Finish 2.4 Stoichiometry

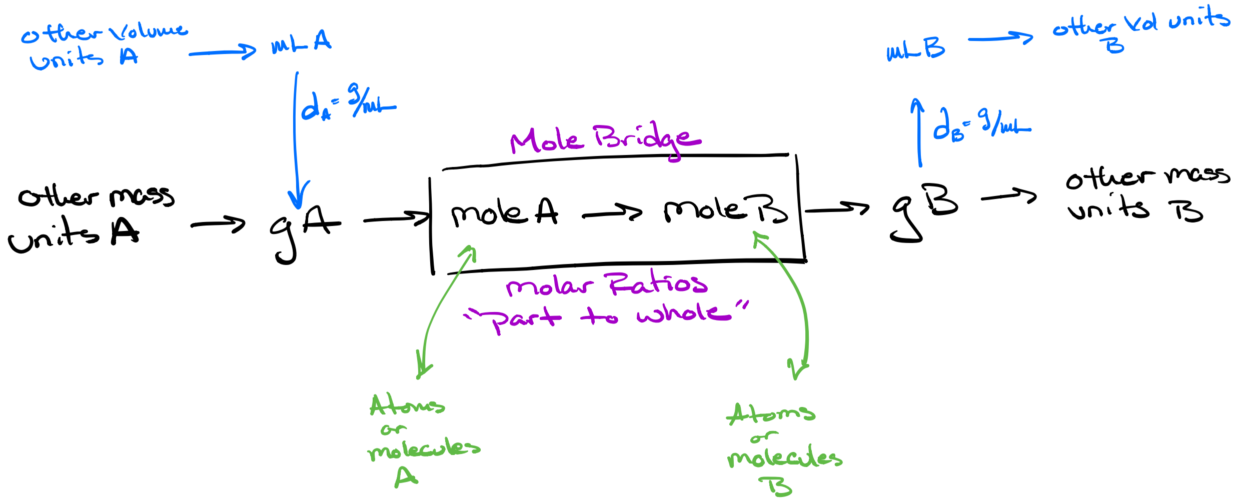
Pickup Ions from 2.3

move into Chapter 3 - Electronic Structure

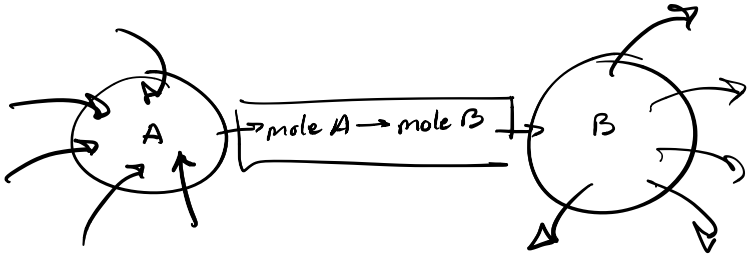
Next Week - Exam 1 Chapters 1 & 2

100 pt Exam

Stoichiometry Road Map

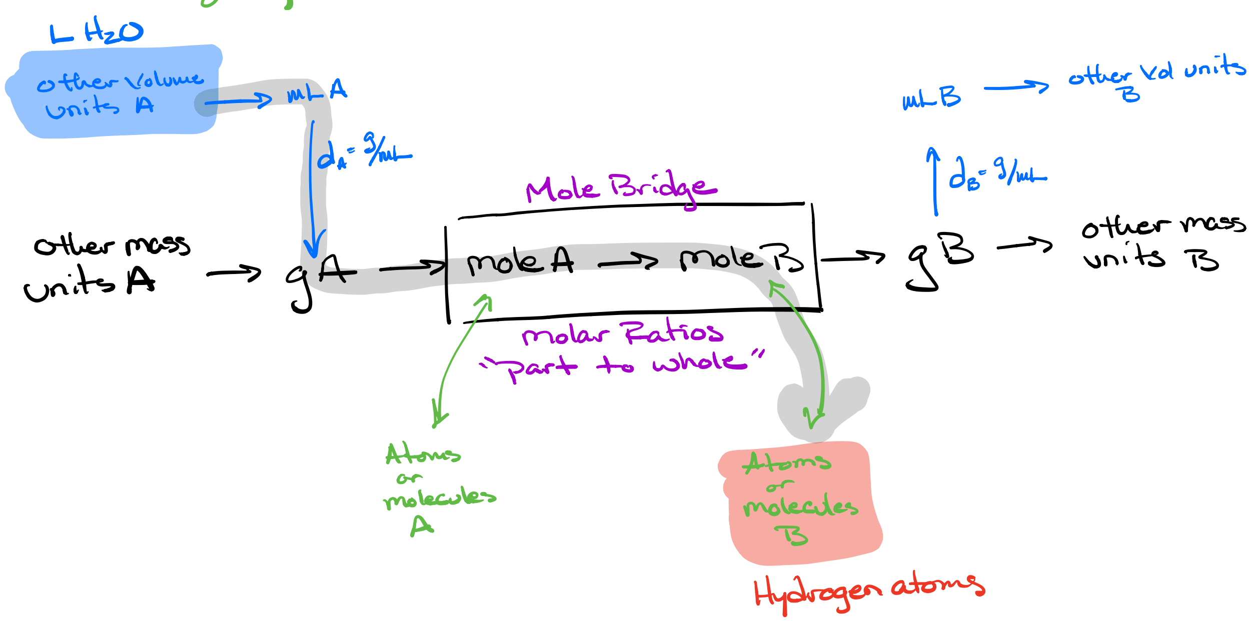


$$\text{Density} = \frac{\text{mass}}{\text{volume}} = g/mL$$



Example

Calculate the number of hydrogen atoms (desired) in a sample of water with a volume of 10.92 L (Given) if the density of the water is 0.997 g/mL (equality).



