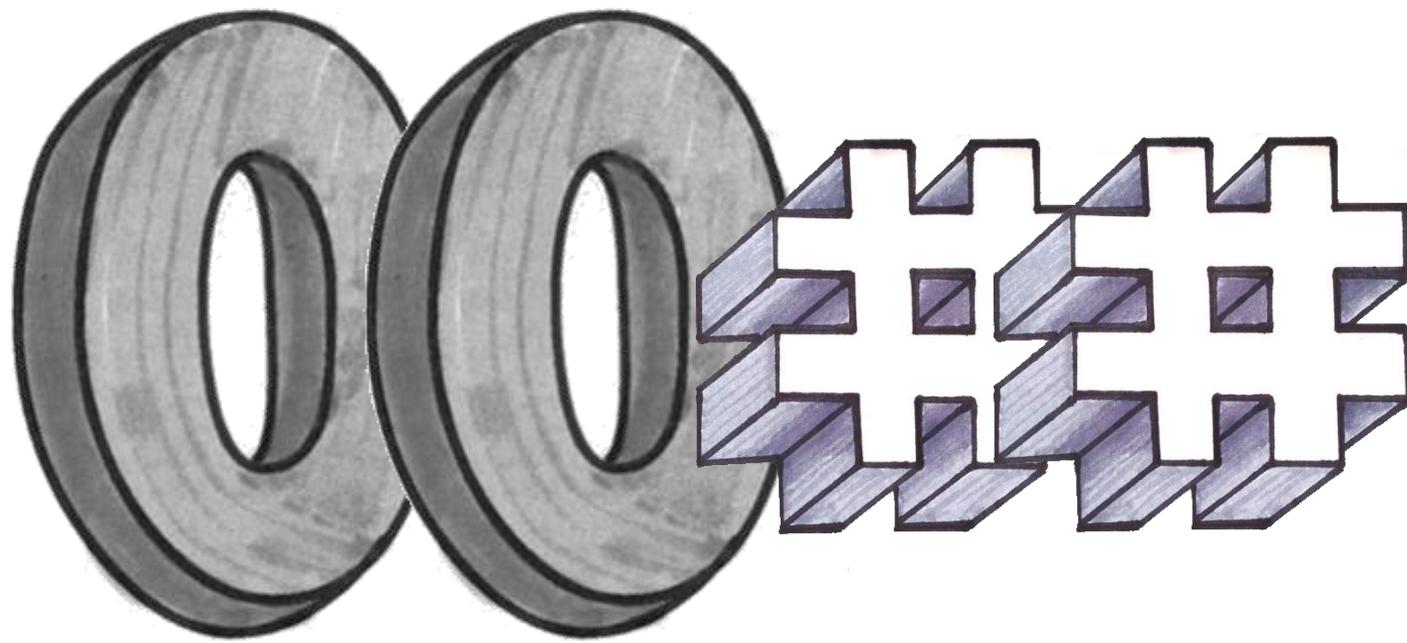
*What about  
zero?*



*Zeros between non-zeros are always significant*

1002 kg = 4 sig. fig.

