Number	Round to 1sf	Round to 2sf
1628	2000	1600
247		
$5209	$5,000 = 5×10^3	5209 = 5200 = 5.2×10^3
1643		
18		
5.38		
2.73		
0.726		
0.319		
0.463		
0.0183	$0.0183 = 0.02 = 2 \times 10^{-2}$	$0.0183 = 0.018 = 1.8 \times 10^{-2}$
0.0736		
3847		
629		
18.29		
0.8273		
1.347		
2.636		
0.1937		
0.038		
13.473		
1758.2		

Exponent + → Exponent − ←

Express each number in standard form.

1. 2.4×10^{4} = 24000
2. 9.0×10^{3}
3. 4.385×10^{7}
4. 1.03×10^{9}
5. 3.05×10^{2} = 305
6. 5.11×10^{10}
7. 6.000032×10^{6}
8. 1.0×10^{1}
9. 8.75×10^{5}
10. 8.49×10^{-2} = .0849
11. 7.1×10^{-6}
12. 1.0×10^{-3}
13. 4.39×10^{-7}
14. 1.25×10^{-4} = .000125

Express each number in scientific notation.

>1 Exponent + < 1 Exponent −

15. 40,000
16. 16
17. 876,000,000. = 8.76×10^{8}
18. 4500
19. 151. = 1.51×10^{2}
20. 0.00037
21. 83,000,000
22. 919,100
23. 5,000,000,000,000
24. 0.13
25. 0.0000007 7×10^{-7}
26. 0.0067 6.7×10^{-3}

Pure Substance

Elements

Single Symbol

H_2, Na, O_2, N_2

S_8

Compounds

2 or more Element Symbols in whole # Ratios

H_2O, NaCl, $C_6H_{12}O_6$

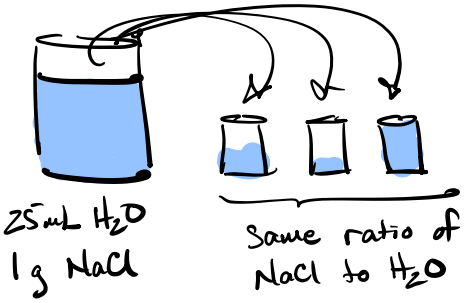
"And"

Mixture (Cannot be represented by a Chemical formula

Homogeneous

$H_2O + NaCl$

Salt water



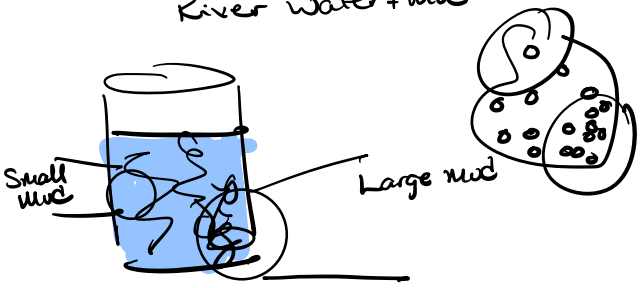
25 mL H_2O

1 g NaCl

Same ratio of NaCl to H_2O

Heterogeneous

Granite, River water + mud



with - And = + = 🎵 = mixture

Material	Pure Substance or Mixture	Element, Compound, Homogeneous, Heterogeneous
concrete	mixture	Heterogeneous
sugar + pure water ($C_{12}H_{22}O_{11} + H_2O$)	mixture	Homogeneous
iron filings (Fe)	Pure Substance	element
limestone ($CaCO_3$)	Pure Substance	Compound
orange juice (w/pulp)	mixture	Heterogeneous
Pacific Ocean	mixture	Heterogeneous
air inside a balloon O_2 and N_2 and CO_2	mixture	gas - Homogeneous
aluminum (Al)	Pure Substance	Element
magnesium (Mg)	Pure Substance	Element
acetylene (C_2H_2)	Pure Substance	Compound
tap water in a glass H_2O and $MgCl_2$ and NaCl and...	mixture	Homogeneous
soil		
pure water (H_2O)		
chromium (Cr)		
Chex mix		
salt + pure water ($NaCl + H_2O$)	mixture	
benzene (C_6H_6)		
muddy water		
brass (Cu mixed with Zn)		
baking soda ($NaHCO_3$)		

PHYSICAL AND CHEMICAL PROPERTIES AND CHANGES

Name _____Key_____

PHYSICAL PROPERTY	**CHEMICAL PROPERTY**
1. observed with senses 2. determined without destroying matter Boiling Points, Melting Point, density, Color, Vicosity	1. indicates how a substance reacts with something else 2. matter will be changed into a new substance after the reaction → Burning, reacting or reaction

Identify the following as a chemical (C) or physical property (P):

P 1. blue color
P 2. density
C 3. flammability (burns)
* C 4. solubility (dissolves)
C 5. reacts with acid
C 6. supports combustion
P 7. sour taste
_____8. melting point
_____9. reacts with water
_____10. hardness
_____11. boiling point
_____12. luster
_____13. odor
_____14. reacts with air

PHYSICAL CHANGE	**CHEMICAL CHANGE**
1. a change in size, shape, or state → Solid Liquid Gas 2. no new substance is formed	1. a change in the physical and chemical properties 2. a new substance is formed

Identify the following as physical *(P)* or chemical *(C)* changes.

