

Basic Electronics

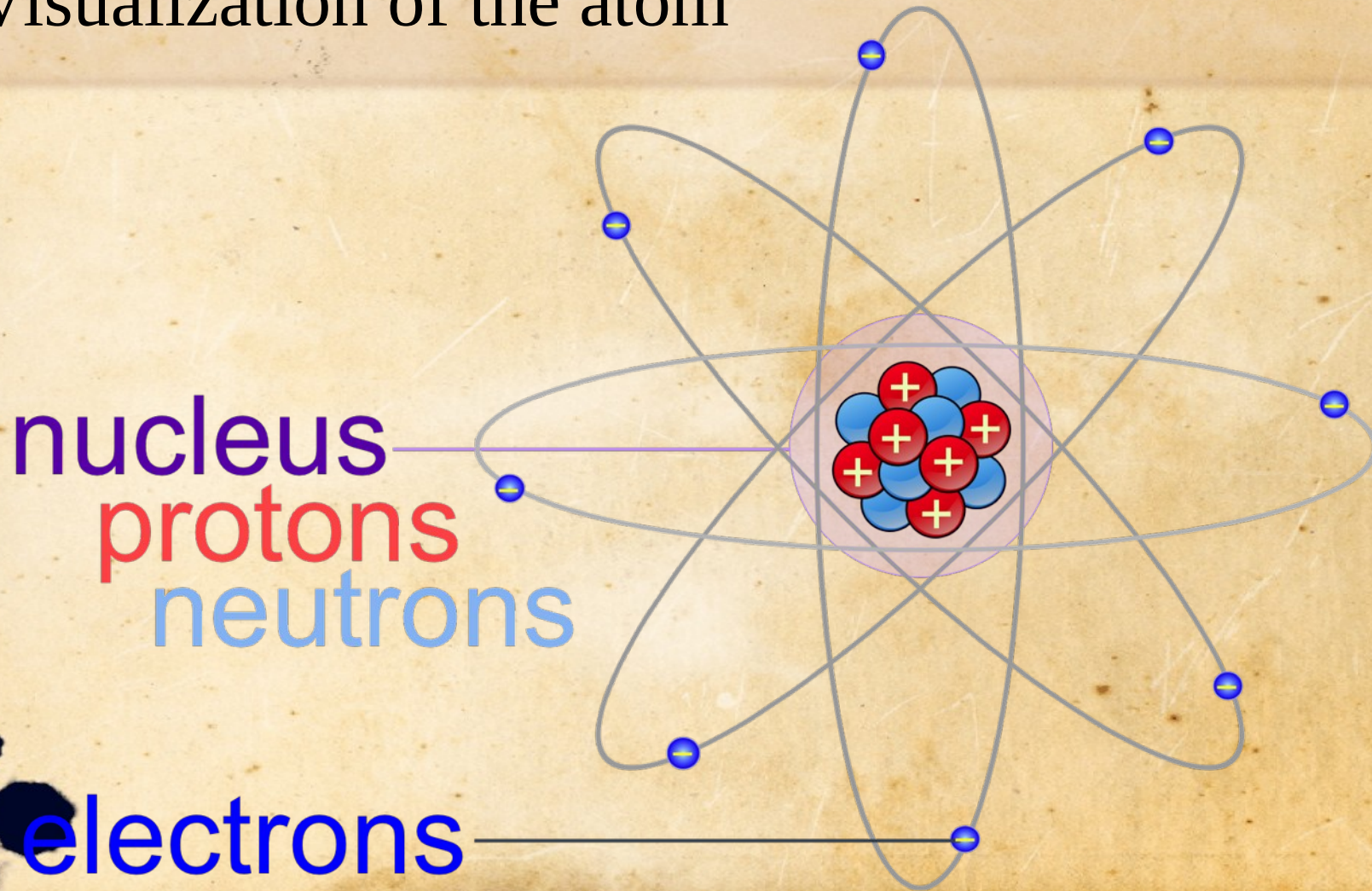
Electronics