$$L\ H_2O \xrightarrow{1000\,mL = 1\,L} mL\ H_2O \xrightarrow{0.997\,g = 1\,mL} g\ H_2O \xrightarrow{\text{molar mass } H_2O \text{ PT}} mole\ H_2O \xrightarrow{\text{molar ratios}} mole\ H \xrightarrow{6.022\times10^{23}} atoms\ H$$

4 def 3 4 Counted 4

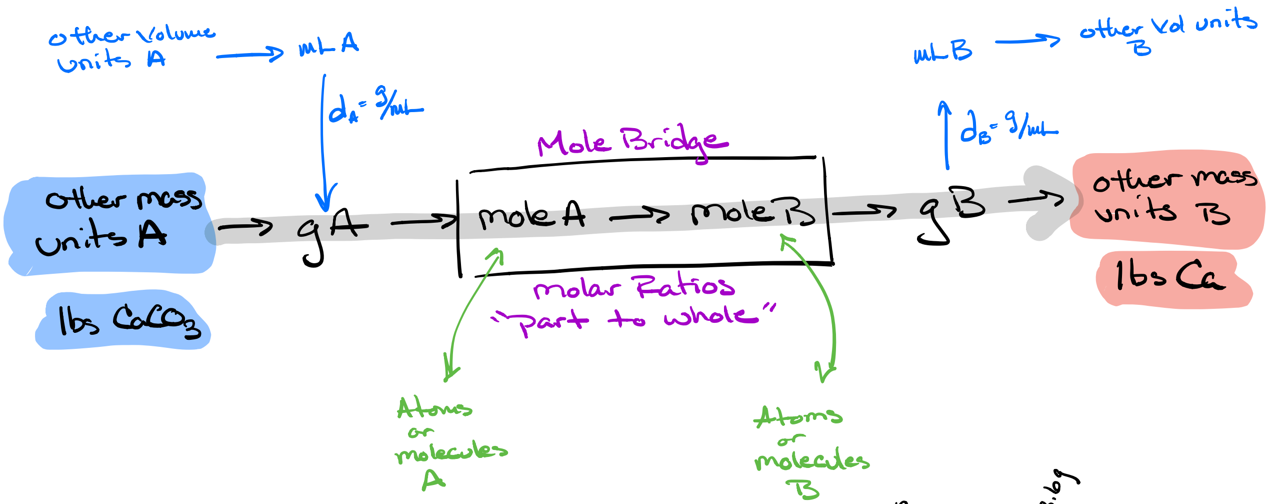
$$10.92\ \cancel{L\ H_2O} \times \frac{1000\ \cancel{mL\ H_2O}}{1\ \cancel{L\ H_2O}} \times \frac{0.997\ \cancel{g\ H_2O}}{1\ \cancel{mL\ H_2O}} \times \frac{1\ \cancel{mole\ H_2O}}{18.02\ \cancel{g\ H_2O}} \times \frac{2\ \cancel{mole\ H}}{1\ \cancel{mole\ H_2O}} \times \frac{6.022\times10^{23}\ atoms\ H}{1\ \cancel{mole\ H}} =$$