_____1. NaCl (Table Salt) dissolves in water.
C 2. Ag (Silver) tarnishes $2Ag + O_2 \rightarrow Ag_2O$
_____3. An apple is cut.
_____4. Heat changes H_2O to steam.
_____5. Baking soda reacts to vinger.
C 6. Fe (Iron) rusts. $4Fe + 3O_2 \rightarrow 2Fe_2O_3$
P 7. Alcohol evaporates .
P 8. Ice melts.
_____9. Milk sours.
_____10. Sugar dissolves in water.
_____11. Wood rots.
_____12. Pancakes cook.
C 13. Grass grows. ⇐
P 14. A tire is inflated.
_____15. Food is digested.
_____16. Paper towel absorbs water.

Physical and Chemical Changes

Part A

Can you recognize the chemical and physical changes that happen all around us? If you change the way something looks, but haven't made a new substance, a **physical change** (P) has occurred. If the substance has been changes into another substance, a **chemical change** (C) has occurred.

1.		An ice cube is placed in the sun. Later there is a puddle of water. Later still the puddle is gone.
2.		Two chemical are mixed together and a gas is produce.
3.		A bicycle changes color as it rusts. Chemical
4.		A solid is crushed to a powder. Physical
5.		Two substances are mixed and light is produced. Chemical
6.		A piece of ice melts and reacts with sodium.
7.		Mixing salt and pepper.
8.		Chocolate syrup is dissolved in milk.
9.		A marshmallow is toasted over a campfire.
10.		A marshmallow is cut in half.

Part B
Read each scenario. Decide whether a physical or chemical change has occurred and give evidence for your decision. The first one has been done for you to use as an example.

	Scenario	Physical or Chemical Change?	Evidence…
1.	Umm! A student removes a loaf of bread hot from the oven. The student cuts a slice off the loaf and spreads butter on it.	Physical	Cut Bread melted butter
2.	Your friend decides to toast a piece of bread, but leaves it in the toaster too long. The bread is black and the kitchen if full of smoke.	Chemical	Burned the bread bread + O_2 → Burnt toast
3.	You forgot to dry the bread knife when you washed it and reddish brown spots appeared on it.		
4.	You blow dry your wet hair.		
5.	In baking biscuits and other quick breads, the baking powder reacts to release carbon dioxide bubbles. The carbon dioxide bubbles cause the dough to rise.		
6.	You take out your best silver spoons and notice that they are very dull and have some black spots.		
7.	A straight piece of wire is coiled to form a spring.		
8.	Food color is dropped into water to give it color.		
9.	Chewing food to break it down into smaller particles represents a _____ change, but the changing of starch into sugars by enzymes in the digestive system represents a _____change.		
10.	In a fireworks show, the fireworks explode giving off heat and light.		

Part C: True (T) or False (F)

1.		Changing the size and shapes of pieces of wood would be a chemical change.
2.		In a physical change, the makeup of matter is changed.
3.		Evaporation occurs when liquid water changes into a gas.
4.		Evaporation is a physical change.
5.		Burning wood is a physical change.
6.		Combining hydrogen and oxygen to make water is a physical change.
7.		Breaking up concrete is a physical change.
8.		Sand being washed out to sea from the beach is a chemical change.
9.		When ice cream melts, a chemical change occurs.
10.		Acid rain damaging a marble statue is a physical change.