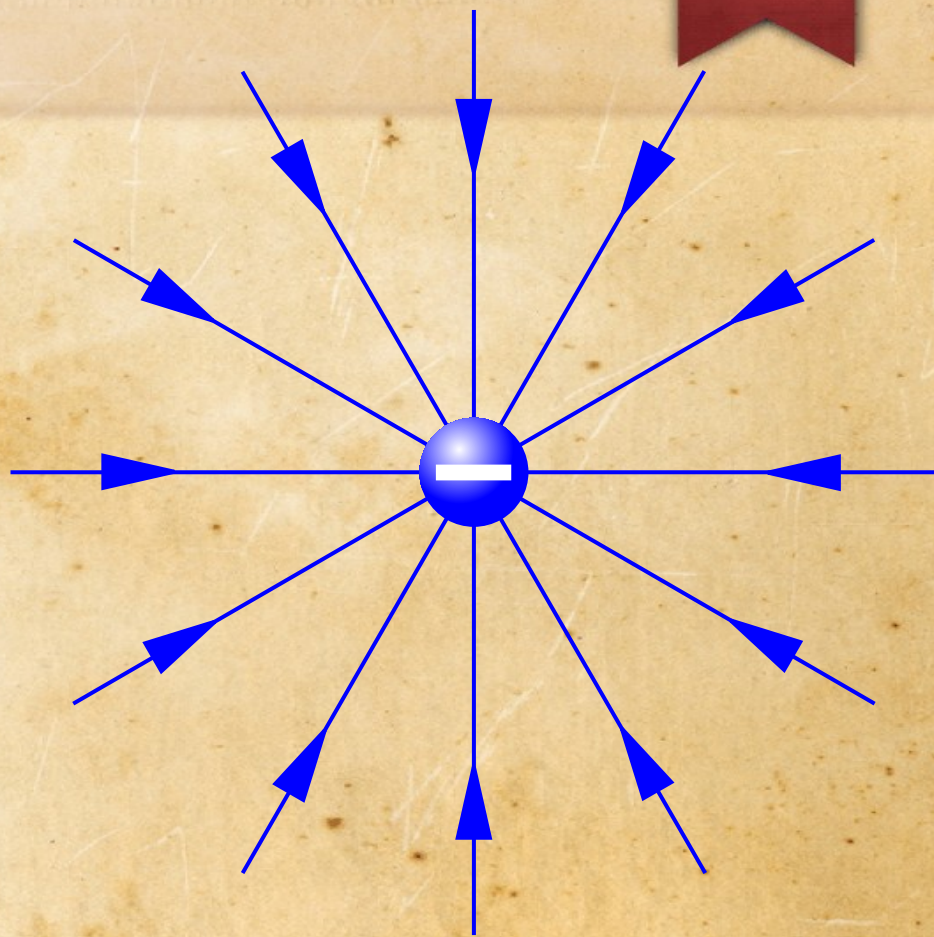
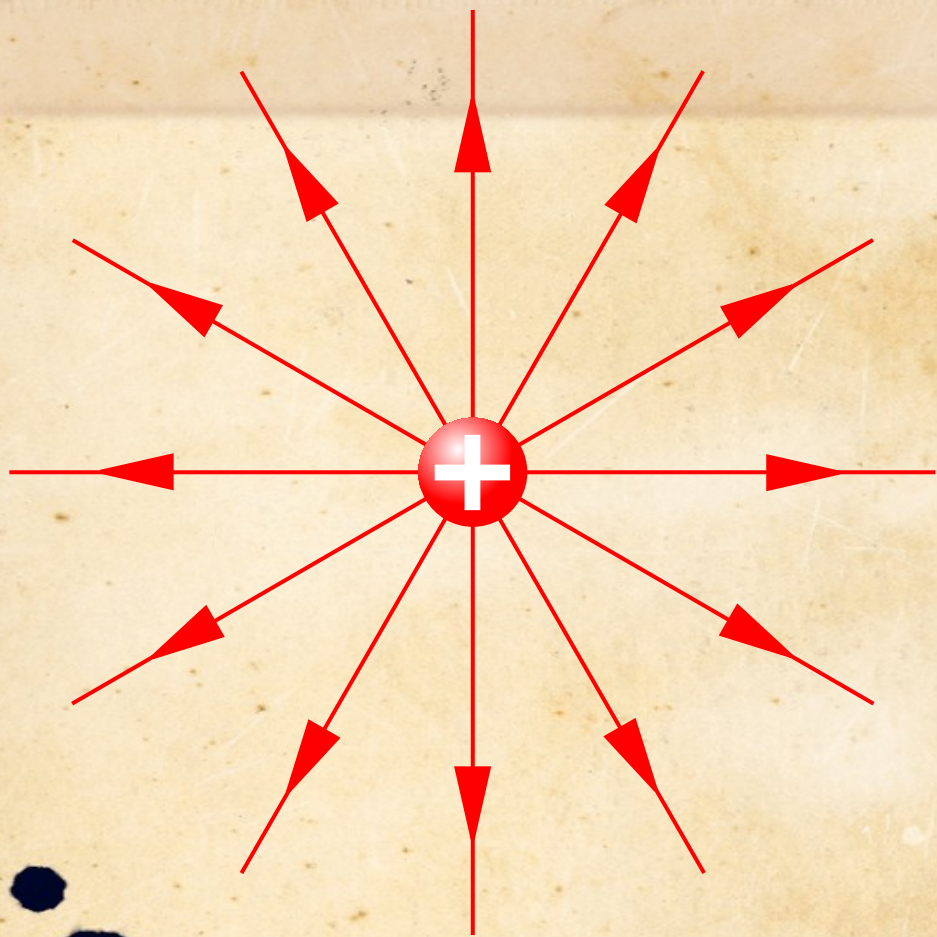
Introduction to Electronics