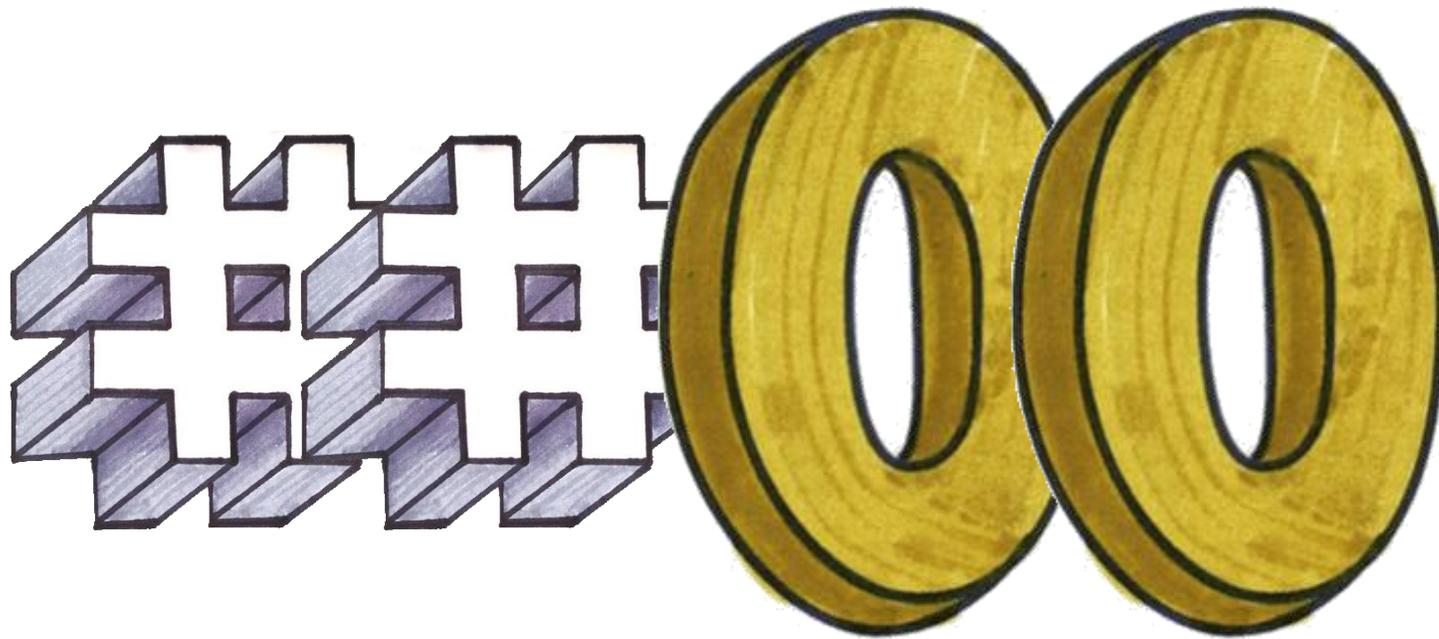
3.01 mL = 3 sig. fig.



*Leading zeros are NOT significant*

0.001 °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.?