Important Dimensional Analysis Equalities

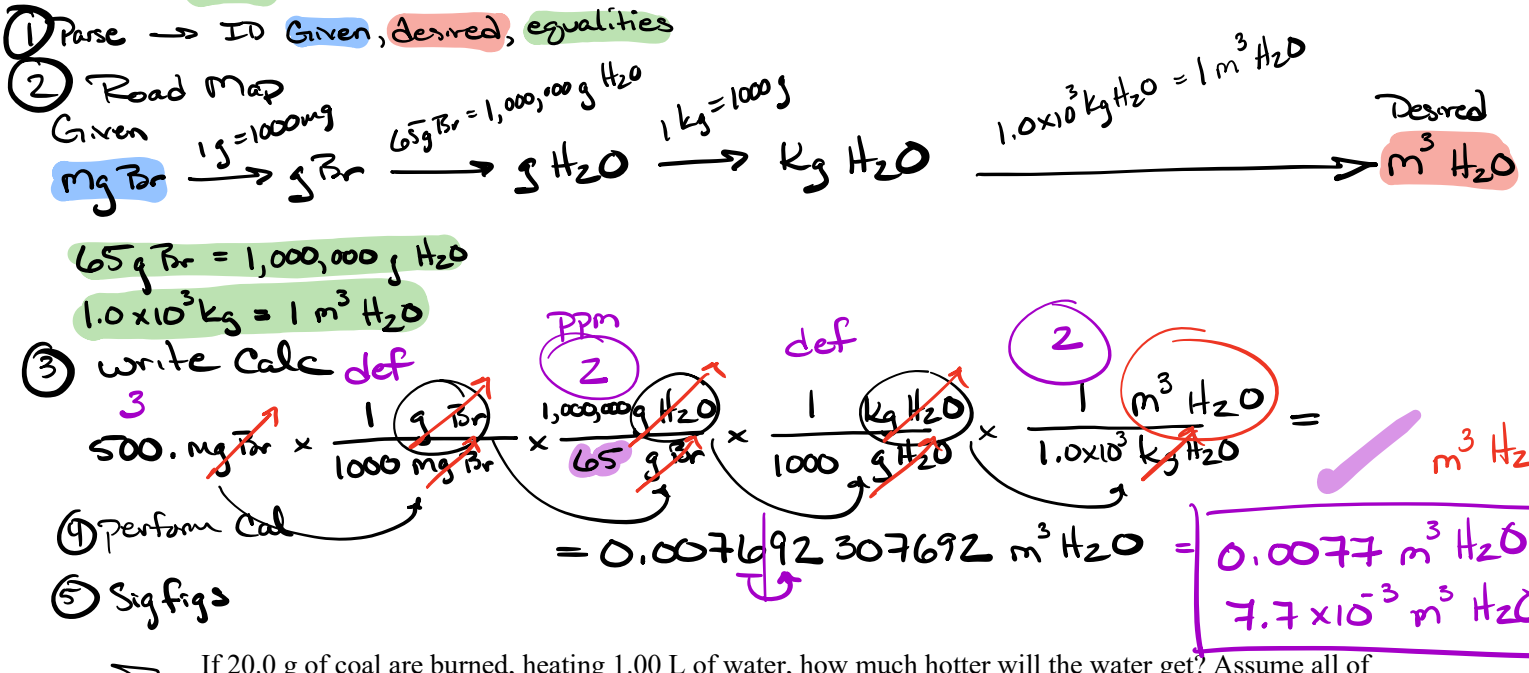
3 keys

mass	1 lb = 453.6 g	4 SF
length	1 in = 2.54 cm	Exact
Volume	1 gal = 3.785 L	4 SF

SI System

Tera	T	$\times 10^{12}$			
Giga	G	$\times 10^{9}$			
mega	M	$\times 10^{6}$	$1\ Mm = 1 \times 10^{6}\ m$		
Kilo	k	$\times 10^{3}$	$1\ km = 1 \times 10^{3}\ m$	or	$1\ km = 1000\ m$
~~Deca~~	~~D~~	$\times 10^{1}$			
Base	—				
Centi	c	$\times 10^{-2}$	$1\ cm = 1 \times 10^{-2}\ m$	or	$100\ cm = 1\ m$
milli	m	$\times 10^{-3}$	$1\ mm = 1 \times 10^{-3}\ m$	or	$1000\ mm = 1\ m$
micro	μ	$\times 10^{-6}$	$1\ \mu m = 1 \times 10^{-6}\ m$		
nano	n	$\times 10^{-9}$			
femto	f	$\times 10^{-12}$			

The bromine content of the ocean is about 65 g of bromine per million g of sea water. How many cubic meters of ocean must be processed to recover 500. mg of bromine, if the density of sea water is 1.0×10^3 kg/m^3? (Answer: 7.7×10^{-3} m^3)



If 20.0 g of coal are burned, heating 1.00 L of water, how much hotter will the water get? Assume all of the heat lost by the coal is gained by the water. (Answer: 129 °C)

Additional information: Density of water, 1.00 g/mL; specific heat of water, 4.184 J/(g·°C); heat of combustion of coal, 27.00 MJ/kg.

