Tuesday 1/7/20

"Isotopes" POGIL

p^+ + # n^0 = mass

p^+ − # e^- = charge on atom — ions

Isotope symbol for element X

mass # − atomic # = # of n^0

X: charge (if any)

# of protons - is solely responsible for chemical and physical characteristic of an atom. Different # of p^+ → different element

# of neutrons - neutrons exert the strong force on p^+ to keep nucleus from falling apart. different # of n^0 → different isotope

# of electrons - electrons are attracted to the p^+ in the nucleus, they tend to balance charge. excess or lack of e^- → ions

Carbon-12 → $^{12}_{6}C$

↑ element ↑ mass #

Boron-11 → $^{11}_{5}B$

Wed 1/8/20 H_2 O_2 HO ratio of O:H $\frac{16g}{2g}$ or $\frac{8}{1}$

Law of Definite proportions → H_2O is always $\frac{2g\ H}{18g\ H_2O}$

regardless of the amount of H_2O

Law of Multiple proportions

→ $\frac{32g\ O}{16g\ O} = 2$

CO → molar mass = 28g
$12g\ C$

CO_2 → molar mass = 44g
$12g\ C$

$3\ doz \times \frac{12\ donuts}{1\ doz} = 36\ donuts$

$3\ mol \times \frac{6.02 \times 10^{23}\ donuts}{1\ mol} = 18.06 \times 10^{23}\ donuts$

Dalton's Atomic Theory

1. All matter is composed of atoms.
2. All atoms of a particular element are identical to all other atoms of that element. isotopes n^0
3. Atoms can never be subdivided, created, or destroyed. p^+, e^-, n^0
4. Atoms combine in simple, whole-number ratios to form compounds.
5. Chemical reactions occur when atoms are combined, separated and or rearranged.

elemental symbol	atomic #	# of p^+	# n^0	# e^-	mass #	isotope symbol	ion? (Y/N) ± charge
K	19	19	21	18	40	$^{40}_{19}K^+$	Y (+1)
H	1	1	2	1	3	$^{3}_{1}H$	N (0)
Cl	17	17	18	18	35	$^{35}_{17}Cl^-$	Y (-1)
U	92	92	143	92	235	$^{235}_{92}U$	n
N_2	11	11	12	10	23	$^{23}_{11}N_2^+$	Y (+1)

$$\%\text{error} = \left| \frac{\text{experimental value} - \text{known value}}{\text{known value}} \right| \times 100\%$$

Metal A	Metal B	Metal C	H_2O
2.70 g/mL	11.3 g/mL	7.30 g/mL	1.00 g/mL

H_2O

$1 mol = 6.02 \times 10^{23}$ particles

1 mol H = 1.0 g
1 mol O = 16.0 g
} from per. table

H_2O

$(2 \times H) = 2.0 g$

$1 \times O = 16.0 g$

$18.0 g/mol$

retro H:H_2O $\frac{2.0 g}{18.0 g}$

retro H:O $\frac{2.0 g}{16.0 g} = \frac{1}{8}$

KO K_2O K_4O

O 1.00 g

K 1.22 g

K 2.44 g

K 4.89 g

retro K:O

1.22 → $\frac{2.44}{1.22} = 2$

2.44 → $\frac{4.89}{2.44} \approx 2$

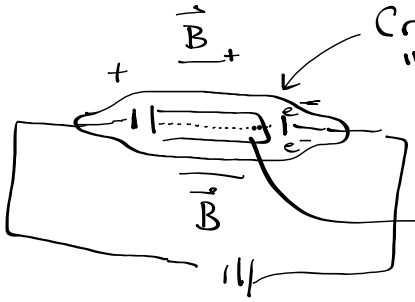
4.89

$\frac{4.89}{1.22} = 4$

Thursday 1/9/20

Discovery of the electron (e^-) 1897

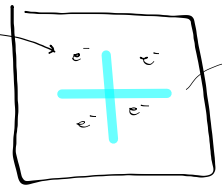
J. J. Thomson



Crooke's tube
"Cathode ray tube"

electron beam deflects in a magnetic field.