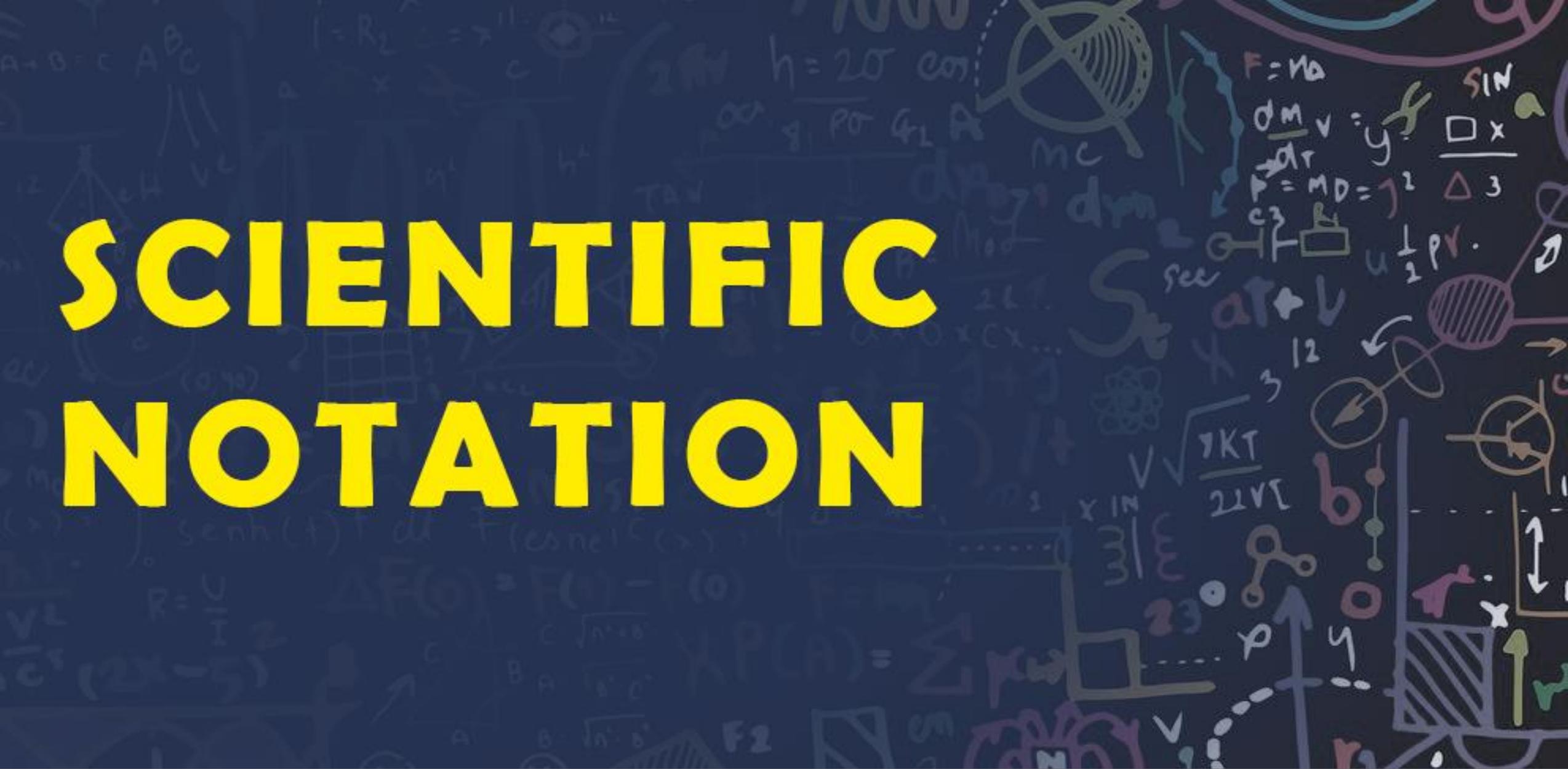
Uncertainty and Decimals

# 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)  $2.97 \times 10^5$       3 sig fig
- e) 100.00      5 sig fig
- f) 100,000      Ambiguous

Significant Digits Practice

# SCIENTIFIC NOTATION

The background of the slide is a dark blue-grey color filled with various scientific and mathematical symbols and diagrams in lighter shades of blue, green, and yellow. These include algebraic equations like  $a+b=c$ ,  $F=ma$ ,  $\frac{dm}{dt}v = y$ ,  $P=MD = \frac{1}{2}pv$ , and  $\frac{7KT}{21VE}$ . There are also geometric shapes like circles, triangles, and rectangles, some with arrows indicating direction or flow. The overall aesthetic is that of a chalkboard or a collection of scientific notes.

120,000,000,000,000,000,000,000,000,000  
Standard Notation

$1.2 \times 10^{23}$   
Scientific Notation

A **POSITIVE** exponent means the original number was large.

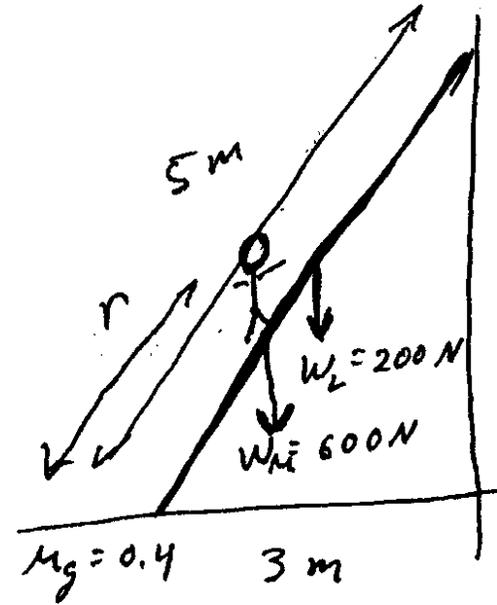
$$46,600,000 = 4.66 \times 10^7$$

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	$\mu$	1/1,000,000	microgram = $\mu$ g = $10^{-6}$ 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?

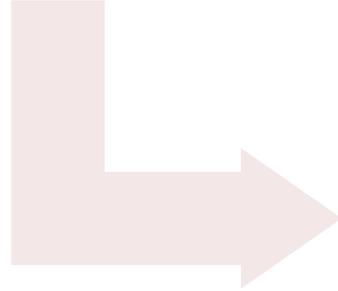
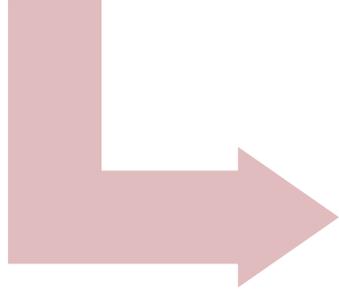


# Word Problems

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**

# CONQUER THE PROBLEM!!!

•BEFORE•

## PLAN

- \*Read & visualize
- \*Reread & code
- \*Sketch & predict

What is the problem asking?  
What would be a reasonable answer?