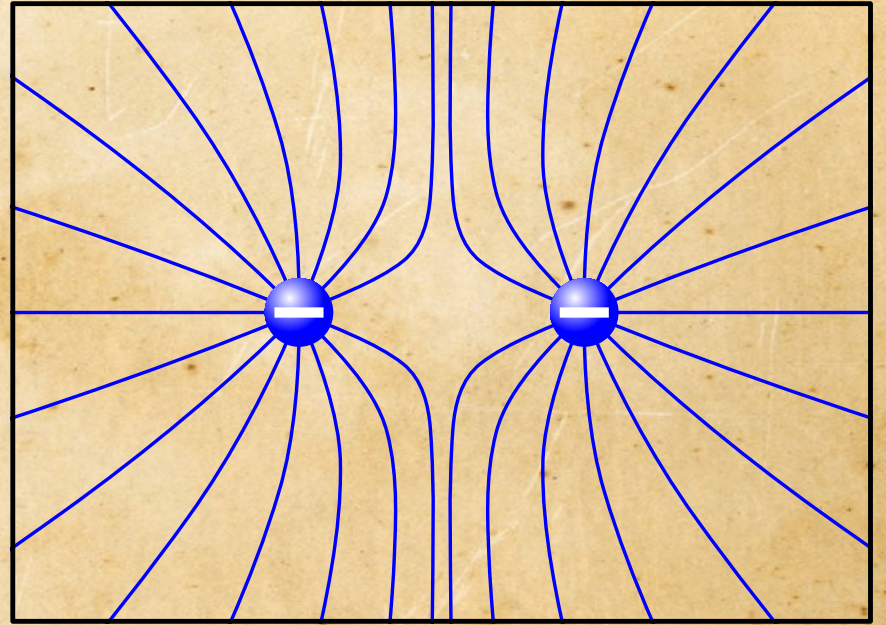
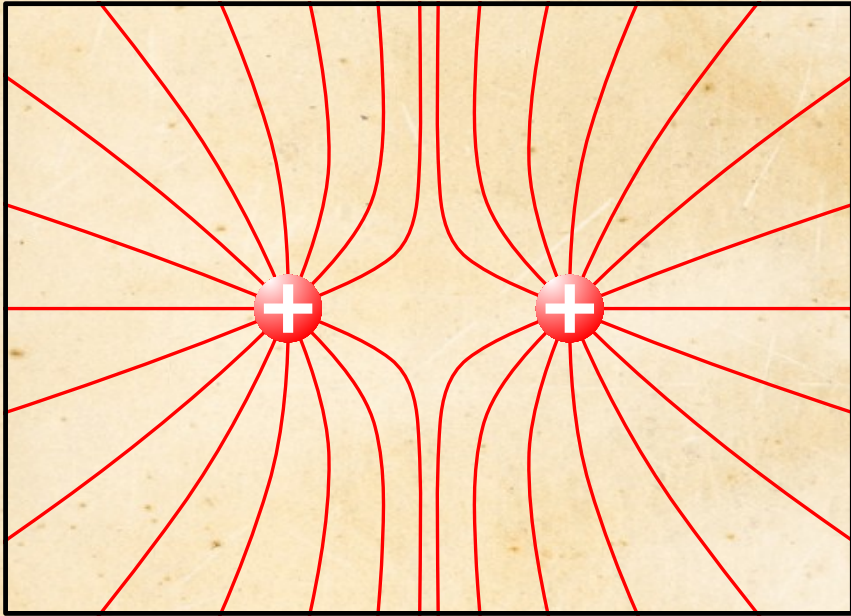
Lecture Contents