Mole

Atoms & molecules are so small that we group to deal with in a meaningful way

12 eggs = 1 "dozen" eggs

dozen = 12

1 × 12 eggs

1 mole = 6.022×10^{23}

1 "mole" of atoms = 1 × 6.022×10^{23} atoms

× 6.022×10^{23}

1 "mole" of molecules = 1 × 6.022×10^{23} molecules

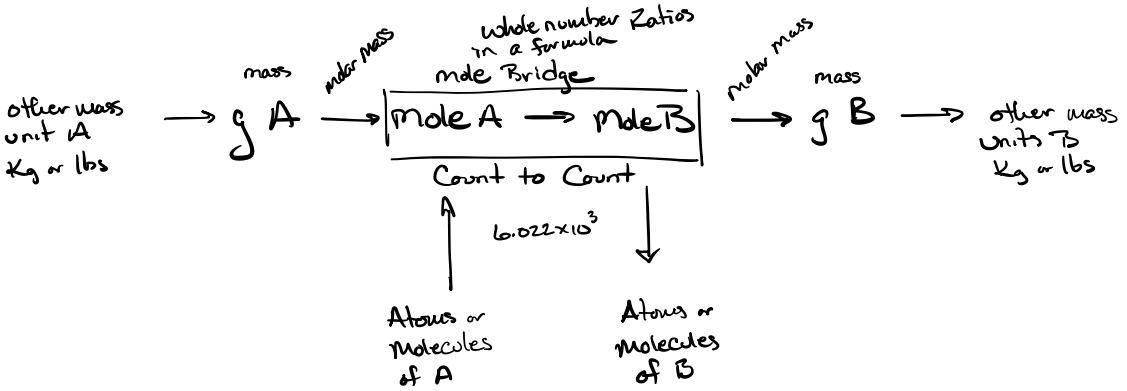
3.72 moles of oxygen atoms = 3.72 × 6.022×10^{23} oxygen atoms

Group — Individual

Stoichiometry

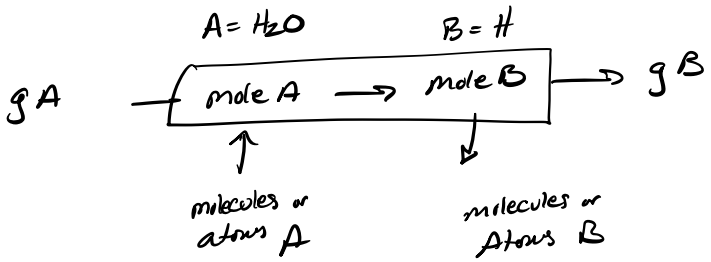
"Mass to Mole Conversions"

General Roadmap



mole A → mole B

How many moles of H are in 6.72 mole of H_2O?



1 mole H_2O = 2 mole H

mole H_2O → mole H

Equality Comes from Subscripts in formula

1 mole H_2O = 2 mole H

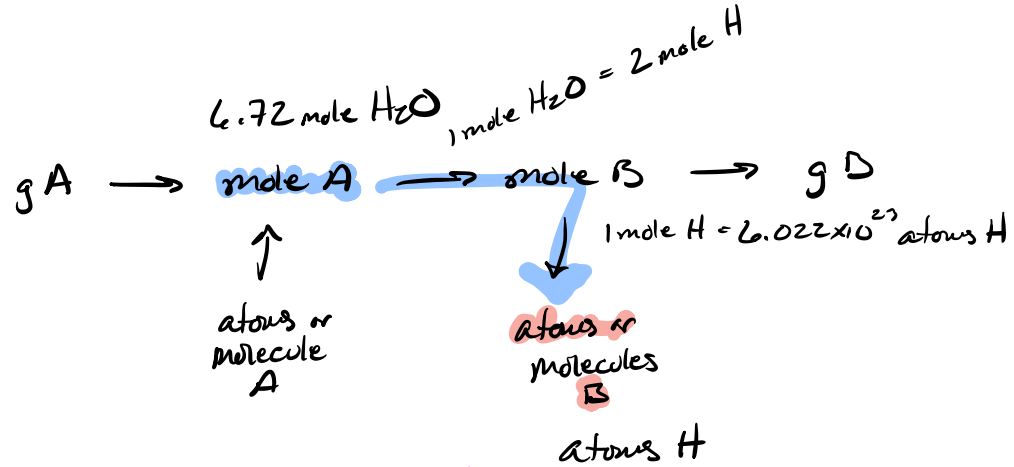
Exact = Counted

$$6.72 \text{ mole } H_2O \times \frac{2 \text{ mole H}}{1 \text{ mole } H_2O} = 13.44 \text{ mole H}$$

3 sig figs

= 13.4 mole H

How many atoms of H are in 6.72 mole H_2O.