•DURING•

## SOLVE

- \*Show my strategies
- \*Show my thinking

Are my strategies effective and efficient?  
Is there another way to solve?

•AFTER•

## CHECK

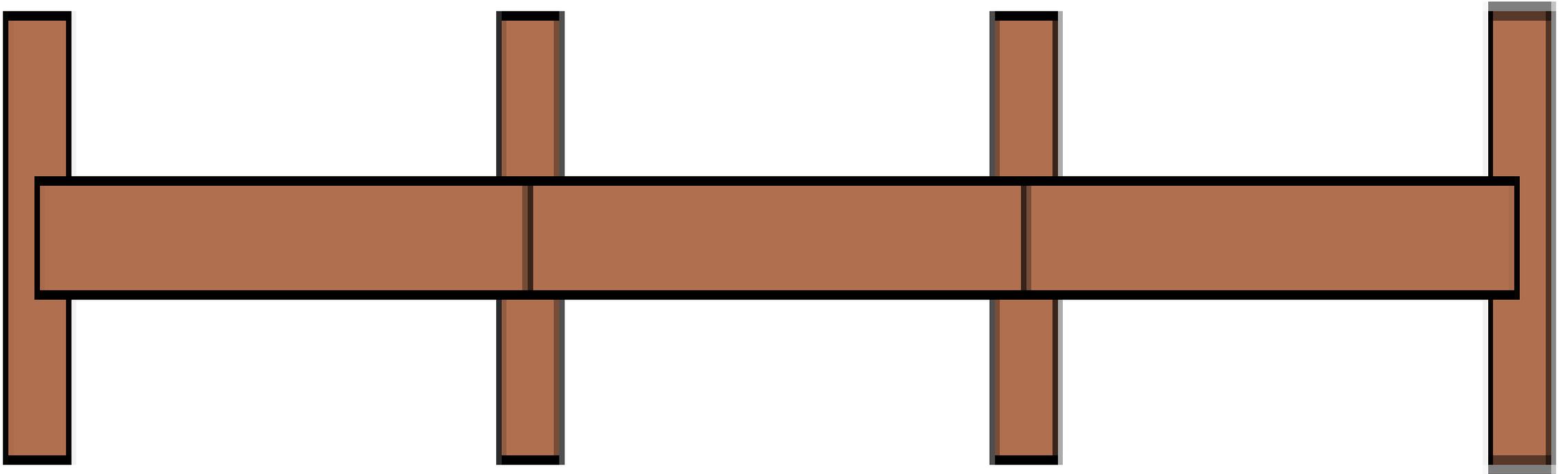
- \*Check my work.
- \*Go back to the question.
- \*Answer in a complete sentence.

Did I answer the question?  
Does my answer make sense?

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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.

$$\frac{7 \text{ days}}{1 \text{ wk}}$$

$$\frac{60 \text{ sec}}{1 \text{ min}}$$

$$\frac{12 \text{ in}}{1 \text{ ft}}$$

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:

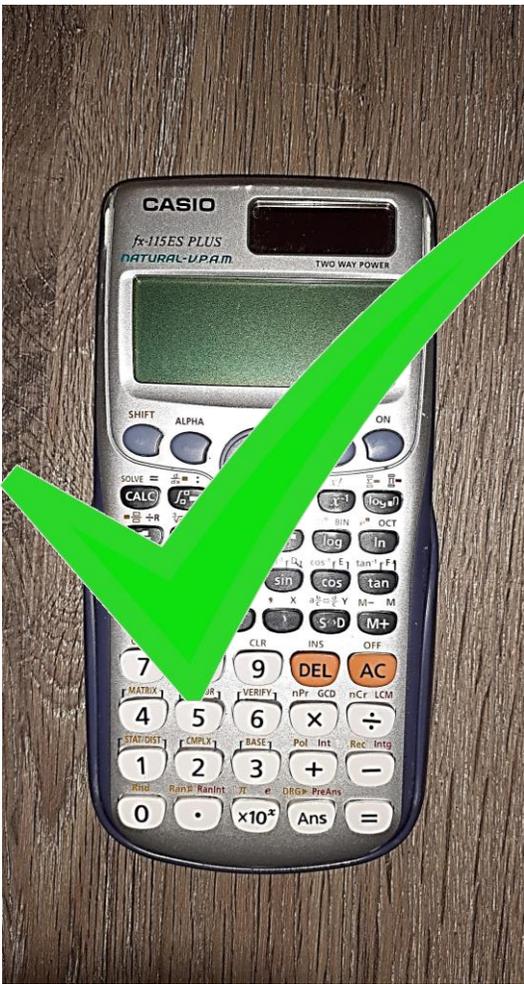
Make a fence post and solve it

<del>\$100</del>	100 pennies	10,000 pennies	= Multiply top row straight across and record your answer
	<del>\$1</del>	1 unitless	= Multiply bottom row straight across and record your answer