Atomic model after Thomson → the "plum-pudding" model

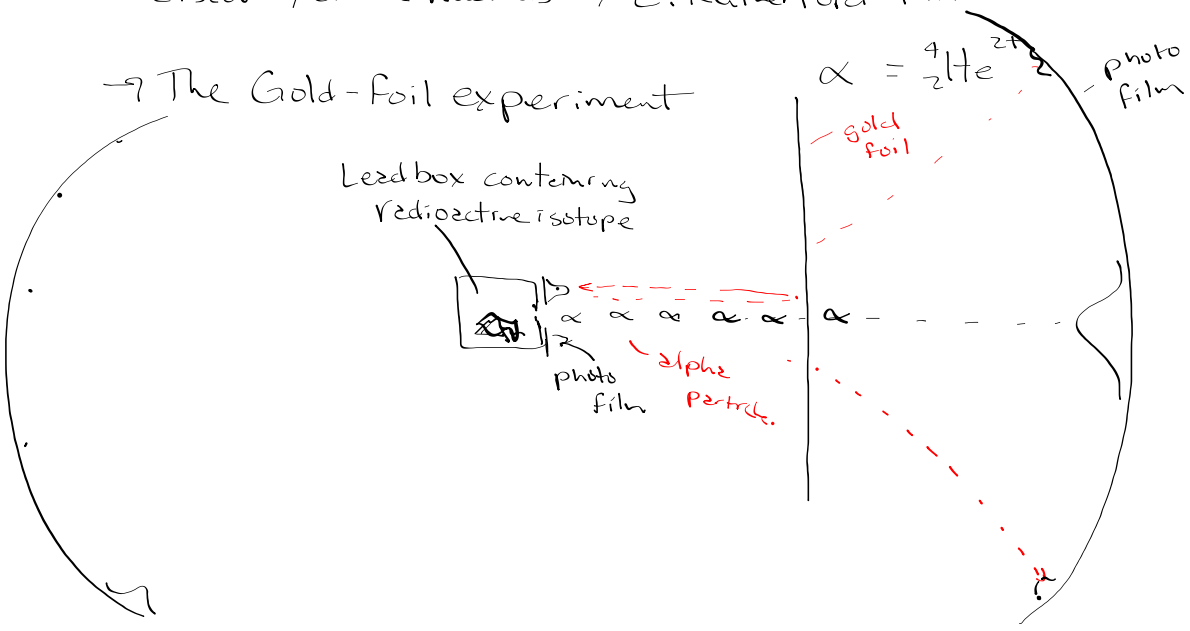


electrons are the "plums"

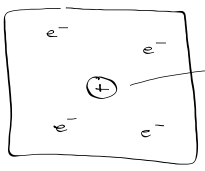
positive charged field.

The discovery of the nucleus → E. Rutherford 1911

→ The Gold-foil experiment

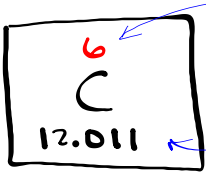


Conclusion:



nucleus –
- contains all of the + charge and most of the mass of the atom

Calculating average atomic mass



atomic # (# of protons in the nuc)

average atomic mass

Bb - bowling-ball onium

relative abundance

Bb-16 80% are Bb-16

Bb-10 20% are Bb-10

$$\frac{16+16+16+16+16+16+16+16+10+10}{10} = \text{AVG}$$

$$\frac{(8 \times 16)}{10} + \frac{(2 \times 10)}{10} =$$

$$\left(\frac{8}{10} \times 16\right) + \left(\frac{2}{10} \times 10\right) =$$

$$(0.80 \times 16) + (0.20 \times 10) = 14.8\#$$

Copper has two isotopes Cu-63 & Cu-65

The masses and rel. abd. for these are as follows

	rel. abd.	measured mass (u) — or amu = the mass of p⁺/n°
Cu-63	69.15%	62.929601
Cu-65	30.85%	64.927794

Calculate the average atomic mass of Copper.