$$7.276688 \times 10^{26}\ atoms\ H$$

$$\boxed{7.28 \times 10^{26}\ atoms\ H}$$

Example

27.6 lbs of $CaCO_3$ (gypsum) contain how many lbs of Ca?



$$\text{lbs } CaCO_3 \xrightarrow{1\text{ lb} = 453.6\text{ g}} \text{g } CaCO_3 \xrightarrow{\text{molar mass } CaCO_3} \text{mole } CaCO_3 \xrightarrow{\text{molar Ratios}} \text{mole Ca} \xrightarrow{\text{molar mass Ca}} \text{g Ca} \xrightarrow{1\text{ lb} = 453.6\text{ g}} \text{lbs Ca}$$

① molar mass $CaCO_3$

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

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

$$3 \text{ mole O} \times \frac{16.00 \text{ g O}}{1 \text{ mole O}} = 48.00$$

$$100.09 \text{ g/mole } CaCO_3$$

③

$$27.6 \text{ lbs } CaCO_3 \times \frac{\overset{4}{453.6} \text{ g } CaCO_3}{1 \text{ lbs } CaCO_3} \times \frac{1 \text{ mole } CaCO_3}{\underset{5}{100.09} \text{ g } CaCO_3} \times \frac{\overset{\text{Count}}{1} \text{ mole Ca}}{1 \text{ mole } CaCO_3} \times \frac{\overset{4}{40.08} \text{ g Ca}}{1 \text{ mole Ca}} \times \frac{\overset{4}{1} \text{ lbs Ca}}{453.6 \text{ g Ca}} =$$

$27.6 \times \cancel{453.6} \times 40.08 \div 100.09 \div \cancel{453.6} = 11.052133$ lbs Ca

$\boxed{= 11.1 \text{ lbs Ca}}$

Chapter 2.3 Nuclide Symbols (Ions)

$p^+ + n^0$ mass # → X ← Charge = $p^+ + e^-$

p^+ atomic # → X

Ion - A charged particle that has a difference betwee the number of protons (p^+) and the electrons (e^-).

Ions

- **Cation** - has more protons (p^+) than electrons (e^-) resulting in positive Charge
- **Anion** - has more electrons (e^-) than protons (p^+) resulting in a negative Charge.

$${}^{23}_{11}Na \longrightarrow {}^{23}_{11}Na^{+} + e^{-}$$

Sodium atom

Same = neutral atom

p^{+} 11

n° $23-11=12$

e^{-} 11

Sodium ion

"Cation"

p^{+} 11

n° $23-11=12$

e^{-} 10 ← 1 less e^{-}

$${}^{24}_{12}Mg \longrightarrow {}^{24}_{12}Mg^{2+} + 2e^{-}$$

$p^{+} = 12$

$n^{\circ} = 12$

$e^{-} = 12$

$p^{+} = 12$

$n^{\circ} = 12$

$e^{-} = 10$

$${}^{16}_{8}O + 2e^{-} \longrightarrow {}^{16}_{8}O^{2-}$$

$p^{+} = 8$

$n^{\circ} = 16-8=8$

$e^{-} = 8$

"Anion"