There are 10,000 pennies in \$100.00



1 mol =  $6.022 \times 10^{23}$  quantity

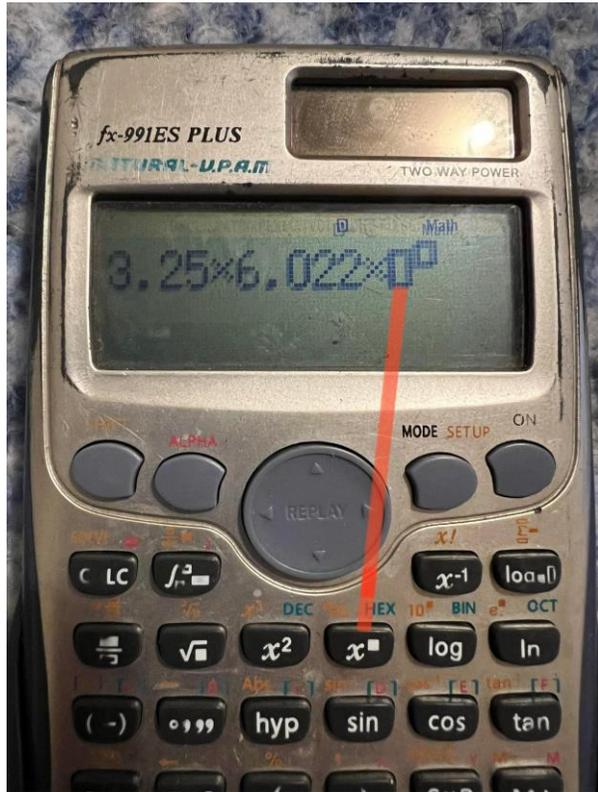


1. Casio FX115ESPLUS scientific calculator    2. Texas Instruments TI-36X Pro

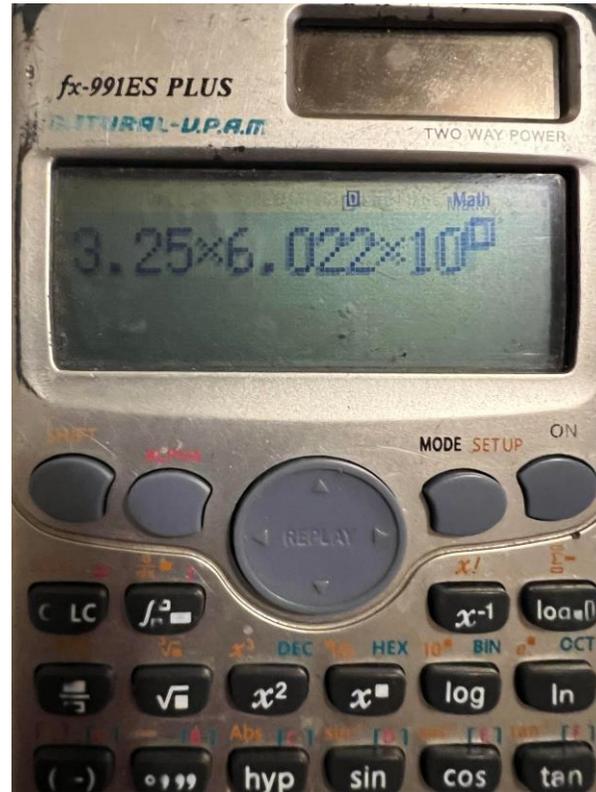
# Calculators

Calculate the number of molecules in 3.25 moles of H<sub>2</sub>O.