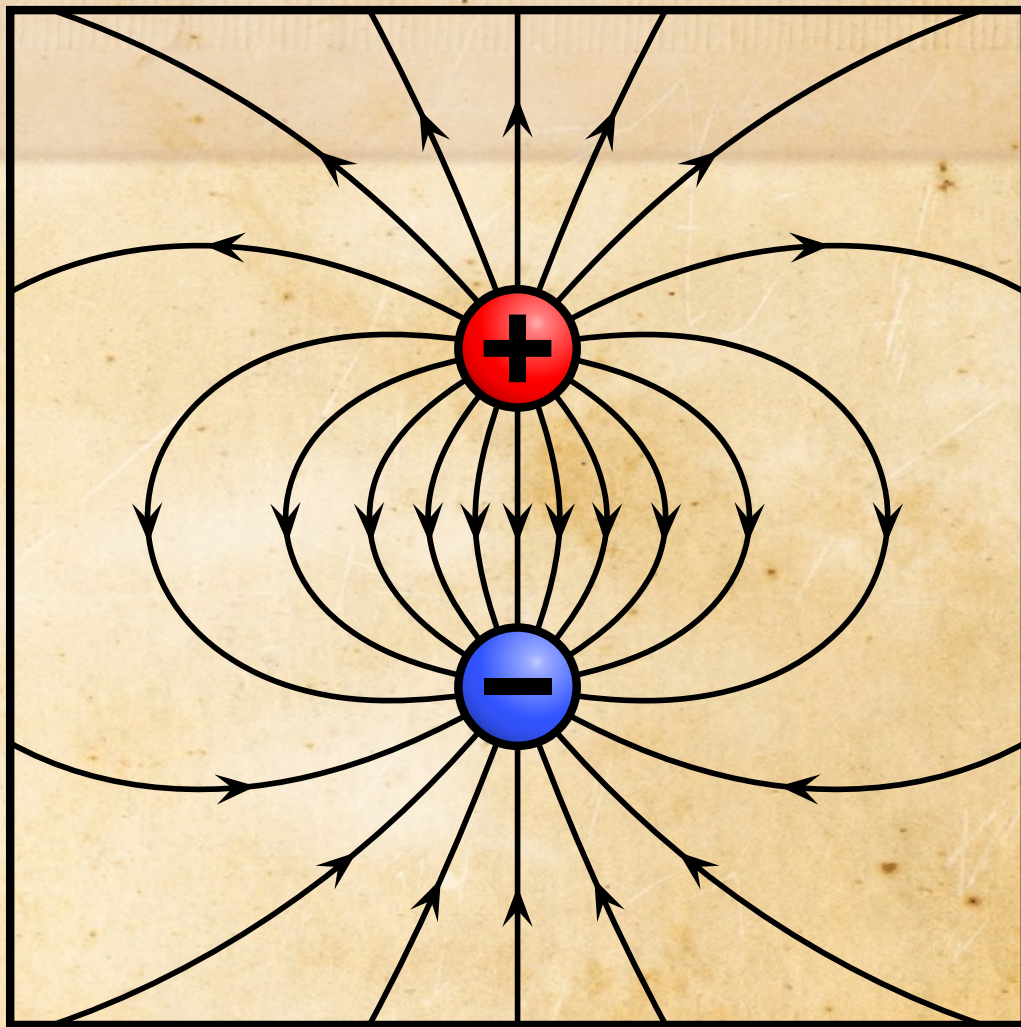
- Chemistry
 - Atoms, charges, electrons
 - Electron flow and current