3

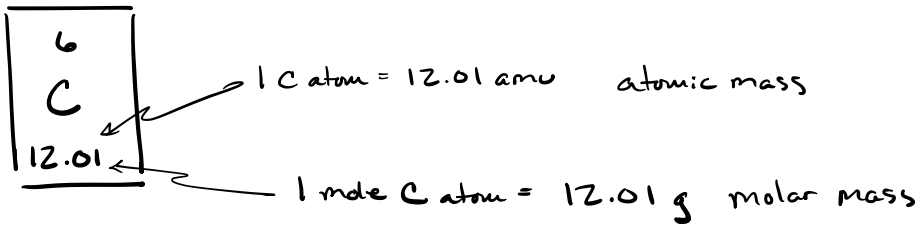
$$6.72 \text{ mole } H_2O \times \frac{2 \text{ mole H}}{1 \text{ mole } H_2O} \times \frac{6.022\times10^{23} \text{ atoms H}}{1 \text{ mole H}}$$

(Exact; 4)

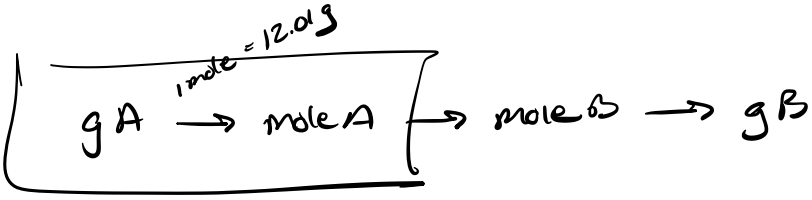
$$6.72 \times 2 \times 6.022\times10^{23} = 8.093568\times10^{24} \text{ atoms H}$$

(x x; E / EE)

$$= \boxed{8.09\times10^{24} \text{ atoms H}}$$



How many grams does 2.903 moles of Carbon weigh?



$$2.903 \text{ moles C} \times \frac{12.01 \text{ g C}}{1 \text{ mole C}} = 34.86503 \text{ g C}$$

$$= \boxed{34.87 \text{ g C}}$$

What is the molar mass, the mass of 1 mole in grams, of H_2O?

Find mass of each part

$$1 \text{ mole } H_2O = \underset{\text{Exact}}{2} \text{ mole H} \times \frac{1.008 \text{ g H}}{1 \text{ mole H}} = 2.016 \text{ g H}$$

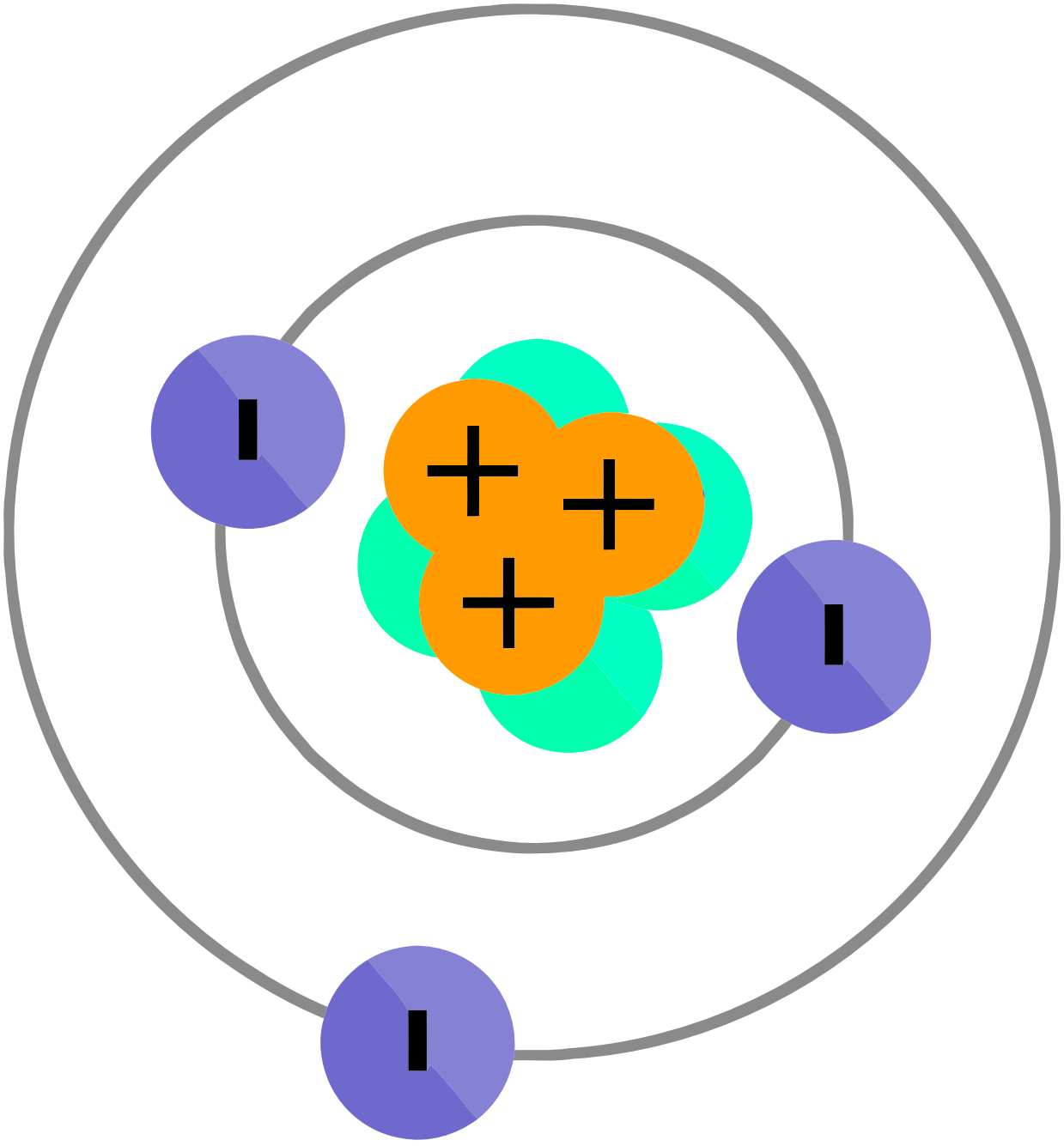
$$1 \text{ mole } H_2O = 1 \text{ mole O} \times \frac{16.00 \text{ g O}}{1 \text{ mole O}} = 16.00 \text{ g O}$$