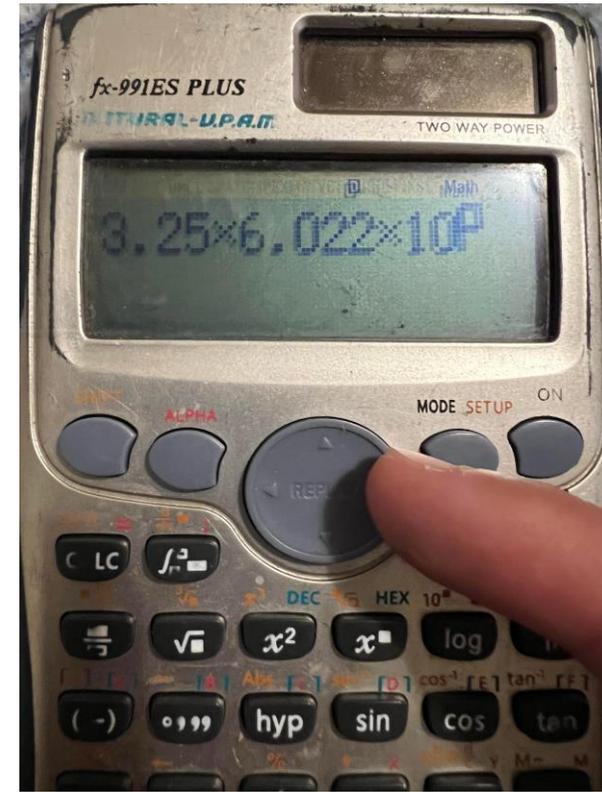
Solution:  $(3.25 \text{ moles}) \times (6.022 \times 10^{23} \text{ mole}^{-1}) = 1.96 \times 10^{24} \text{ molecules}$



Press 'x' with an exponent' button



Enter '10'

