

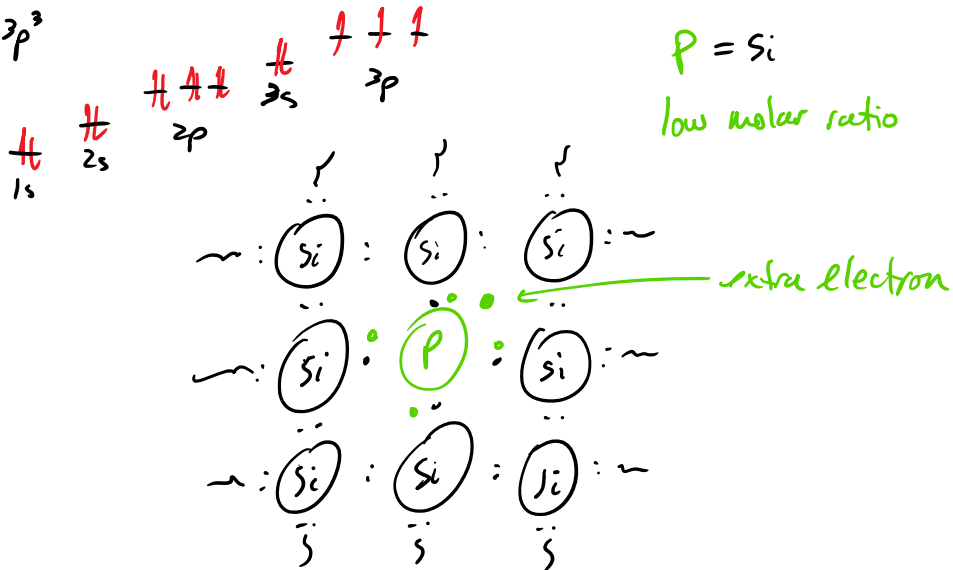
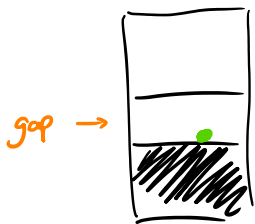
Dopants (Extrinsic) - to the semiconductors

n-type - more electrons

P - phosphorous
[Ne] 3s² 3p³

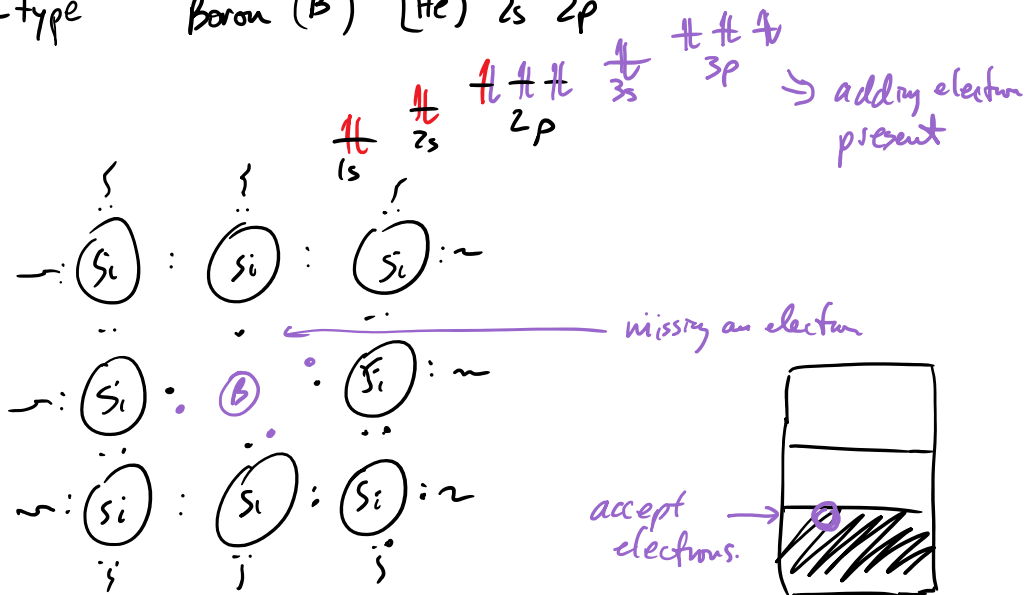


Si
↓
0.2-0.5 mm
↓
Q?
found?



