An object has a mass of 20.0 g. When it is submerged in a graduated cylinder initially containing 85.0 mL of water, the water level rises to 95.0 mL. What is the density of the object in mg/dL?

\[ d = \frac{m}{V} \]

\[ d = \frac{20.0 \text{ g}}{95.0 \text{ mL} - 85.0 \text{ mL}} = 2.00 \text{ g/mL} \]

\[ 2.00 \times 10^{-3} \text{ mg/mL} \times 10^{-1} \frac{\text{mL}}{\text{dL}} = 2.00 \times 10^{5} \frac{\text{mg}}{\text{dL}} \]
How many mL of benzene will you use in an experiment that requires 1.8 kg of the substance. The density of benzene is 0.90 g/mL?

\[
1.8 \text{ kg} \times 1000 \frac{\text{g}}{\text{kg}} \times \frac{1}{0.90} \frac{\text{mL}}{\text{g}} = 2.0 \times 10^3 \text{ mL}
\]
Assume that 1m is about 3 ft

Show schematically how many square feet are in a square meter

\[ 3^2 = 9 \]
Now Show schematically how many cubic feet are in a cubic meter

\[ 3^3 = 27 \]
Calculate how many mm\(^3\) are in 20 m\(^3\)?

\[
20 \text{ m}^3 \times \left(10^3\right)^3 \frac{\text{mm}^3}{\text{m}^3} = 20 \times 10^8 \text{ mm}^3
\]

or

\[
2.0 \times 10^{10} \text{ mm}^3
\]
Calculate how many nm\(^2\) are in a 150m\(^2\)?
Practice Element Symbols

- \( \frac{23}{11}X \): is which element? (Name and symbol)
  - \( ^{23}\text{Na} \) - Sodium

- Has how many neutrons?
  - \( \frac{212}{82}X+2 \)
    - \( ^{212}\text{Pb}^{2+} \)
    - \( 212 - 82 = 130 \) neutrons

- Has how many protons, neutrons, electrons?
  - \( \frac{79}{35}X-1 \)
    - \( ^{79}\text{Br}^- \)
    - 35 protons
    - \( 78 - 35 = 43 \) neutrons
    - 36 electrons

- Write the symbol that corresponds to: 26p\(^+\), 24e\(^-\), 30n
  - \( ^{26}\text{Fe}^{2+} \)
Valence Electrons

• For the trace element selenium the number of valence electrons is: 6

• What is the number of valence electrons for:

  • Phosphorus?: 5
  • Xenon?: 8
Let’s play the element jeopardy:

1) Look at you periodic table and answer quickly and correctly:

RULES:
Each correct answer collects 5 points for your team.
A wrong one costs your team 10!

2) Write down all the answers yours AND the correct ones and at the end hand your sheet of paper to the LA
Name an alkaline earth metal that is a macronutrient and is also involved in photosynthesis:

Magnesium
Name an alkali metal has 11 electrons when it is neutral

\[ \text{Na} \text{ (sodium)} \]
How many valence electrons does the Li+ cation have?

2
How many valence electrons does the element Fluorine have?
How many protons does the element Gold have?
Is Arsenic a metal, non-metal or metalloid?
Double jeopardy:

1) Look at your periodic table and answer quickly and correctly:

RULES:
Each correct answer collects 10 points for your team. A wrong one costs your team 20!

2) Write down all the answers yours AND the correct ones and at the end hand your sheet of paper to the LA
How many neutrons does C-14 have?
Write down the symbol for the isotope of Plutonium with 157 neutrons.

\[ ^{251}_{94} \text{Pu} \]
How many electrons does the element Calcium have? 20

\[ Ca \]
How many valence electrons does the element Calcium have?

2
How many valence electrons does the Ca\textsuperscript{2+} cation have?

8
Write down the symbol of the element with 92 protons and 143 neutrons

\[ {\^{235}}U \]
Calculate the atomic weight of element Cl if 75% of its nuclei have 18 neutrons and 25% of its nuclei have 20 neutrons.

\[
\text{Atomic Weight (AM)} = 0.75 \times 35 + 0.25 \times 32 = 35.5
\]
• Part 1
• A teacup contains approximately 0.50 mg of gold. How many grams of gold do five teacups contain?

\[
0.50 \text{ mg} \times 10^{-3} \frac{\text{g}}{\text{mg}} \times 5 \text{ teacups} = 0.0025 \text{ g or } 2.5 \times 10^{-3} \text{ g}
\]

• Part 2
• Using your answer from above, how many moles of gold do five teacups contain?

