Warm Up

How many molecules of O_2 are in 1.0×10^{-12} moles O_2?

Warm Up

How many grams are in 0.564 mol F_2?

Objective:

TSWBAT:
Describe the relationship between moles and mass
and moles and volume
Also, practice making conversions between moles and representative particles.

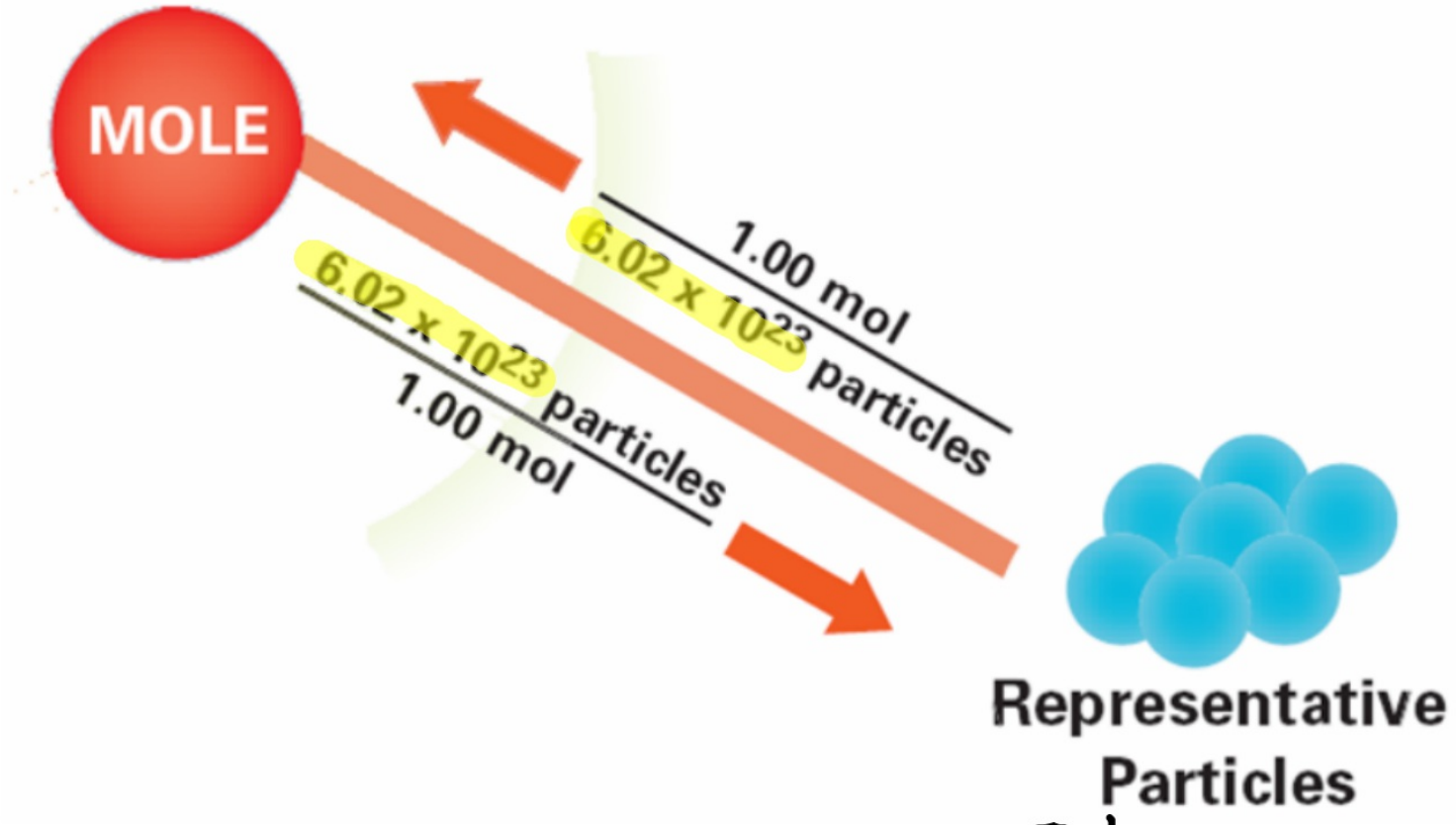
Review:

What are the three ways we measure matter?

1. Counting
2. Mass
3. Volume

We are still on counting.

Counting:


MOLE
1.00 mol
6.02 x 10^23 particles
6.02 x 10^23 particles
1.00 mol
Representative Particles
atoms
molecules, f.u.'s

Warm Up

What are the products of
the combustion of any hydrocarbon?
Give an example.

If you are doing a make-up project, they are due on Monday, Nov. 19th.

How many atoms of Fe are in 7.77 mol Fe?

More practice:

How many representative particles are in 16.7 mol oxygen?