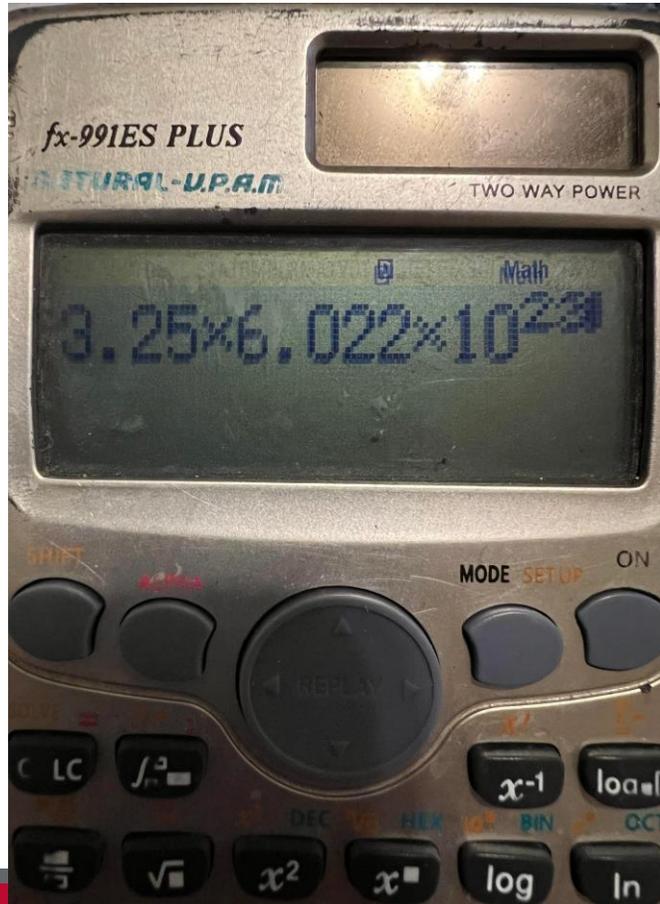


Enter '>' key as shown

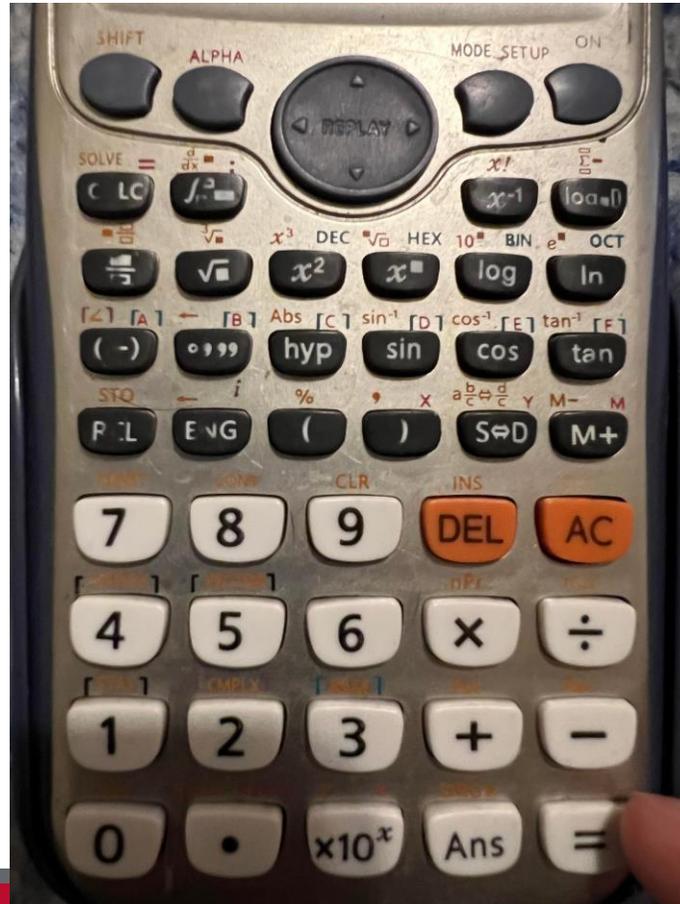
**Multistep Dimensional Analysis**

# Using Your Calculator

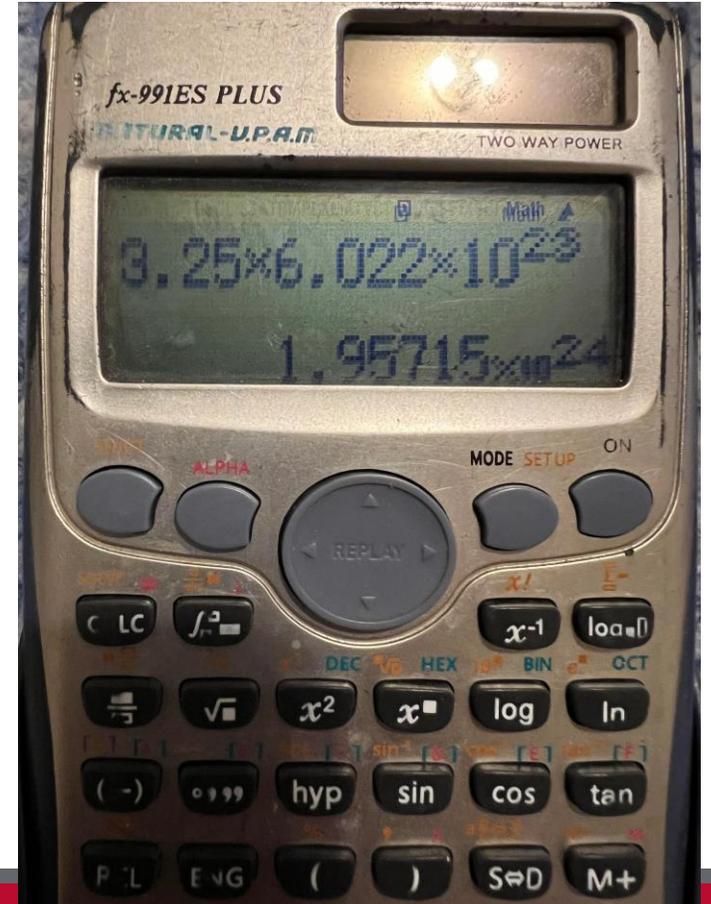
Some calculators have ^ key, and you can enter  $10^{23}$ .



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  $5.84 \times 10^{-3}$  kg. Then placed in a cup of water the ring displaces  $5.56 \times 10^{-7} \text{ m}^3$ . The density of platinum is  $21.4 \frac{\text{g}}{\text{cm}^3}$ . Is the ring real?

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Given:

$$m = 5.84 \times 10^{-3} \text{ kg}$$

$$V = 5.56 \times 10^{-7} \text{ m}^3$$

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

Find: Determine if Density of ring = Density of Platinum

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



# Conversion Factors Needed

$$1 \text{ kg} = 1000 \text{ g}$$

$$1 \text{ m} = 100 \text{ cm}$$

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

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

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!

# Questions?

Give  
feedback.

Win a gift  
certificate!



[goto.unm.edu/ess-feedback](https://goto.unm.edu/ess-feedback)

Don't forget to follow up on social media.