$p^{+} = 8$

$n^{\circ} = 8$

$e^{-} = 10$

2 extra e^{-} making 2− charges

Examples

$^{35}_{17}Cl^{-}$ ← 1 more e^- than total p^+

$p^+ = 17$

$n^\circ = 35 - 17 = 18$

$e^- = 17 + 1 = 18$

$^{14}_{7}N^{3-}$ ← 3 more e^- than total p^+

$p^+ = 7$

$n^\circ = 7$

$e^- = 10$

$^{27}_{13}Al^{3+}$

$p^+ = 13$

$n^\circ = 14$

$e^- = 10$

$$\begin{array}{rl} 13^+ & p^+ \\ +\ 10^- & e^- \\ \hline 3^+ & \end{array}$$

$^{52}_{24}Cr^{6+}$

$p^+ = 24$

$n^\circ = 28$

$e^- = 18$

$$\begin{array}{rl} 24+ & p^+ \\ +\ 18^- & e^- \\ \hline +6 & \end{array}$$

$^{31}_{15}P$ ← no need to show $\varnothing$

Neutral atom

$P^+ = 15$

$n^\circ = 16$ equal

$e^- = 15$

$$\begin{array}{rl} 15^+ & P^+ \\ +\ 15^- & e^- \\ \hline \varnothing & \end{array}$$

1 1A	2 2A	3 3B	4 4B	5 5B	6 6B	7 7B	8 8B	9 8B	10 8B	11 1B	12 2B	13 3A	14 4A	15 5A	16 6A	17 7A	18 8A
1 H Hydrogen 1.008																	2 He Helium 4.003
3 Li Lithium 6.941	4 Be Beryllium 9.012											5 B Boron 10.81	6 C Carbon 12.01	7 N Nitrogen 14.01	8 O Oxygen 16.00	9 F Fluorine 19.00	10 Ne Neon 20.18
11 Na Sodium 22.99	12 Mg Magnesium 24.30											13 Al Aluminum 26.98	14 Si Silicon 28.09	15 P Phosphorus 30.97	16 S Sulfur 32.07	17 Cl Chlorine 35.45	18 Ar Argon 39.95
19 K Potassium 39.10	20 Ca Calcium 40.08	21 Sc Scandium 44.96	22 Ti Titanium 47.87	23 V Vanadium 50.94	24 Cr Chromium 52.00	25 Mn Manganese 54.94	26 Fe Iron 55.84	27 Co Cobalt 58.93	28 Ni Nickel 58.69	29 Cu Copper 63.55	30 Zn Zinc 65.41	31 Ga Gallium 69.72	32 Ge Germanium 72.64	33 As Arsenic 74.92	34 Se Selenium 78.96	35 Br Bromine 79.90	36 Kr Krypton 83.80
37 Rb Rubidium 85.47	38 Sr Strontium 87.62	39 Y Yttrium 88.91	40 Zr Zirconium 91.22	41 Nb Niobium 92.91	42 Mo Molybdenum 95.94	43 Tc Technetium (98)	44 Ru Ruthenium 101.1	45 Rh Rhodium 102.9	46 Pd Palladium 106.4	47 Ag Silver 107.9	48 Cd Cadmium 112.4	49 In Indium 114.8	50 Sn Tin 118.7	51 Sb Antimony 121.8	52 Te Tellurium 127.6	53 I Iodine 126.9	54 Xe Xenon 131.3
55 Cs Cesium 132.9	56 Ba Barium 137.3		72 Hf Hafnium 178.5	73 Ta Tantalum 180.9	74 W Tungsten 183.8	75 Re Rhenium 186.2	76 Os Osmium 190.2	77 Ir Iridium 192.2	78 Pt Platinum 195.1	79 Au Gold 197.0	80 Hg Mercury 200.6	81 Tl Thallium 204.4	82 Pb Lead 207.2	83 Bi Bismuth 209.0	84 Po Polonium (209)	85 At Astatine (210)	86 Rn Radon (222)
87 Fr Francium (223)	88 Ra Radium (226)		104 Rf Rutherfordium (261)	105 Db Dubnium (262)	106 Sg Seaborgium (266)	107 Bh Bohrium (264)	108 Hs Hassium (277)	109 Mt Meitnerium (268)	110 Ds Darmstadtium (281)	111 Rg Roentgenium (272)	112 Cn Copernicium (285)	113 Nh Nihonium (284)	114 Fl Flerovium (289)	115 Mc Moscovium (288)	116 Lv Livermorium (289)	117 Ts Tennessine	118 Og Oganesson