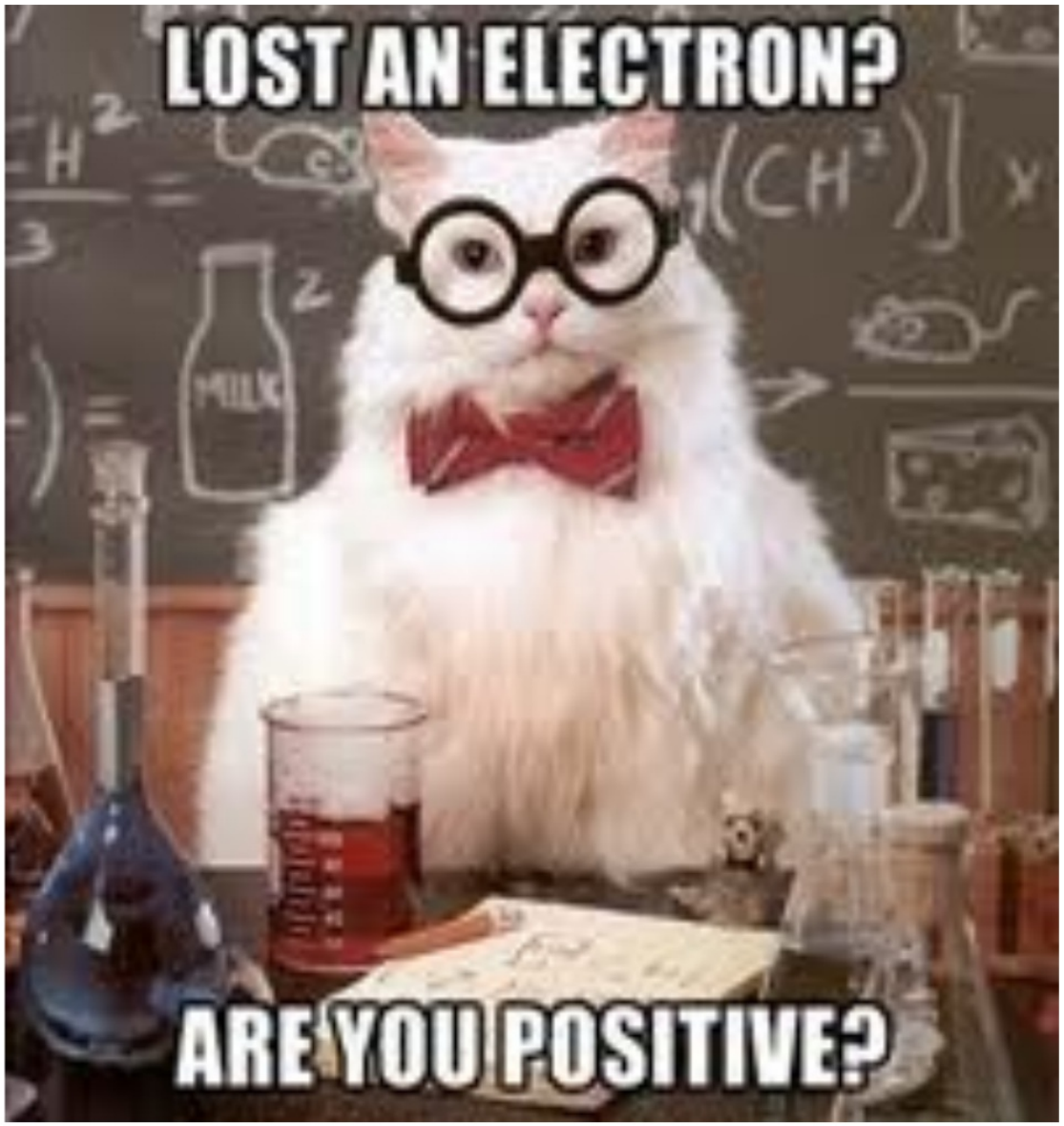
(ask yourself what the rep.particles for oxygen would be)

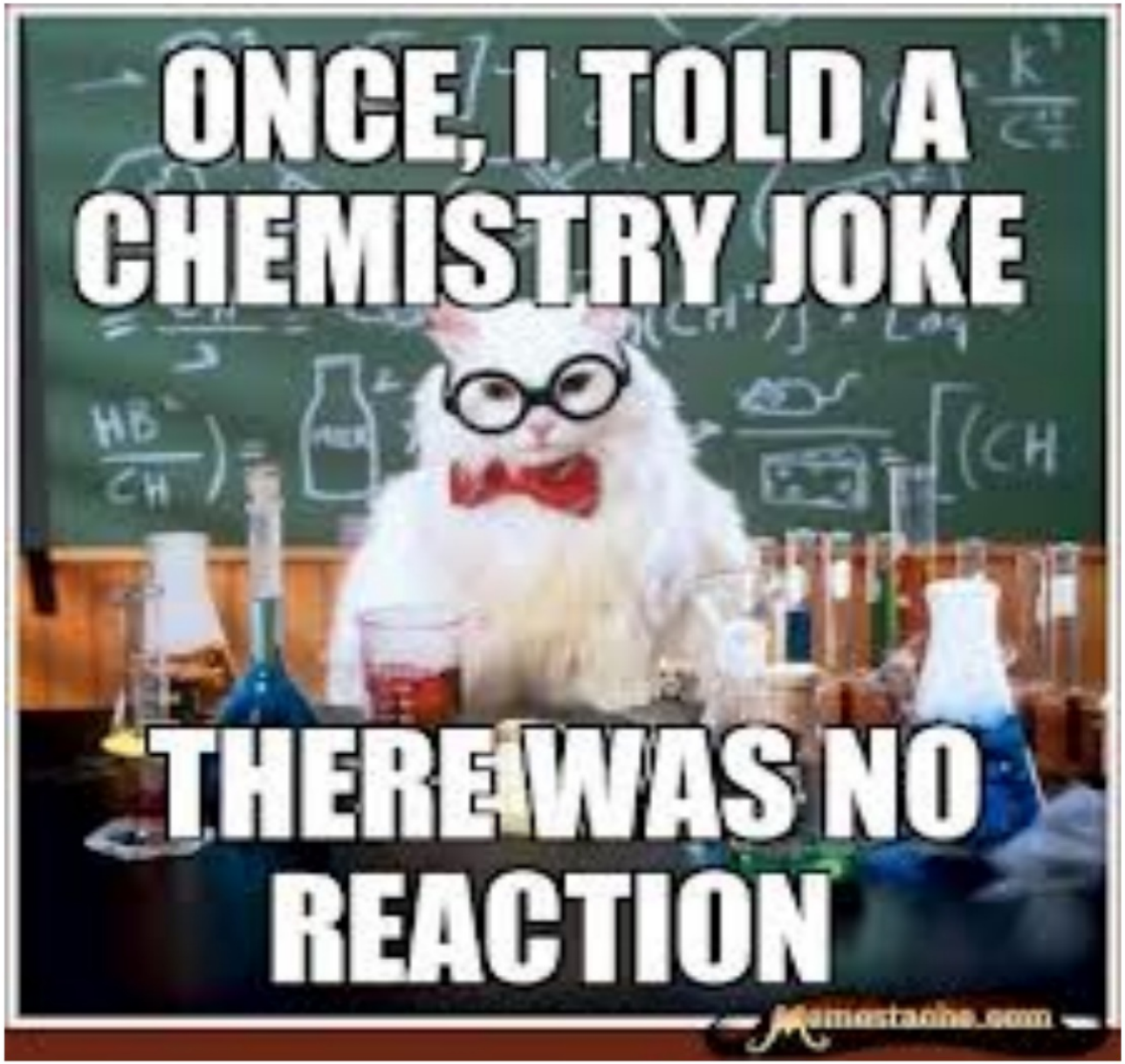
How many mol of Lithium are in 5.55×10^{14} atoms of Li?