p-type

Boron (B) [He] 2s² 2p¹



November 8, 2024 2:00 PM

1

H

Hydrogen

Atomic Number

Symbol

Name

Electron Configuration

1

H

Hydrogen

1s¹

PubCchem

3 Li Lithium [He]2s ¹		4 Be Beryllium [He]2s ²																		5 B Boron [He]2s ² 2p ¹	6 C Carbon [He]2s ² 2p ²	7 N Nitrogen [He]2s ² 2p ³	8 O Oxygen [He]2s ² 2p ⁴	9 F Fluorine [He]2s ² 2p ⁵	10 Ne Neon [He]2s ² 2p ⁶
11 Na Sodium [Ne]3s ¹		12 Mg Magnesium [Ne]3s ²																		13 Al Aluminum [Ne]3s ² 3p ¹	14 Si Silicon [Ne]3s ² 3p ²	15 P Phosphorus [Ne]3s ² 3p ³	16 S Sulfur [Ne]3s ² 3p ⁴	17 Cl Chlorine [Ne]3s ² 3p ⁵	18 Ar Argon [Ne]3s ² 3p ⁶
19 K Potassium [Ar]4s ¹	20 Ca Calcium [Ar]4s ²	21 Sc Scandium [Ar]4s ¹ 3d ¹	22 Ti Titanium [Ar]4s ² 3d ²	23 V Vanadium [Ar]4s ² 3d ³	24 Cr Chromium [Ar]4s ¹ 3d ⁵	25 Mn Manganese [Ar]4s ² 3d ⁵	26 Fe Iron [Ar]4s ² 3d ⁶	27 Co Cobalt [Ar]4s ² 3d ⁷	28 Ni Nickel [Ar]4s ² 3d ⁸	29 Cu Copper [Ar]4s ¹ 3d ¹⁰	30 Zn Zinc [Ar]4s ² 3d ¹⁰	31 Ga Gallium [Ar]4s ² 3d ¹⁰ 4p ¹	32 Ge Germanium [Ar]4s ² 3d ¹⁰ 4p ²	33 As Arsenic [Ar]4s ² 3d ¹⁰ 4p ³	34 Se Selenium [Ar]4s ² 3d ¹⁰ 4p ⁴	35 Br Bromine [Ar]4s ² 3d ¹⁰ 4p ⁵	36 Kr Krypton [Ar]4s ² 3d ¹⁰ 4p ⁶								
37 Rb Rubidium [Kr]5s ¹	38 Sr Strontium [Kr]5s ²	39 Y Yttrium [Kr]5s ¹ 4d ¹	40 Zr Zirconium [Kr]5s ² 4d ²	41 Nb Niobium [Kr]5s ¹ 4d ⁴	42 Mo Molybdenum [Kr]5s ¹ 4d ⁵	43 Tc Technetium [Kr]5s ² 4d ⁵	44 Ru Ruthenium [Kr]5s ¹ 4d ⁷	45 Rh Rhodium [Kr]5s ¹ 4d ⁸	46 Pd Palladium [Kr]5s ⁰ 4d ¹⁰	47 Ag Silver [Kr]5s ¹ 4d ¹⁰	48 Cd Cadmium [Kr]5s ² 4d ¹⁰	49 In Indium [Kr]5s ² 4d ¹⁰ 5p ¹	50 Sn Tin [Kr]5s ² 4d ¹⁰ 5p ²	51 Sb Antimony [Kr]5s ² 4d ¹⁰ 5p ³	52 Te Tellurium [Kr]5s ² 4d ¹⁰ 5p ⁴	53 I Iodine [Kr]5s ² 4d ¹⁰ 5p ⁵	54 Xe Xenon [Kr]5s ² 4d ¹⁰ 5p ⁶								
55 Cs Cesium [Xe]6s ¹	56 Ba Barium [Xe]6s ²	* 57 La Lanthanum [Xe]6s ¹ 4f ¹ 5d ⁰	72 Hf Hafnium [Xe]6s ² 4f ¹⁴ 5d ²	73 Ta Tantalum [Xe]6s ² 4f ¹⁴ 5d ³	74 W Tungsten [Xe]6s ² 4f ¹⁴ 5d ⁴	75 Re Rhenium [Xe]6s ¹ 4f ¹⁴ 5d ⁵	76 Os Osmium [Xe]6s ² 4f ¹⁴ 5d ⁶	77 Ir Iridium [Xe]6s ² 4f ¹⁴ 5d ⁷	78 Pt Platinum [Xe]6s ¹ 4f ¹⁴ 5d ⁹	79 Au Gold [Xe]6s ¹ 4f ¹⁴ 5d ¹⁰	80 Hg Mercury [Xe]6s ² 4f ¹⁴ 5d ¹⁰	81 Tl Thallium [Xe]6s ² 4f ¹⁴ 5d ¹⁰ 6p ¹	82 Pb Lead [Xe]6s ² 4f ¹⁴ 5d ¹⁰ 6p ²	83 Bi Bismuth [Xe]6s ² 4f ¹⁴ 5d ¹⁰ 6p ³	84 Po Polonium [Xe]6s ² 4f ¹⁴ 5d ¹⁰ 6p ⁴	85 At Astatine [Xe]6s ² 4f ¹⁴ 5d ¹⁰ 6p ⁵	86 Rn Radon [Xe]6s ² 4f ¹⁴ 5d ¹⁰ 6p ⁶								
87 Fr Francium [Rn]7s ¹	88 Ra Radium [Rn]7s ²	** 89 Ac Actinium [Rn]7s ¹ 5f ¹ 6d ⁰	104 Rf Rutherfordium [Rn]7s ² 5f ¹⁴ 6d ²	105 Db Dubnium [Rn]7s ² 5f ¹⁴ 6d ³	106 Sg Seaborgium [Rn]7s ² 5f ¹⁴ 6d ⁴	107 Bh Bohrium [Rn]7s ¹ 5f ¹⁴ 6d ⁵	108 Hs Hassium [Rn]7s ² 5f ¹⁴ 6d ⁶	109 Mt Meitnerium [Rn]7s ² 5f ¹⁴ 6d ⁷	110 Ds Darmstadtium [Rn]7s ¹ 5f ¹⁴ 6d ⁸	111 Rg Roentgenium [Rn]7s ¹ 5f ¹⁴ 6d ⁹	112 Cn Copernicium [Rn]7s ² 5f ¹⁴ 6d ¹⁰	113 Nh Nihonium [Rn]7s ² 5f ¹⁴ 6d ¹⁰ 7p ¹	114 Fl Flerovium [Rn]7s ² 5f ¹⁴ 6d ¹⁰ 7p ²	115 Mc Moscovium [Rn]7s ² 5f ¹⁴ 6d ¹⁰ 7p ³	116 Lv 										