\[
2.5 \times 10^{-3} \text{ g} \times \frac{1}{184.0} \frac{\text{mol}}{\text{g}} = 1.3 \times 10^{-5} \text{ mol}
\]
• Part 1

A teacup contains approximately 0.50 mg of gold. How many grams of gold do five teacups contain?

\[ 0.50 \text{ mg} \times \frac{1}{10^3} \text{ g/mg} \times 5 \text{ teacups} = 2.5 \times 10^{-3} \text{ g} \]

• Part 2

Using your answer from above, how many moles of gold do five teacups contain?

\[ 2.5 \times 10^{-3} \text{ g} \times \frac{1 \text{ mol}}{186.7 \text{ g}} = 1.365 \times 10^{-5} \text{ mol} \]
Part 1
Write the formula of chlorine molecule (Lewis structure) and show what bonds are present

\[
\text{Cl}_2
\]

Part 2
How many valence electrons does each atom have in bonds and lone pairs?

Part 3
Does each atom have a noble gas configuration?

\[
\text{Formal charge of Cl} \quad \rightarrow \quad 7 - (6+1) = 0
\]

Yes \quad Ar

\[
+6 \quad -2
\]

\[
\frac{8}{8}
\]
• What form of potassium would be found in blood?

a) K
b) P

c) Pt

d) $K^{2+}$

e) $K^+$
• What is the correct name of CaCl$_2$?
  a) Calcium chloride
  b) Calcium dichloride
  c) Calcium chlorite
  d) Calcium dichlorite
What is the correct way to represent calcium oxide?

- A) Ca$_2$O
- B) CaO
- C) CaO$_2$
- D) CaO$_3$
How many molecules of are in 5.3g of ammonium hydroxide?

\[ N = 6.02 \times 10^{23} \text{ molecules mol}^{-1} \]

\[ \text{NH}_3 + \text{H}^+ \rightarrow \text{NH}_4^+ \quad \text{H}_2\text{O} - \text{H}^+ \rightarrow \text{HO}^- \]

\[ \text{NH}_4^+ + \text{OH}^- \rightarrow \text{NH}_4\text{OH} \]
How many molecules are in 5.3g of ammonium hydroxide?

Step 1: Write the molecular formula for ammonium hydroxide.

Step 2: Find the molecular weight of the compound using the periodic table.

Step 3: Determine the number of moles using MW and given information.

Step 4: Use the number of moles to determine the number of molecules based on Avogadro’s number.
How many molecules are in 5.3g of ammonium hydroxide?

1. Ammonium hydroxide: NH₄OH

2. MW of NH₄OH:
   - N= 14.01 x1 → 14.01 g/mol
   - H= 1.01 x4 → 4.04 g/mol
   - O= 16.02 x1 → 16.02 g/mol
   - H= 1.01 x1 → 1.01 g/mol
   - Total: 35.08 g/mol
How many molecules are in 5.3g of ammonium hydroxide?

# moles of NH$_4$OH = \( \frac{\text{weight of sample (g)}}{\text{MW of NH}_4\text{OH (g/mol)}} \)

\[ \frac{5.3\text{g}}{35.08\text{g/mol}} = 0.15 \text{ mol NH}_4\text{OH} \]

# molecules = \# mol x 6.023 x 10$^{23}$ molecule/mol

\[ (0.1512 \text{ mol}) x (6.023 x 10^{23} \text{ molecule/mol}) \]

\[ = 9.1 \times 10^{22} \text{ molecules} \]

Notice that we kept a couple more sig figs in order to avoid accumulating rounding errors!!
How many moles of lead can be found in 3 moles of lead (II) nitrate?

• Step 1: Write the formula for lead (II) nitrate.
• Step 2: Multiply the number of moles of lead in the compound (designated by the formula) by the given number of moles of compound.

\[ 3 \text{ mol } \text{Pb(NO}_3\text{)}_2 \times \frac{1 \text{ mol Pb}}{1 \text{ mol Pb(NO}_3\text{)}_2} = 3 \text{ mol Pb} \]

\[ 3 \text{ mol Pb(NO}_3\text{)}_2 \times 6 \frac{\text{mol O}_2}{\text{mol Pb(NO}_3\text{)}_2} = 18 \text{ mol O}_2 \]

Oxygen?
How many moles of lead can be found in 3 moles of lead (II) nitrate?