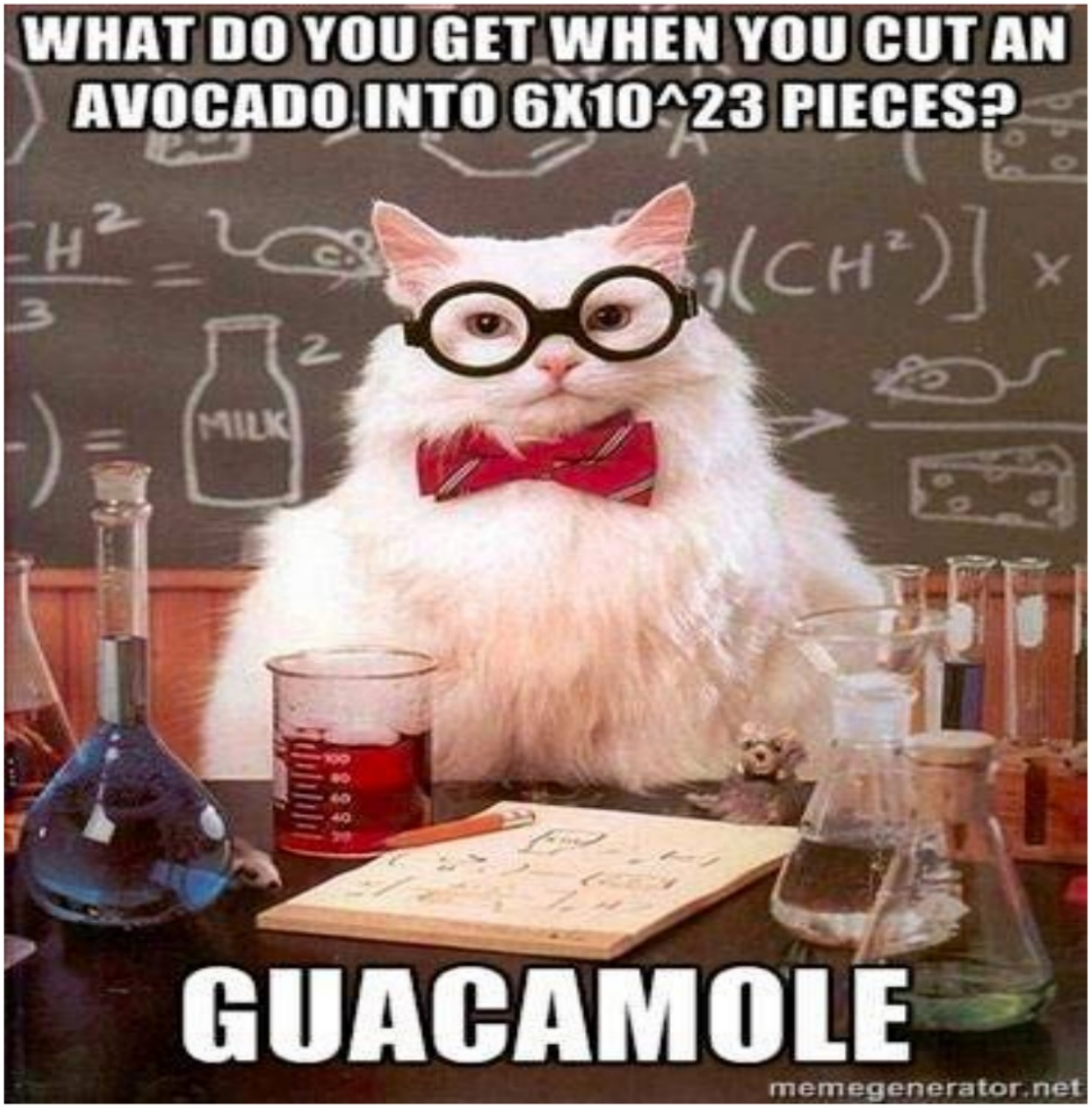
Warm Up

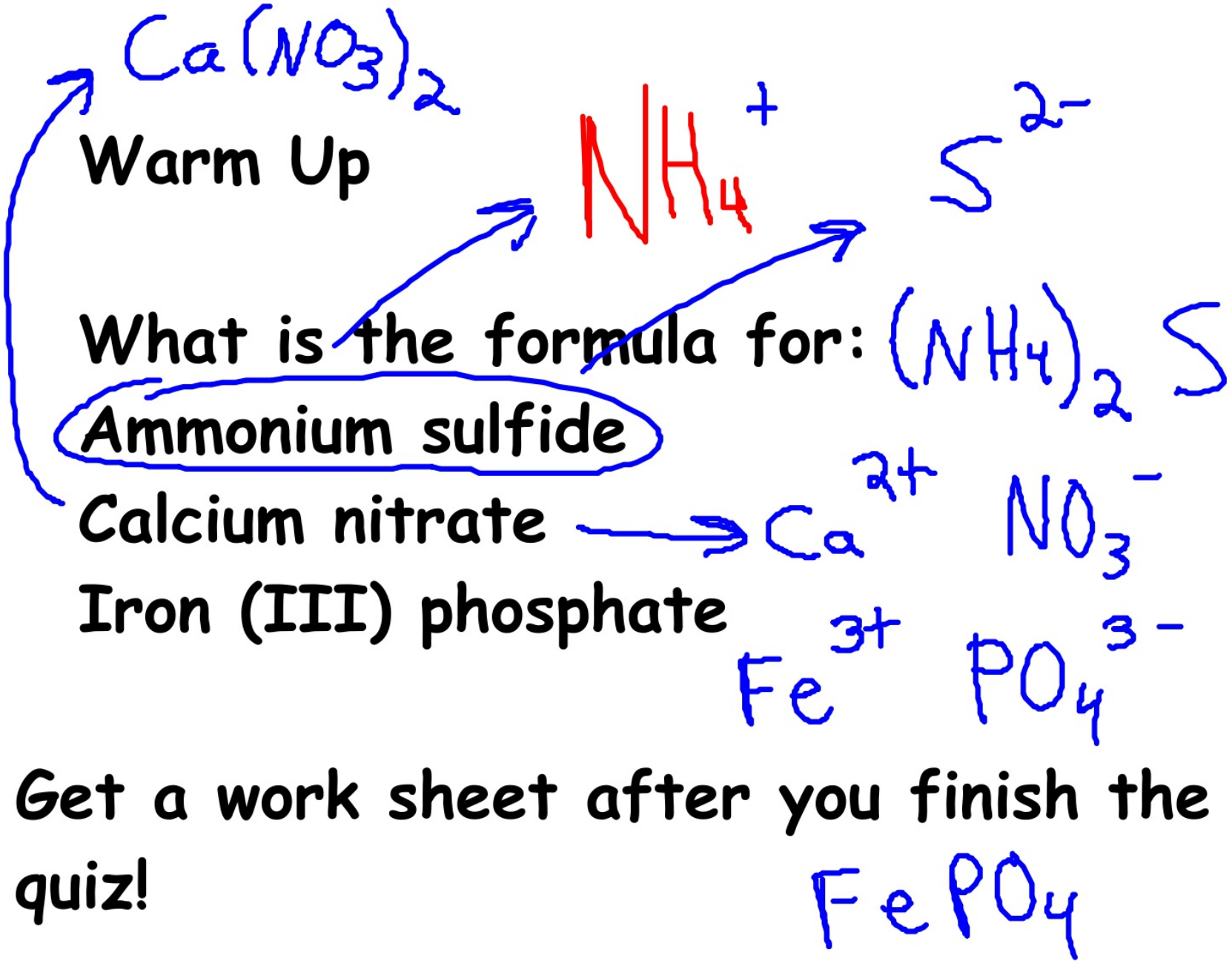
How many moles of bromine are in 7,888,112 molecules of bromine?

Get a calculator & your book


LOST AN ELECTRON?
ARE YOU POSITIVE?


ONCE, I TOLD A CHEMISTRY JOKE
THERE WAS NO REACTION
Memestache.com


WHAT DO YOU GET WHEN YOU CUT AN AVOCADO INTO 6X10^23 PIECES?
MILK
GUACAMOLE
memegenerator.net



Get a work sheet after you finish the quiz!

Mole Road Map: Where am I???

Want: atoms Given: mol

1. How many atoms are in 4.56 mol Fe?

$4.56\ \text{mol} \times \frac{6.02 \times 10^{23}\ \text{atoms}}{1.00\ \text{mol}} =$

2. How many grams are in 7.68 mol CH_4?

C = 12
H = 1 x 4 / 16

$7.68\ \text{mol} \times \frac{\text{MM}}{1.00\ \text{mol}} =$ MM → 16

3. How many moles would 4.56×10^{54} molecules Cl_2 be?

$4.56 \times 10^{54}\ \text{molecules} \times \frac{1.00\ \text{mol}}{6.02 \times 10^{23}\ \text{molecules}} =$

4. How many moles is 5.67 g Br_2?

$5.67\ \text{g}\ Br_2 \times \frac{1.00\ \text{mol}}{159.8\ \text{g}\ Br_2} =$

2.50 moles $Fe(OH)_2$ to grams

$$2.50 \text{ moles } Fe(OH)_2 \times \frac{89.8 \text{ g}}{1.00 \text{ mole}} =$$

225 g

Fe = 55.8 =

O = 16 x 2 = 32

H = 1.0 x 2 = 2

$15.0\,g\ N_2O_3 \rightarrow$ moles

$$15.0\,g \times \frac{1.00\,mol}{76.0\,g} = \frac{15.0}{76.0} =$$