Lanthanides	57 La Lanthanum 138.9	58 Ce Cerium 140.1	59 Pr Praseodymium 140.9	60 Nd Neodymium 144.2	61 Pm Promethium (145)	62 Sm Samarium 150.4	63 Eu Europium 152.0	64 Gd Gadolinium 157.2	65 Tb Terbium 158.9	66 Dy Dysprosium 162.5	67 Ho Holmium 164.9	68 Er Erbium 167.3	69 Tm Thulium 168.9	70 Yb Ytterbium 173.0	71 Lu Lutetium 175.0
Actinides	89 Ac Actinium (227)	90 Th Thorium 232.0	91 Pa Protactinium 231.0	92 U Uranium 238.0	93 Np Neptunium (237)	94 Pu Plutonium (244)	95 Am Americium (243)	96 Cm Curium (247)	97 Bk Berkelium (247)	98 Cf Californium (251)	99 Es Einsteinium (252)	100 Fm Fermium (257)	101 Md Mendelevium (258)	102 No Nobelium (259)	103 Lr Lawrencium (262)

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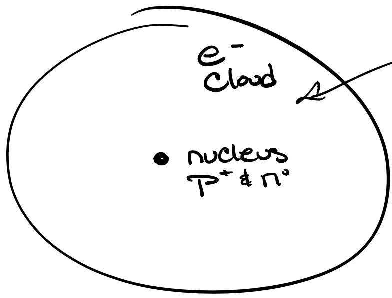
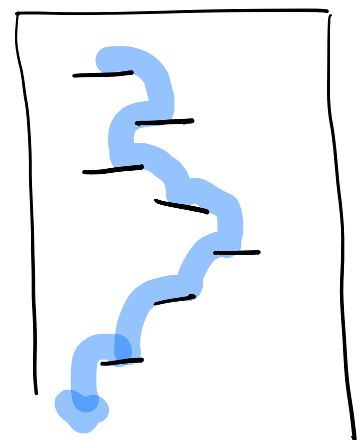
Values rounded to four significant figures

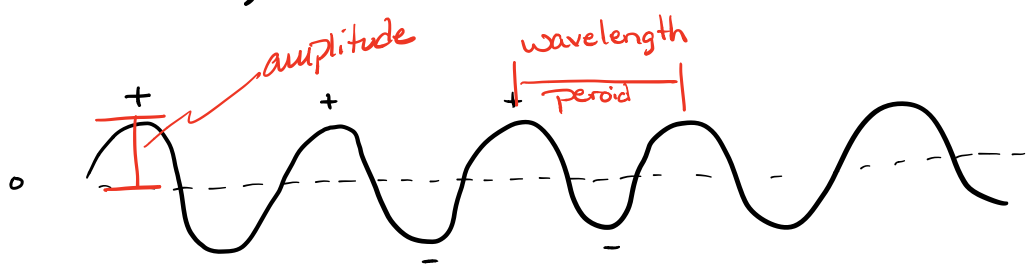
Chapter 3 - Electronic Configurations



structure to the e⁻



Electromagnetic radiation



Energy is proportional to the period
the smaller the period the higher the energy