• Step 1:  Lead (II) nitrate: Pb(NO$_3$)$_2$

• Step 2:

According to the molecular formula, there is one mole of Pb in each mole of Pb(NO$_3$)$_2$

\[ 1\text{mol Pb/mol Pb(NO}_3\text{)_2} \times 3\text{mol Pb(NO}_3\text{)_2} = 3\text{ mol Pb} \]
LA activity: Stepping on a firm ground on compound formulas before moving on;

The molecular mass of the compound \( \text{Na}_2(\text{C}_x\text{O}_y)_z \) is 105.96g. Based on this information, suggest a molecular formula for this compound and explain your answer.
\( Z = 1 \). Why? Sodium can only be \( \text{Na}^+ \) (Group 1A) unless in elemental form

Step 1: Write down what you know.
- MW of compound X: 105.96g/mol
- Mass of 2 moles Na: 22.99g/mol \( \times 2 = 45.98 \)g
- Mass of remaining amounts of C and O in compound X = 105.96g - 45.98g = 59.98g
- Molecular formula: \( \text{Na}_2\text{C}_x\text{O}_y \)

Step 2: Consider the possible compounds that carbon and oxygen can form to react with 2 moles of sodium using the weight as a guide.
Solution:

The molecular formula Na$_2$C$_x$O$_x$ resembles an ionic compound formed between 2 Na$^+$ ions and a polyatomic ion formed by the C and O atoms. The C$_x$O$_x$ ion must have a -2 charge to balance out the 2 Na$^+$ ions and have a MW of 59.98g.

- Possible ion: CO$_3^{2-}$
- MW: C(12.01)+ O(3x15.99)= 59.98g MATCH!!

Molecular formula for Compound X: Na$_2$CO$_3$
• An unknown solid is placed on a balance and the measurement reads 5.000 grams.
• The solid is dropped into a beaker of water and the level rises from 15.0 mL to 25.0 mL.

A. What is the density of the solid in g/mL?

\[ d = \frac{m}{V} = \frac{5.000 \text{ g}}{25.0 \text{ mL} - 15.0 \text{ mL}} = 0.500 \text{ g/mL} \]

B. If the solid has a molecular weight of 15 g/mol, then how many moles of the solid are there?

\[ 5.000 \text{ g} \times \frac{1 \text{ mol}}{15 \text{ g}} = 0.3333 \text{ mol} \]
Question 2 Answer

A. \( \text{D} = \frac{\text{m}}{\text{v}} \)

\[ \text{V} = (25.0 \text{ mL}) - (15.0 \text{ mL}) = 10.0 \text{ mL} \]

\[ \text{D} = \frac{(5.000 \text{ g})}{(10.0 \text{ mL})} = 0.5 \rightarrow 0.500 \text{ g/mL} \]

B. \( 5.000 \text{ g} \times \frac{1 \text{ mol}}{15 \text{ g}} = 0.333 \rightarrow 0.33 \text{ mol} \)
• A solid is weighed at 15.00 grams
• When placed in water, part of the solid dissolves and part of the solid remains as an insoluble precipitate

  $15.00 - 3.000 = 12.00\text{ g}$

• The mixture is poured through a filtering funnel and the insoluble precipitate is caught in the filter, which is then dried and weighed at 3.145 g.

• The filter paper is dried and weighed after all the solid has been transferred to a vial. It weighs 0.145 g

  $3.145\text{ g} - 0.145\text{ g} = 3.000\text{ g net}$

• What is the % by mass of the soluble portion of the original solid?

  $\frac{12.00\text{ g}}{15.00\text{ g}} \times 100\% = 80\%$
Question 3 Answer

1) Mass of solid in paper is $3.145\text{g (solid+paper)} - 0.145\text{g (paper)} = 3.000\text{g}$

\[
\text{%mass} = \frac{\text{mass}_x}{\text{mass}_{\text{total}}} \times 100
\]

\[
\text{mass}_x = (15.00 \text{ g}) - (3.000 \text{ g}) = 12.00 \text{ g}
\]

\[
\text{%mass} = \frac{12.00 \text{ g}}{15.00 \text{ g}} \times 100
\]

\[
= 0.80 \times 100
\]

\[
= 80\%
\]
If Jane Doe
blood glucose \( C_6H_{12}O_6 \) g

\[
\text{102 mg C}_6\text{H}_{12}\text{O}_6 \frac{\text{g}}{\text{L}}
\]

\[
\text{How many molecules}
\]

\[
\text{MW } 180.1568 \frac{\text{g}}{\text{mol}}
\]

\[
\frac{102 \text{mg glucose}}{\text{L}} \times 1 \text{mg glucose} \times \frac{1 \text{ mol glucose}}{180.1568 \text{ g glucose}} \times 6.02 \times 10^{23} \text{ molecules} \frac{\text{mol}}{}
\]

\[
= 3.41 \times 10^{20} \text{ molecules}
\]