Reminder :-): September 18 --> September 27 - applies to conductors and semi-conductors

Book Section 9:

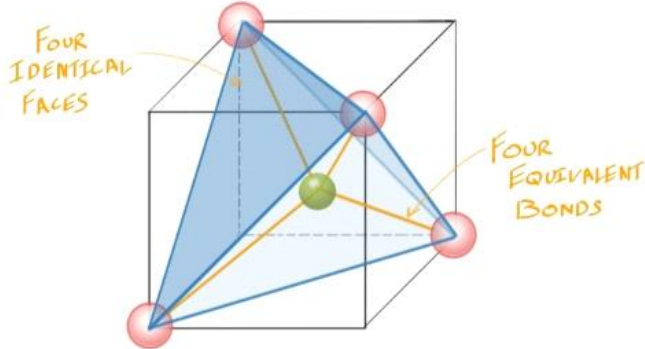


Figure 18. The **tetrahedral** interstitial site at the centre of a cube. Note that the coordination number is also 4, in addition to the number of faces on the solid formed by this site, however the name comes from the solid geometry, not the coordination number.

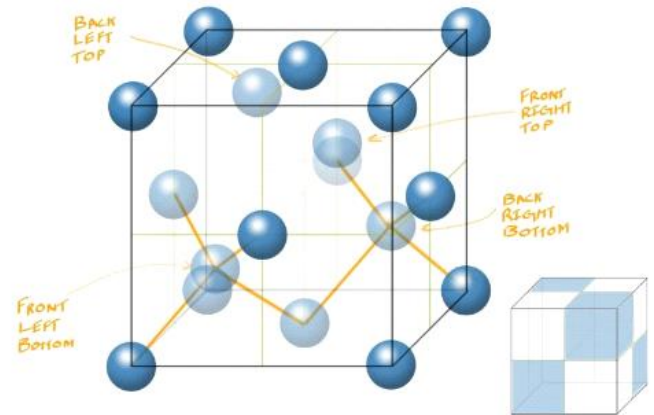
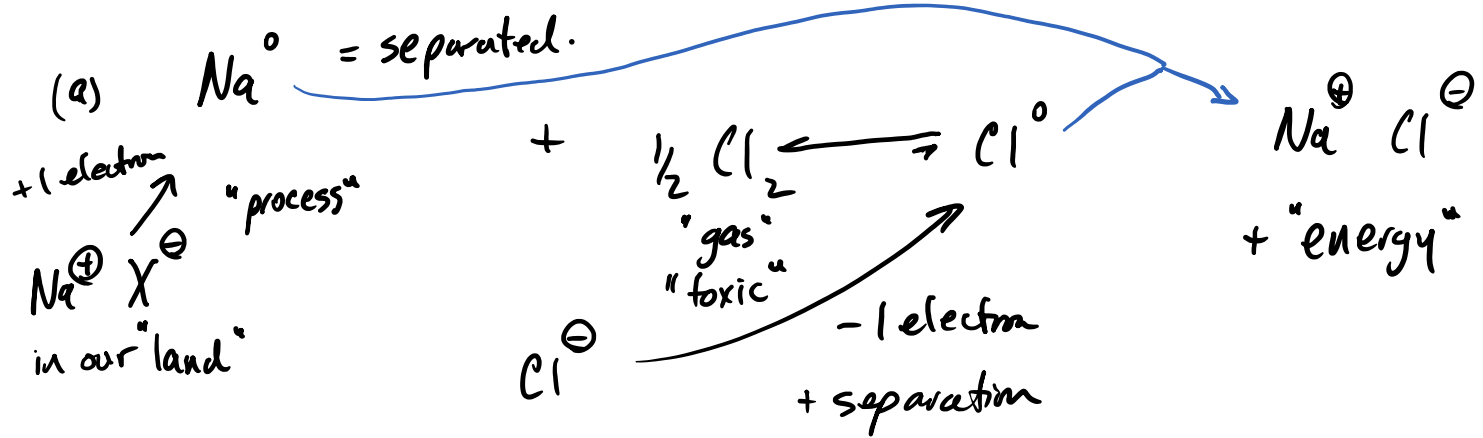