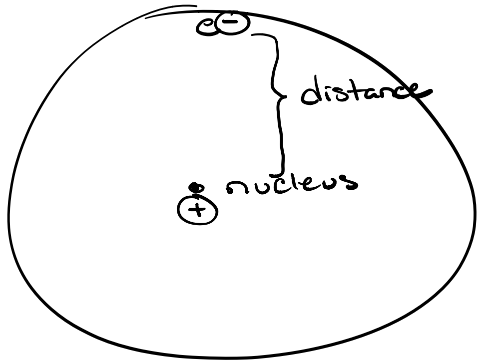
High energy

Electromagnetic Spectrum

Low energy

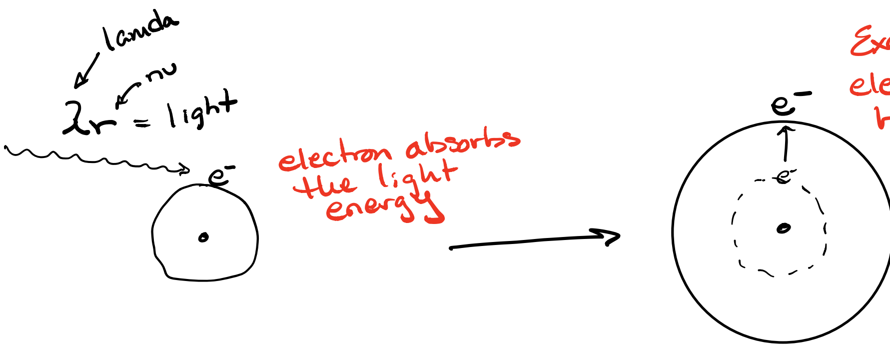
X-rays   ultra violet   Visible   InfraRed   Radiowaves

Small = high energy → 450 nm   750 nm

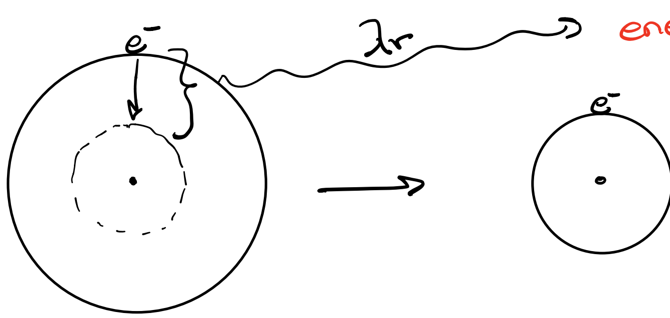


farther the e^- from the nucleus the more energy it has

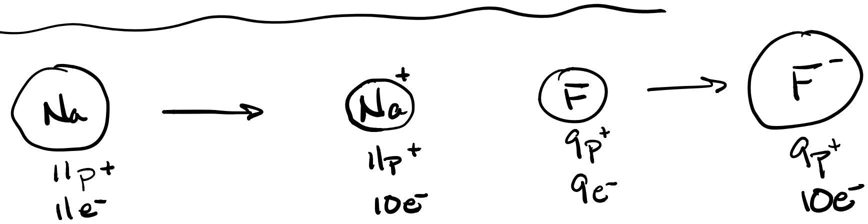
The distance from the nucleas determins the potential energy of the e^-