$(0.6915 \times 62.929601u) + (0.3085 \times 64.927794u) = 63.55\ u$ or amu

Molar-mass - the mass of one mole of a substance

→ "substance" = element or compound

$2H_2 + O_2 \rightarrow 2H_2O$

$2.0\,g\,H_2 + 32.0\,g\,O_2 \rightarrow 36.0\,g\,H_2O$

How many molecules are there in $1.50\,g\,H_2O$?

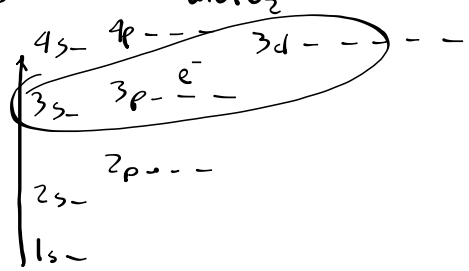
$$1.50\,g\,H_2O \times \frac{1\ mol\,H_2O}{18.0\,g\,H_2O} \times \frac{6.02\times10^{23}\ molecules\,H_2O}{1\ mol\,H_2O} =$$

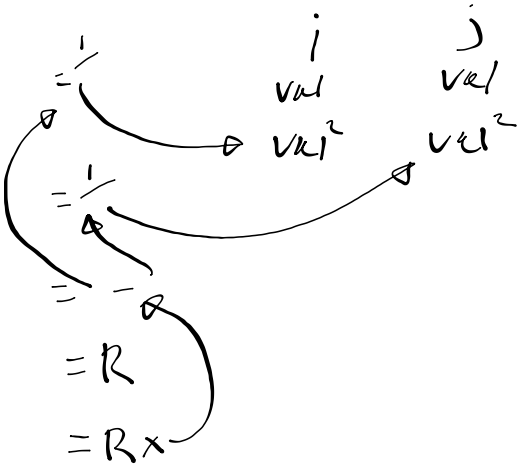
What is the mass of 3.45×10^{22} molecules of O_2?

$$3.45\times10^{22}\ molec._{O_2} \times \frac{1\ mol\,O_2}{6.02\times10^{23}\ molecules\ O_2} \times \frac{32.0\ g\,O_2}{1\ mol\,O_2} =$$

To the tune of "Take on me"

Take-home test
(Take-home test)
Cry on break
(Take-home test)
Turn it in -
in a day or TWO





Friday 1/10/20

From the hmk #18, 19 p. 92

18) How many moles of atoms are there in...

a) 6.022×10^{23} atoms Ne $\times \frac{1 \text{ mol Ne}}{6.022\times10^{23} \text{ atoms Ne}} = 1.000 \text{ mol Ne}$

b) 3.011×10^{23} atoms Mg $\times \frac{1 \text{ mol Mg}}{6.022\times10^{23} \text{ atoms Mg}} = 0.5000 \text{ mol Mg}$

c) 3.25×10^{5} g Pb $\times \frac{1 \text{ mol Pb}}{207.2 \text{ g Pb}} = 1568.53$

1570 mol Pb

1.57×10^{3} mol Pb

d) 4.50×10^{-12} g O $\times \frac{1 \text{ mol O}}{16.0 \text{ g O}} = 2.81\times10^{-13}$ mol O

19)

	rel. abd.	mass mass (u)
Ar - 36	0.337%	35.97
Ar - 38	0.063%	37.96
Ar - 40	99.600%	39.96