$N_2 = 14 \times 2 = 28$

$O = 16 \times 3 = 48$

76

$0.197\,mol$

How many atoms of tin are in 3.70 mol?

$$3.70 \text{ mol} \times \frac{6.02 \times 10^{23} \text{ atoms}}{1.00 \text{ mol}} =$$

The Mole-Mass Relationship

How do you convert the mass of a substance to the number of moles of the substance?

Use the molar mass of an element or compound to convert between the mass of a substance and the moles of a substance.

$$\text{mass (grams)} = \text{number of moles} \times \frac{\text{mass (grams)}}{1 \text{ mole}}$$

$$\text{moles} = \text{mass (grams)} \times \frac{1 \text{ mole}}{\text{mass (grams)}}$$

What is the molar mass of H_2O?

What is the molar mass of carbon tetrachloride?

What is the molar mass of sulfur hexafluoride?

Converting Moles to Mass

The aluminum satellite dishes in Figure 10.8 are resistant to corrosion because the aluminum reacts with oxygen in the air to form a coating of aluminum oxide (Al_2O_3). This tough, resistant coating prevents any further corrosion. What is the mass of 9.45 mol of aluminum oxide?

Analyze ***List the known and the unknown.***

Known

- number of moles = 9.45 mol Al_2O_3

Unknown

- mass = ? g Al_2O_3

The mass of the compound is calculated from the known number of moles of the compound. The desired conversion is moles $\longrightarrow$ mass.