Figure 19. The structure of diamond cubic. This structure can be thought of as an FCC lattice of atoms with the same atoms occupying half of the available **tetrahedral** interstitial sites, in alternating positions. The alternating positions are illustrated with the shaded "sub-cube" faces in the second cube.

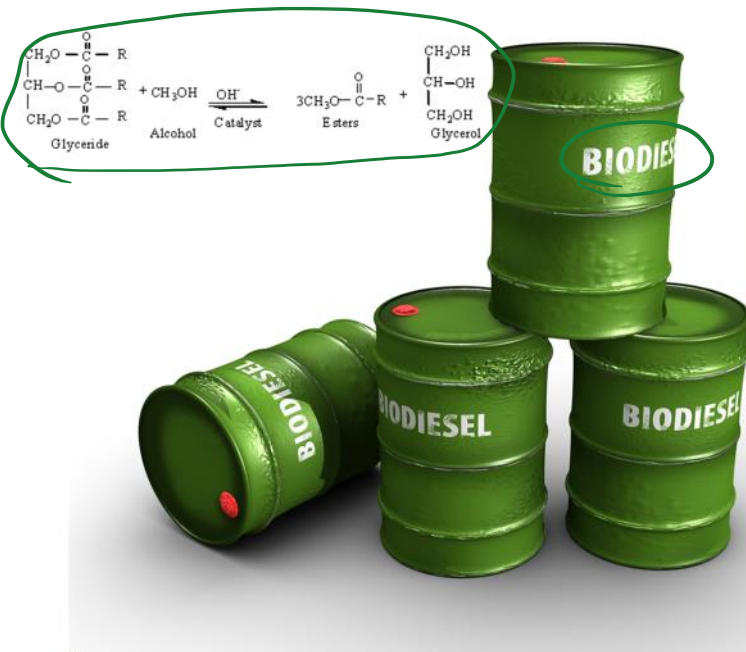
Calculations link:

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Biofuels

November 18, 2024 11:02 AM



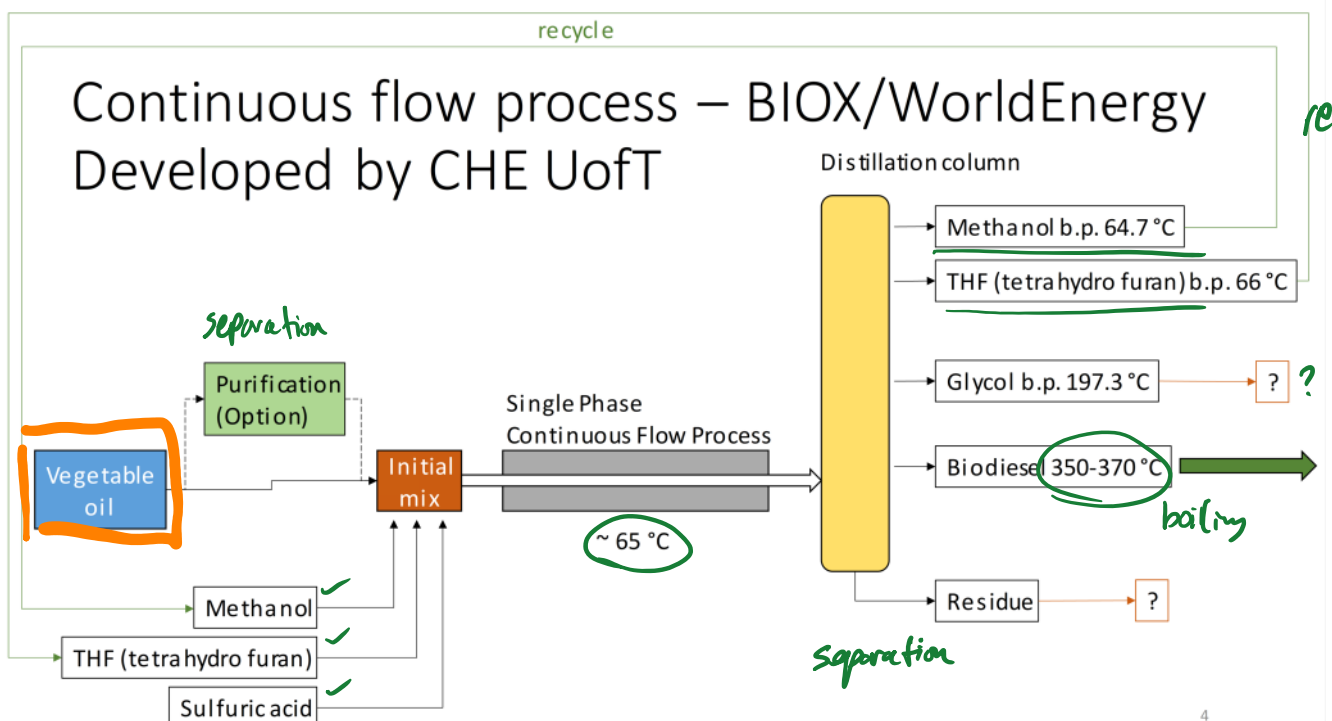
Chemical Engineering & Applied Chemistry
UNIVERSITY OF TORONTO

world energy

1

Continuous flow process – BIOX/WorldEnergy Developed by CHE UofT

recycled



Thermodynamics

(a)
Free Time \rightarrow Kinetics

Free Money \rightarrow economic wise

Free Energy \rightarrow means from where?

(b) Spontaneous \rightarrow process proceeds
without needing energy

temperature winter -20°C if spontaneous @ 10°C
 summer $+35^{\circ}\text{C}$

wrong mix — can also be our "air"

(c) temperature $^{\circ}\text{K}$ - Kelvin temperature 273.15°K - yes
 $^{\circ}\text{C}$ - Celsius temperature 0°C - yes
 $^{\circ}\text{F}$ - Fahrenheit 32°F - no.

\downarrow
to thermodynamics
calculations

Thermodynamics - names etc.

November 18, 2024 11:07 AM

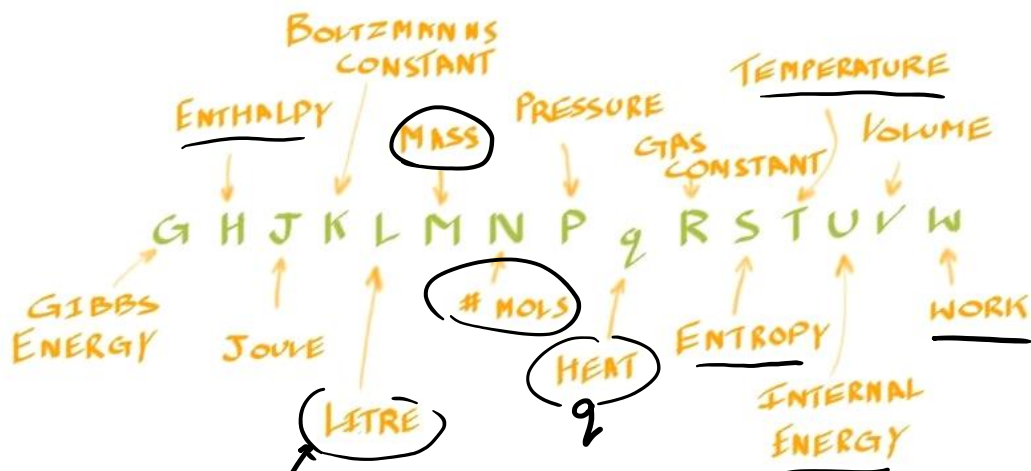


Figure 1. The thermodynamic alphabet.

measure - metric unit of volume - dm^3 - cubic decimeter

cm^3 - centimeters

m^3 - metres



water $\sim \frac{1}{3}$