The answer will be approximately

a) 36 u

b) 38 u

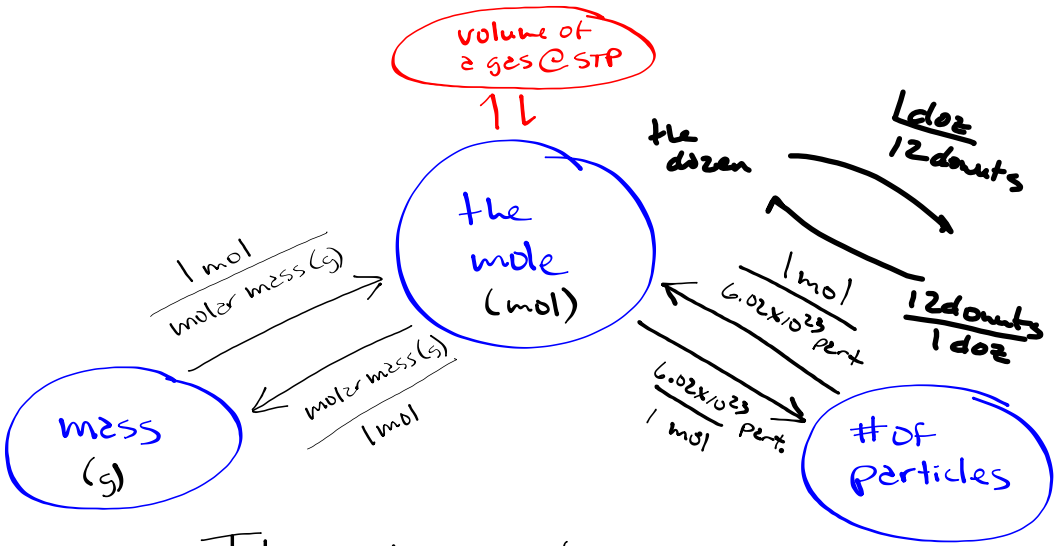
c) 39.96 u

d) cannot be determined

(0.00337 x 35.97u) + (0.00063 x 37.96u) + (0.99600 x 39.96u)

0.121u + 0.024u + 39.80 = 39.945

39.95 u



The molar road map

How many molecules are there in . . . .

a) 5.5 moles of H_2O mol → molecules

$$5.5\ \text{mol}\ H_2O \times \frac{6.02\times10^{23}\ \text{molecules}\ H_2O}{1\ \text{mol}\ H_2O} = 3.3\times10^{24}\ \text{molec.}\ H_2O$$

3300000000000000000000000 molec. H_2O

b) 3.65 g CO_2 mass → mol → part

$$3.65\ \text{g}\ CO_2 \times \frac{1\ \text{mol}\ CO_2}{44.0\ \text{g}\ CO_2} \times \frac{6.02\times10^{23}\ \text{molec.}\ CO_2}{1\ \text{mol}\ CO_2} = 4.99\times10^{22}\ \text{molecules}\ CO_2$$

c) 10.5 g N_2O g → mol → molec

$$10.5\ \text{g}\ N_2O \times \frac{1\ \text{mol}\ N_2O}{44.0\ \text{g}\ N_2O} \times \frac{6.02\times10^{23}\ \text{molecules}\ N_2O}{1\ \text{mol}\ N_2O} = 1.44\times10^{23}\ \text{molecules}\ N_2O$$

Mon 1/13/20

21) How many atoms are there in...

a) $1.50\ \text{mol}\ N_2 \times \frac{6.02\times10^{23}\ \text{atoms}\ N_2}{1\ \text{mol}\ N_2} = 9.03\times10^{23}\ \text{atoms}\ N_2$

c) $7.02\ \text{g}\ Si \times \frac{1\ \text{mol}\ Si}{28.1\ \text{g}\ Si} \times \frac{6.02\times10^{23}\ \text{atoms}\ Si}{1\ \text{mol}\ Si} = 1.50\times10^{23}\ \text{atoms}\ Si$

22) How many grams in ... ?

atoms → mol → g

a) $3.011\times10^{23}\ \text{atoms}\ F \times \frac{1\ \text{mol}\ F}{6.022\times10^{23}\ \text{atoms}\ F} \times \frac{19.0\ \text{g}\ F}{1\ \text{mol}\ F} = 9.500\ \text{g}\ F$

c) $4.50\times10^{12}\ \text{atoms}\ Cl \times \frac{1\ \text{mol}\ Cl}{6.022\times10^{23}\ \text{atoms}\ Cl} \times \frac{35.5\ \text{g}\ Cl}{1\ \text{mol}\ Cl} = 2.65\times10^{-10}\ \text{g}\ Cl$

e) $25\ \text{atoms}\ W \times \frac{1\ \text{mol}\ W}{6.022\times10^{23}\ \text{atoms}\ W} \times \frac{183.8\ \text{g}\ W}{1\ \text{mol}\ W} = 7.63\times10^{-21}\ \text{g}\ W$