Calculate *Solve for the unknown.*

Determine the molar mass of Al_2O_3: 1 mol Al_2O_3 = 102.0 g Al_2O_3

Multiply the given number of moles by the conversion factor relating moles of Al_2O_3 to grams of Al_2O_3.

$$\text{mass} = 9.45 \cancel{\text{ mol } Al_2O_3} \times \frac{102.0 \text{ g } Al_2O_3}{1 \cancel{\text{ mol } Al_2O_3}}$$

$$= 964 \text{ g } Al_2O_3$$

Warm Up

What is the molar mass of $FeCl_2$?

Warm Up

Give the formulas for the following acids:

Sulfuric Acid

Hydrochloric Acid

Nitric Acid

Phosphoric Acid

Objective:

TSWBAT:
Describe the relationship between moles and mass and moles and volume

Find the mass, in grams, of 4.52×10^{-3} mol $C_{20}H_{42}$.

Warm Up:

How many moles are 67.3 g of hexane?

There is NO quiz this week. The test on Quiz #9 material is on Wednesday (late start)

When iron is exposed to air, it corrodes to form red-brown rust. Rust is iron(III) oxide (Fe_2O_3).How many moles of iron (III) oxide are contained in 92.2 g of pure Fe_2O_3?

Analyze *List the known and the unknown.*

Known

- mass = 92.2 g Fe_2O_3

Unknown

- number of moles = ? mol Fe_2O_3

The unknown number of moles of the compound is calculated from a known mass of a compound. The conversion is mass ⟶ moles.

Calculate *Solve for the unknown.*

Determine the molar mass of Fe_2O_3: 1 mol = 159.6 g Fe_2O_3

Multiply the given mass by the conversion factor relating mass of Fe_2O_3 to moles of Fe_2O_3.

$$\text{moles} = 92.2\ \text{g}\ \cancel{Fe_2O_3} \times \frac{1\ \text{mol}\ Fe_2O_3}{159.6\ \text{g}\ \cancel{Fe_2O_3}}$$

$$= 0.578\ \text{mol}\ Fe_2O_3$$

Find the number of moles in 3.70×10^{-1} g of boron.

Warm Up

What is the molar mass of sodium phosphate? How much would 0.37 mol of sodium phosphate weigh?

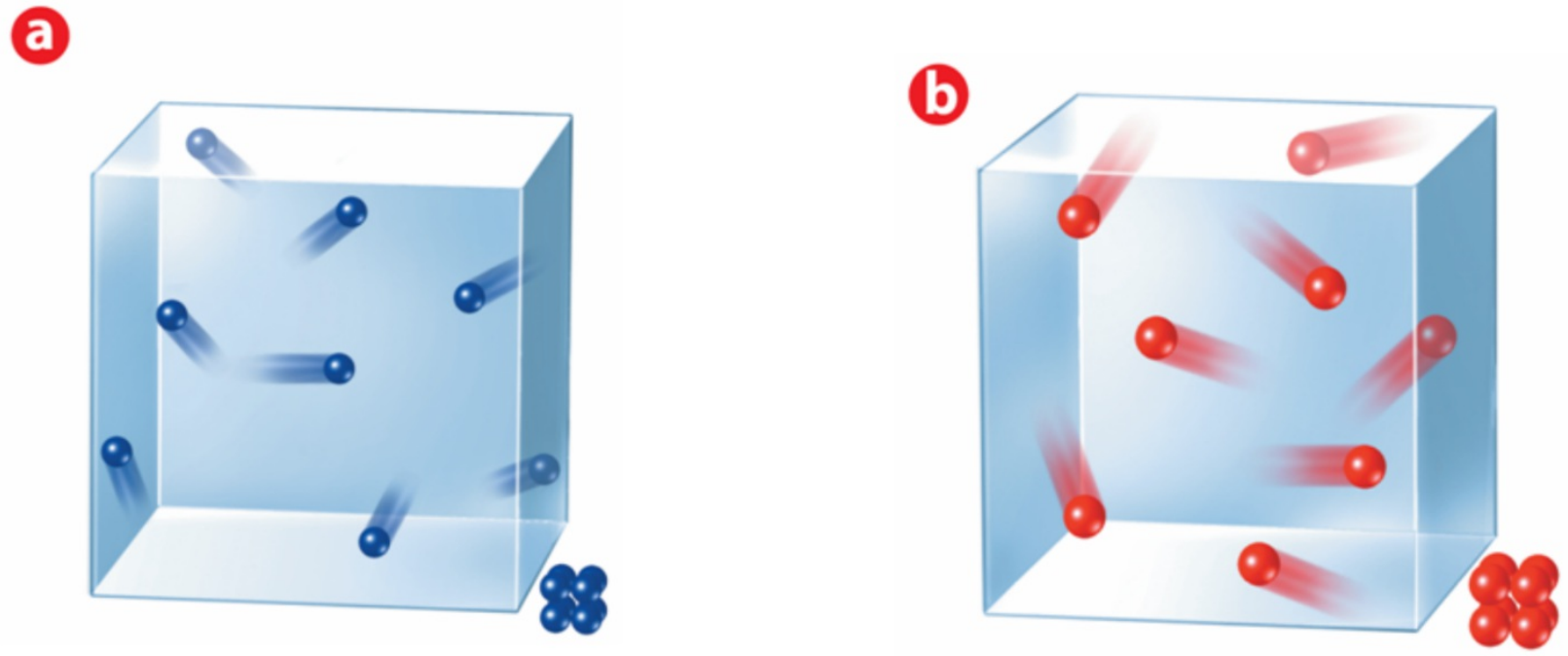
The Mole–Volume Relationship

What is the volume of a gas at STP?

The volume of a gas varies with temperature and pressure.
Because of these variations, the volume of a gas is usually measured at a standard temperature and pressure.

Standard temperature and pressure (STP) means a temperature of **0°C** and a pressure of 101.3 kPa, or **1 atmosphere (atm).**

Avogadro's hypothesis states that equal volumes of gases at the same temperature and pressure contain equal numbers of particles.