$$+$$

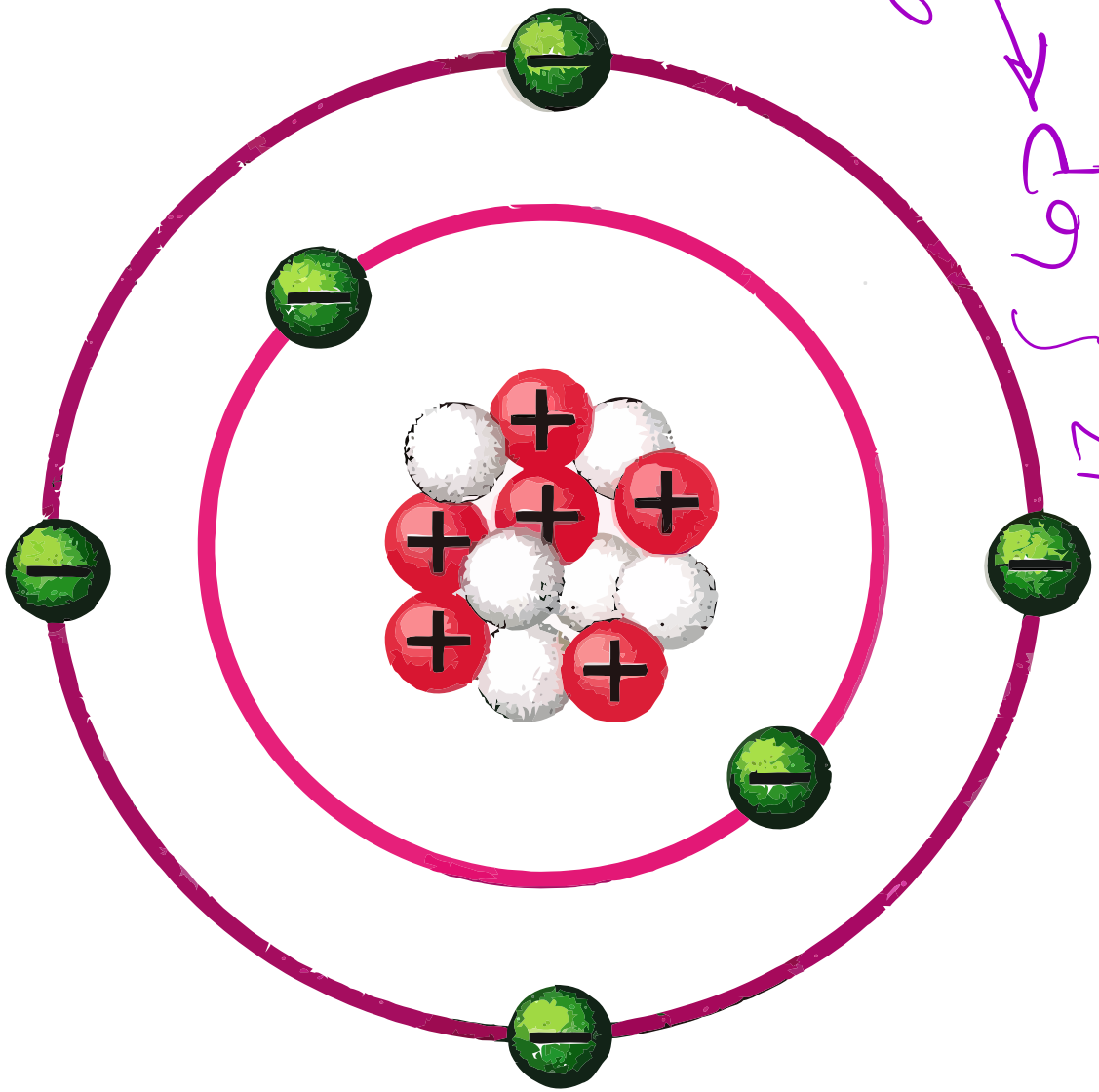
$$18.016 \text{ g } H_2O$$

$$1 \text{ mole } H_2O = 18.02 \text{ g } H_2O$$

$$\boxed{18.02 \text{ g/mole } H_2O}$$



Neutron
Proton
Electron



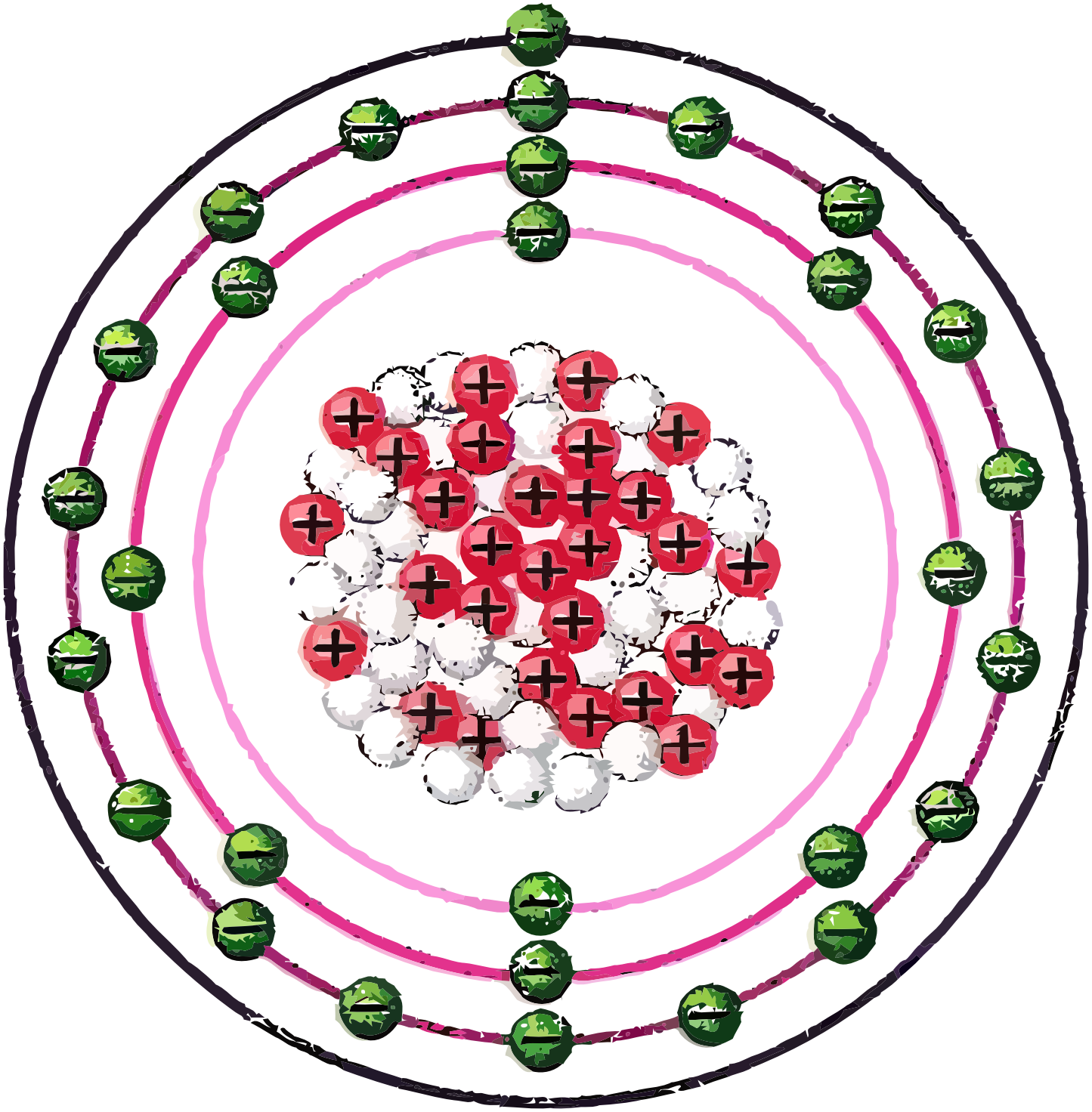
atomic #6

6P
6n
6e⁻

12

6

- Electron
- Proton
- Neutron



29 +

34

29 −

Same = 0

$^{63}_{29}Cu^{\emptyset}$

How many grams of hydroxyapetite $Ca_5(PO_4)_3(OH)$ are in 0.00234 mol?

$$5\ Ca \times \frac{40.08\ g\ Ca}{1\ mole\ Ca} =$$

$$3\ P \times \frac{30.97\ g\ P}{1\ mole\ P} =$$

$$12\ O + 1 = 13\ O \times \frac{16.00\ g\ O}{1\ mole\ O} =$$