23) Determine the # of atoms in ....

g B → mol → atoms B

a) $5.40\ \text{g}\ B \times \frac{1\ \text{mol}\ B}{10.8\ \text{g}\ B} \times \frac{6.02\times10^{23}\ \text{atoms}\ B}{1\ \text{mol}\ B} = 3.01\times10^{23}\ \text{atoms}\ B$

mol K → atom K

c) $0.0384\ \text{mol}\ K \times \frac{6.02\times10^{23}\ \text{atoms}\ K}{1\ \text{mol}\ K} = 2.31\times10^{22}\ \text{atoms}\ K$

e) $1.00\times10^{-10}\ \text{g}\ Au \times \frac{1\ \text{mol}\ Au}{197.0\ \text{g}\ Au} \times \frac{6.02\times10^{23}\ \text{atoms}}{1\ \text{mol}\ Au} = 3.06\times10^{11}\ \text{atoms}\ Au$

$$1\ \text{mol } CH_4 \times \frac{1\ \text{mol C}}{1\ \text{mol } CH_4} \times \frac{6.02\times10^{23}\ \text{atoms C}}{1\ \text{mol C}} =$$

$$\times \frac{4\ \text{mol H}}{1\ \text{mol } CH_4} \times \frac{6.02\times10^{23}\ \text{atoms H}}{1\ \text{mol H}} =$$

CH_4

Practice probs from TLDR #3

1) How many moles are there in ...

e) $C_6H_{12}O_6$ (5.00g)

for 1 molecule $(6 \times 12.0\,amu) + (12 \times 1.01\,amu) + (6 \times 16.0\,amu) = 180\,amu/molecule$

for 1 mol of molecules $(6 \times 12.0\,g) + (12 \times 1.01\,g) + (6 \times 16.0\,g) = 180\,g/mol$

$5.00\,g\,Gluc \times \frac{1\,mol\,Gluc}{180.\,g\,Gluc} =$

1) Calculate the # of mol in 5.00g of...

a) $5.00\,g\,O_2 \times \frac{1\,mol\,O_2}{32.0\,g\,O_2} = 0.156\,mol\,O_2$

e) $5.00\,g\,C_6H_{12}O_6 \times \frac{1\,mol\,C_6H_{12}O_6}{180.\,g\,C_6H_{12}O_6} = 0.0278\,mol\,C_6H_{12}O_6$

molar mass $C_6H_{12}O_6$

$C \times 6 = 72.0\,g\,C$

$H \times 12 = 12.0\,g\,H$

$O \times 6 = 96.0\,g\,O$

$180.\,g\,C_6H_{12}O_6$

$1\,mol\,C_6H_{12}O_6 = 180.\,g\,C_6H_{12}O_6$

2) Calculate the number of molecules in 5.00g of...

d) $CaCO_3$ $(40.1\,g) + (12.0) + (3 \times 16.0\,g) = 100.1\,g$

$5.00\,g\,CaCO_3 \times \frac{1\,mol\,CaCO_3}{100.1\,g\,CaCO_3} \times \frac{6.02 \times 10^{23}\,(F.U.)\,molec.\,CaCO_3}{1\,mol\,CaCO_3} = 3.01 \times 10^{22}\,molec.\,CaCO_3$