At STP, 1 mol (or 6.02×10^{23} representative particles) of any gas occupies a volume of 22.4 L.

The quantity 22.4 L is called the molar volume of a gas.

Calculating Volume at STP

$$\text{volume of gas} = \text{moles of gas} \times \frac{22.4\ \text{L}}{1\ \text{mol}}$$

Calculating the volume of a gas at STP

Sulfur dioxide (SO_2) is a gas produced by burning coal. It is an air pollutant and one of the causes of acid rain. Determine the volume, in liters, of 0.60 mol SO_2 at STP.

Analyze ***List the knowns and the unknown.***

Knowns

- moles = 0.60 mol SO_2
- 1 mol SO_2 = 22.4 L SO_2

Unknown

- volume = ? L SO_2

Use the relationship 1 mol SO_2 = 22.4 L SO_2 (at STP) to write the conversion factor needed to convert moles to volume.

The conversion factor is $\frac{22.4\ \text{L}\ SO_2}{1\ \text{mol}\ SO_2}$.

Calculate *Solve for the unknown.*

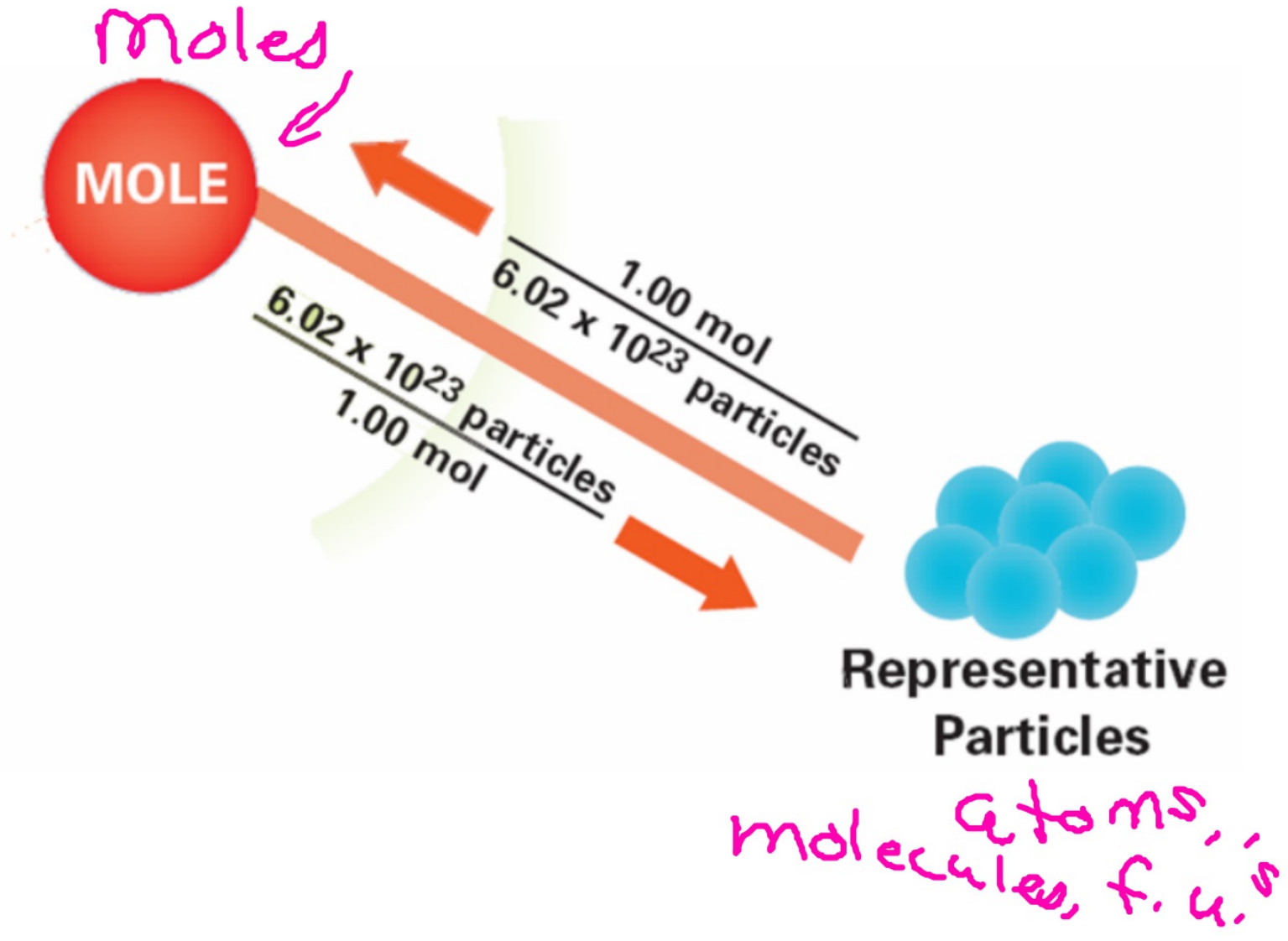
$$\text{volume} = 0.60\ \cancel{\text{mol SO}_2} \times \frac{22.4\ \text{L SO}_2}{1\ \cancel{\text{mol SO}_2}} = 13\ \text{L SO}_2$$

What is the volume of these gases at STP?