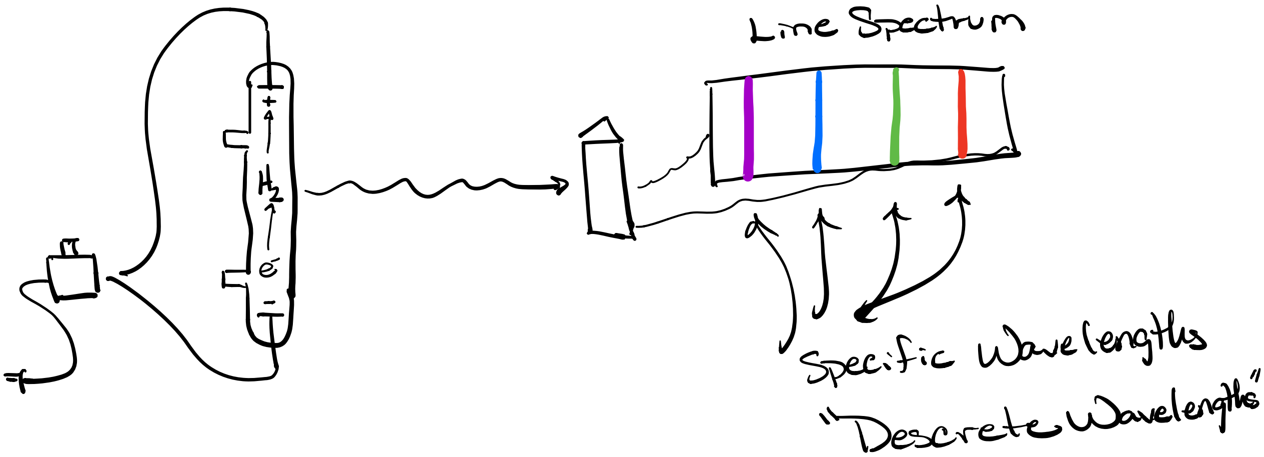
Excited e^-
electron has higher Potential energy

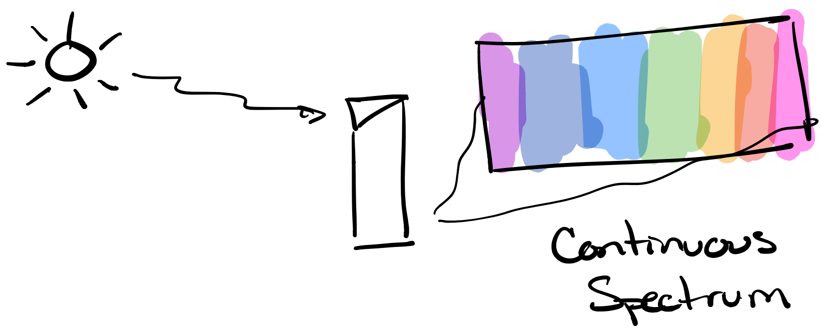


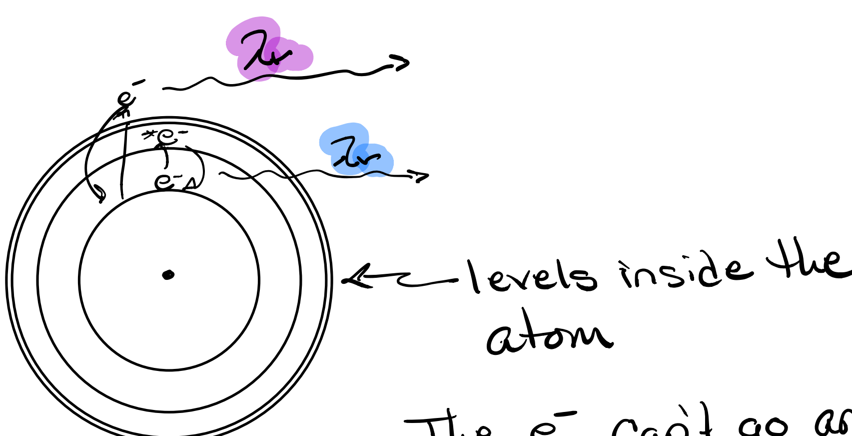
energy released is equal to the distance the e^- traveled



Gas Discharge Tube







The e^- can't go anywhere
it has Specific levels
= Structure