From CA 26 The mole concept

7.) a) How many mol are there in 100.0 g of ethanol? Et-OH

CH_3CH_2OH or C_2H_5OH or C_2H_6O

$(2 \times 12) + (6 \times 1.0) + (1 \times 16.0)$

C H O

$$100.0\text{ g Et-OH} \times \frac{1\text{ mol EtOH}}{46.0\text{ g Et-OH}} = 2.17\text{ mol ethanol}$$

b)

$$2.17\text{ mol EtOH} \times \frac{2\text{ mol C}}{1\text{ mol EtOH}} = 4.34\text{ mol C} \times \frac{12.0\text{ g C}}{1\text{ mol C}}$$

c)

$$2.17\text{ mol EtOH} \times \frac{6\text{ mol H}}{1\text{ mol EtOH}} = 13.0\text{ mol H} \times \frac{1.0\text{ g H}}{1\text{ mol H}}$$

$= 13.0\text{ g H}$

$$2.17\text{ mol EtOH} \times \frac{1\text{ mol O}}{1\text{ mol EtOH}} = 2.17\text{ mol O} \times \frac{16.0\text{ g O}}{1\text{ mol O}}$$

How many g of carbon are there in 100.0 g C_2H_6O?

$$100.0\text{ g } C_2H_6O \times \frac{1\text{ mol } C_2H_6O}{46.0\text{ g } C_2H_6O} \times \frac{2\text{ mol C}}{1\text{ mol } C_2H_6O} \times \frac{12.0\text{ g C}}{1\text{ mol C}} = 52.17\text{ g C}$$

$$1\text{ mol el} \times \frac{4\text{ mol legs}}{1\text{ mol el}} \times \frac{6.02 \times 10^{23}\text{ legs}}{1\text{ mol legs}} =$$

from TLDR #3

2b) Calculate the number of moles in 5.00g of...

$$5.00\text{g } H_2O_2 \times \frac{1 \text{ mol } H_2O_2}{34.0 \text{ g } H_2O_2} \times \frac{6.02\times10^{23} \text{ molecules } H_2O_2}{1 \text{ mol } H_2O_2} = 8.85\times10^{22} \frac{\text{molecules } H_2O_2}{}$$

$H_2O_2 \rightarrow (2 \times 1.0 \text{ g/mol})_{H} + (2 \text{ mol} \times \frac{16 \text{ g O}}{1 \text{ mol}})_{O}$ mass # / atomic # χ

3a) Calc. mass

$$3.75\times10^{22} \text{ molecules } H_2O \times \frac{1 \text{ mol } H_2O}{6.02\times10^{23} \text{ molecules } H_2O} \times \frac{18 \text{ g } H_2O}{1 \text{ mol } H_2O} = 1.12 \text{ g } H_2O$$

c) $0.375 \text{ mol } CO_2 \times \frac{44 \text{ g } CO_2}{1 \text{ mol } CO_2} =$

$$2.17 \text{ mol eth} \times \frac{2 \text{ mol C}}{1 \text{ mol eth}} \times \frac{12.0 \text{ g C}}{1 \text{ mol C}} =$$

$\rightarrow H \times \frac{6 \text{ mol H}}{1 \text{ mol eth}} \times \frac{1.0 \text{ g H}}{1 \text{ mol H}} =$

$\rightarrow O \times \frac{1 \text{ mol O}}{1 \text{ mol eth}} \times \frac{16.0 \text{ g O}}{1 \text{ mol O}} =$

How many atoms are there in..

1) $10.00\ g\ Ag \times \frac{1\ mol\ Ag}{107.9\ g\ Ag} \times \frac{6.02\times10^{23}\ atom\ Ag}{1\ mol\ Ag} =$

2) $7.00\ g\ P_2O_5 \times \frac{1\ mol\ P_2O_5}{142\ g\ P_2O_5} \times \frac{6.02\times10^{23}\ molec\ P_2O_5}{1\ mo P_2O_5} =$

What is the mass of...

molec → mol → g

1) 12.00 mol NaCl

$12.00\ mol\ NaCl \times \frac{58.5\ g\ NaCl}{1\ mol\ NaCl} =$

2) 3.45×10^{22} molecules H_2O

$3.45\times10^{22}\ molec.\ H_2O \times \frac{1\ mol}{6.02\times10^{23}\ molec\ H_2O} \times \frac{18\ g}{1\ mol} =$

Chem 1A

Homework for Friday

Read: 4.1

DO: 1-6 p.103