$$1\ H \times \frac{1.008\ g}{1\ mole\ H} =$$

$$\begin{array}{r} 200.4 \\ 92.91 \\ 208.00 \\ +\quad 1.008 \\ \hline 502.318\ g/mole \end{array}$$

$502.3\ g/mole$

$Ca_5(PO_4)_3(OH)$

molar mass

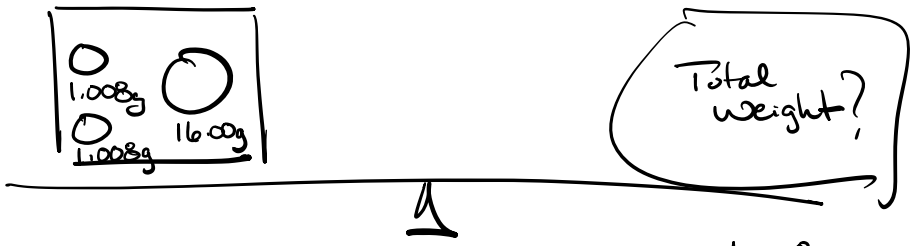
g A → mole A → mole B → g B

3 4

$0.00234 \text{ mole } Ca_5(PO_4)_3(OH) \times \frac{502.3 \text{ g } Ca_5(PO_4)_3(OH)}{1 \text{ mole } Ca_5(PO_4)_3(OH)}$

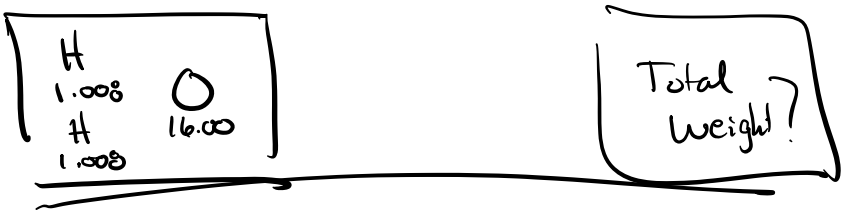
$= 1.175382 \text{ g } Ca_5(PO_4)_3(OH)$

$= 1.18 \text{ g } Ca_5(PO_4)_3(OH)$



$$\begin{array}{r} 1.008 \\ 1.008 \\ +\ 16.00 \\ \hline 18.016\ g \end{array}$$

H_2O



$$1\ \text{mole}\ H_2O \times \frac{2\ \text{mole}\ H}{1\ \text{mole}\ H_2O} \times \frac{1.008\ g}{1\ \text{mole}\ H} = 2.016\ g$$

$$\begin{array}{r} 1.008 \\ +\ 1.008 \end{array}$$

$$1\ \text{mole}\ H_2O \times \frac{1\ \text{mole}\ O}{1\ \text{mole}\ H_2O} \times \frac{16.00\ g}{1\ \text{mole}\ O} = 16.00\ g$$

$$\begin{array}{r} 16.00\ g \\ +\ 2.016\ g \\ \hline 18.016\ g \end{array}$$

H_2O = Add 2 H's & 1 Oxygen

Office hours MW 1:30-2:30

TTh 10-11

Office hour link in canvas in 1st module