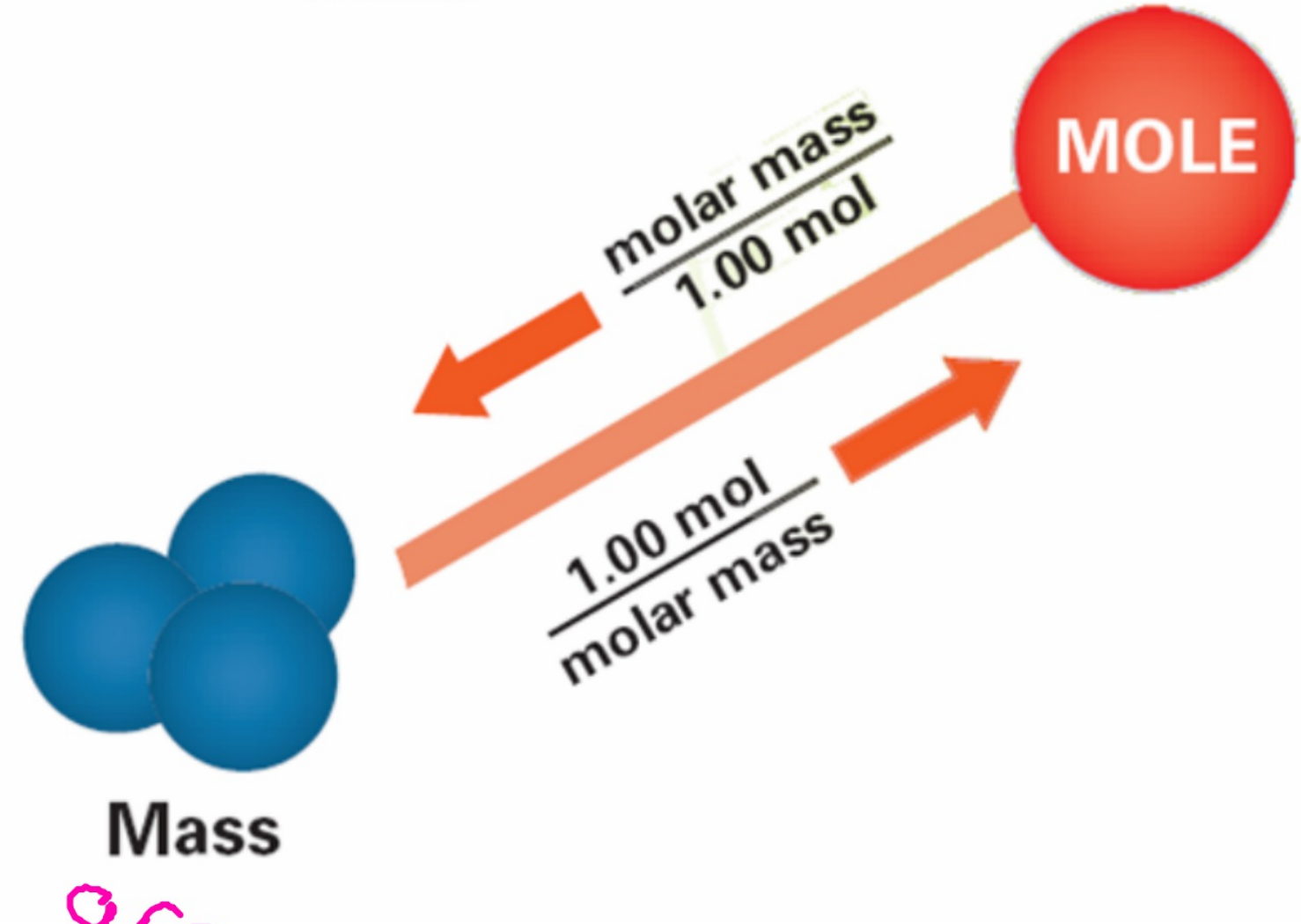
a. 3.20×10^{-3} mol CO_2

b. 3.70 mol N_2

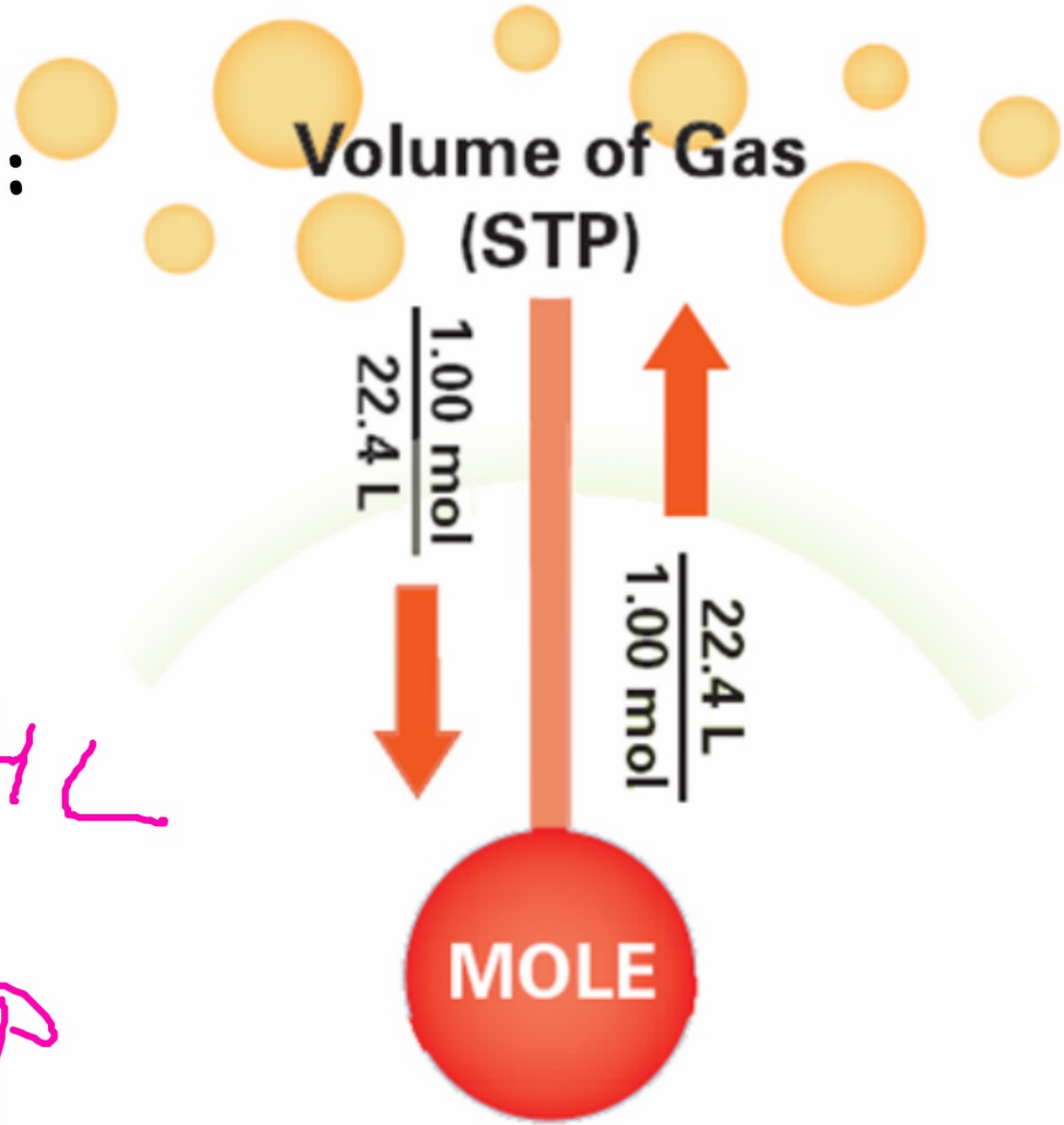
Counting:


Moles
MOLE
1.00 mol
6.02 x 10²³ particles
6.02 x 10²³ particles
1.00 mol
Representative Particles
atoms, ions
molecules, f. u.'s

Mass



Volume:



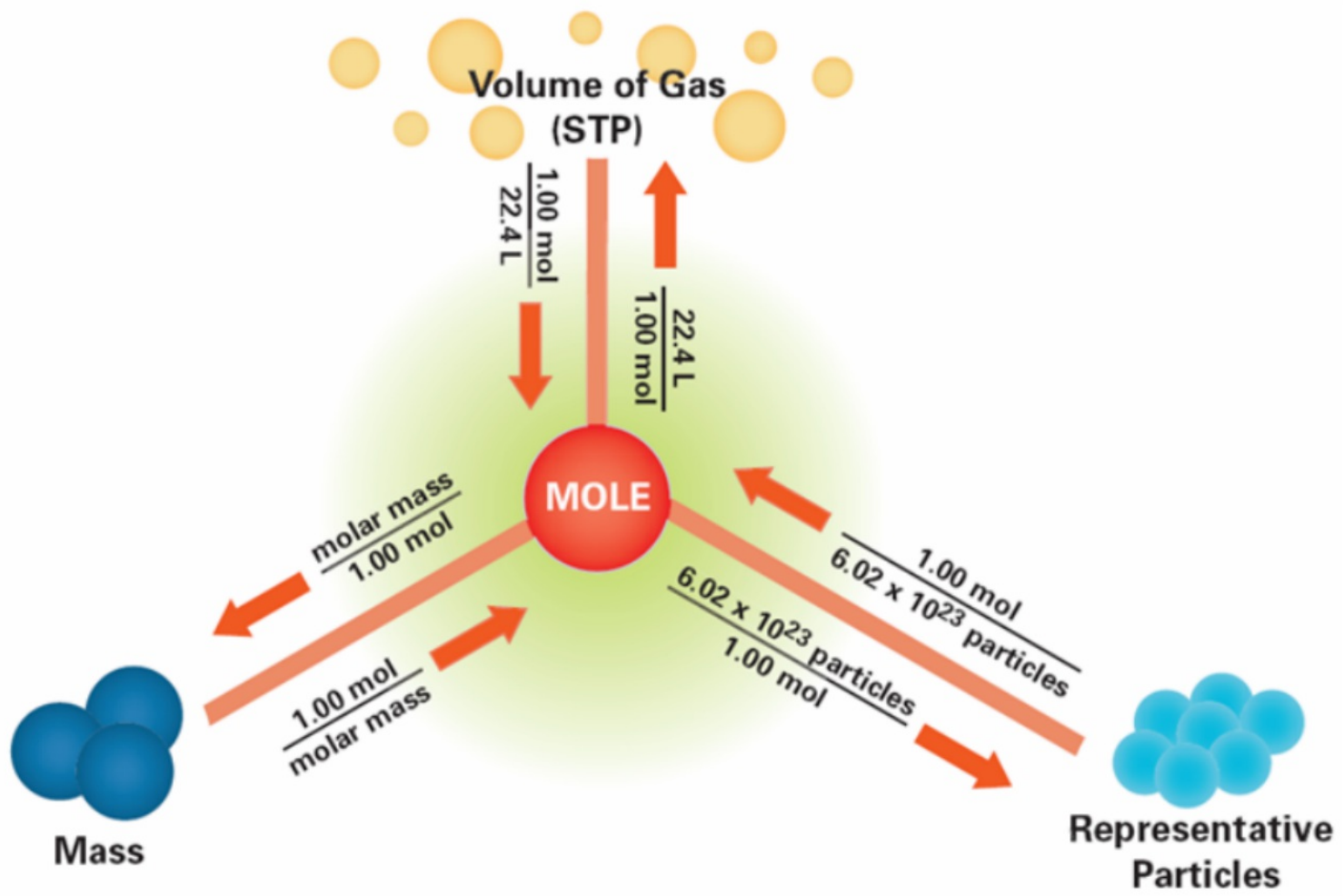
L

22.4 L

@

STP

The Mole Road Map



1. Calculate the number of moles in a spoonful of table sugar ($C_{12}H_{22}O_{11}$) having a mass of 10.5 g.

a. 32.6 mol
b. 3.59×10^{3} mol 
c. 3.07×10^{-2} mol
d. 1.85×10^{22} mol

2.What is the volume of 0.35 mol of oxygen gas at STP?

a.32 L
b.64 L
c.7.8 L
d.16 L

Practice Problems
(use the Mole Road Map!)

p. 298
#17

p. 299
#19

p. 301
#21

p. 303
#26-28

p. 315
#47-54, 58-60