Visualization of the atom





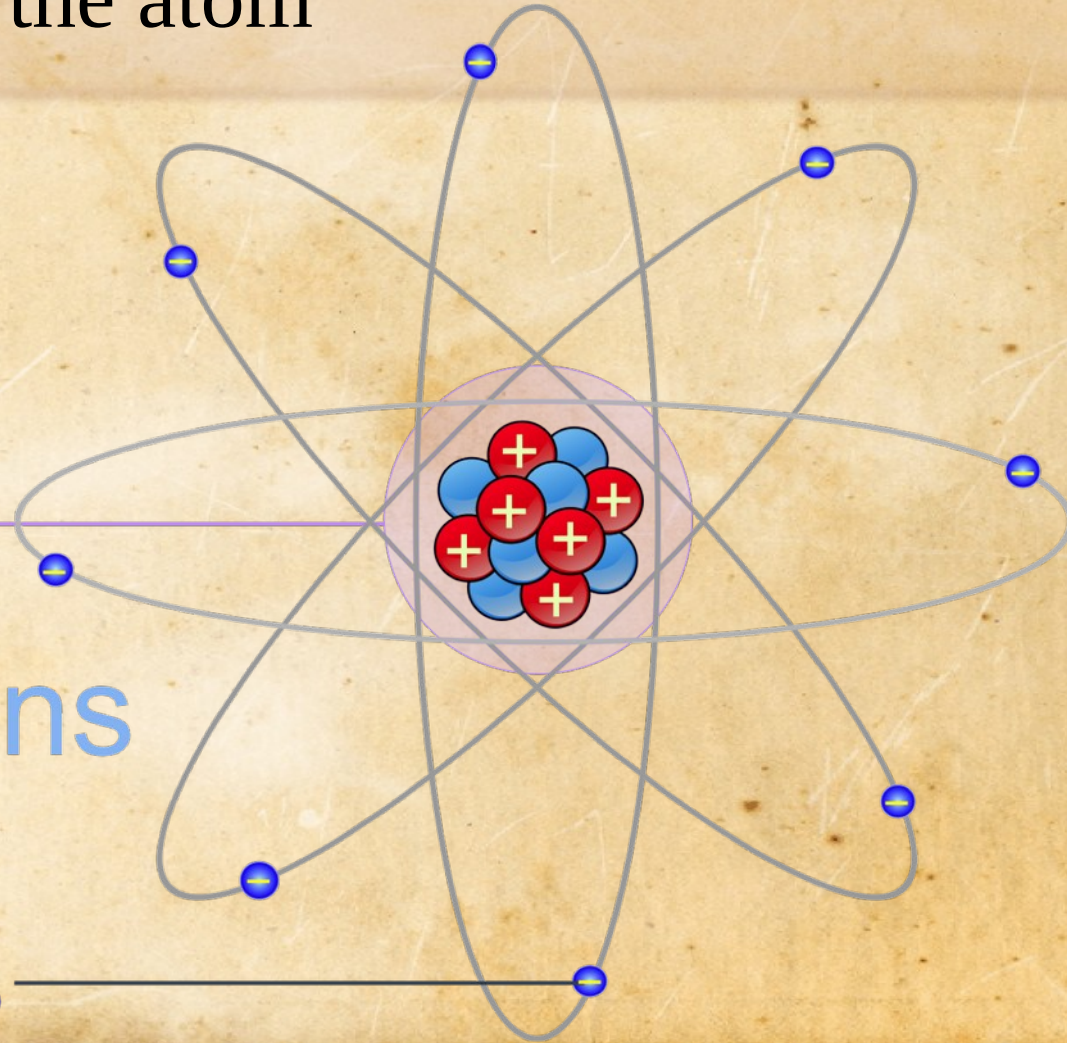


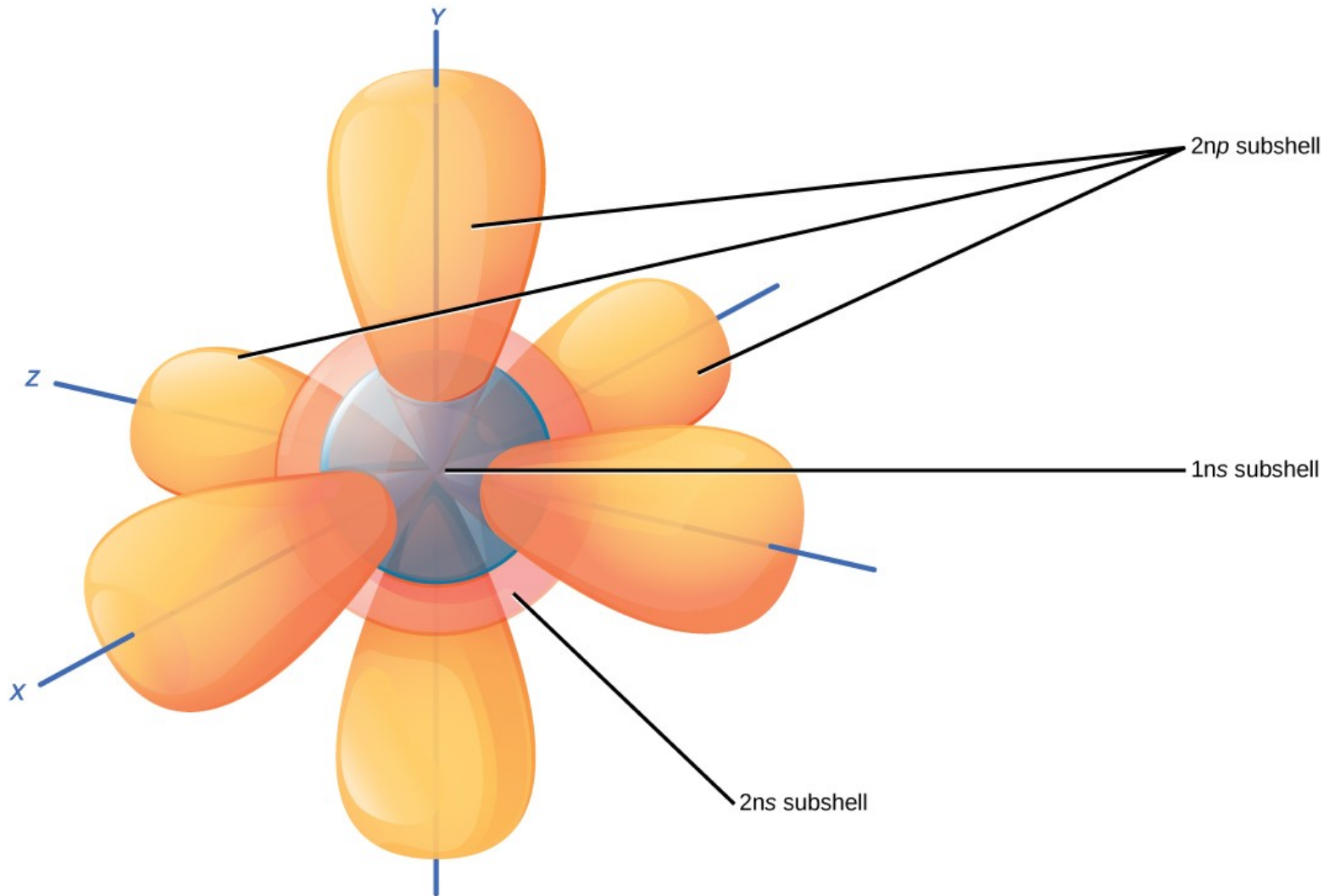


Visualization of the atom

nucleus
protons
neutrons

electrons





Periodic Table of the Elements

Group																		18																			
1																		2																			
1	H Hydrogen																	He Helium																			
2																		10																			
2	Li Lithium	Be Beryllium															B Boron	C Carbon	N Nitrogen	O Oxygen	F Fluorine	Ne Neon															
3																		18																			
3	Na Sodium	Mg Magnesium															Al Aluminium	Si Silicon	P Phosphorus	S Sulfur	Cl Chlorine	Ar Argon															
4		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17		18					
4	K Potassium	Ca Calcium	Sc Scandium	Ti Titanium	V Vanadium	Cr Chromium	Mn Manganese	Fe Iron	Co Cobalt	Ni Nickel	Cu Copper	Zn Zinc	Ga Gallium	Ge Germanium	As Arsenic	Se Selenium	Br Bromine	Kr Krypton																			
5		37		38		39		40		41		42		43		44		45		46		47		48		49		50		51		52		53		54	
5	Rb Rubidium	Sr Strontium	Y Yttrium	Zr Zirconium	Nb Niobium	Mo Molybdenum	Tc Technetium	Ru Ruthenium	Rh Rhodium	Pd Palladium	Ag Silver	Cd Cadmium	In Indium	Sn Tin	Sb Antimony	Te Tellurium	I Iodine	Xe Xenon																			
6		55		56		71		72		73		74		75		76		77		78		79		80		81		82		83		84		85		86	
6	Cs Caesium	Ba Barium	Lu Lutetium	Hf Hafnium	Ta Tantalum	W Tungsten	Re Rhenium	Os Osmium	Ir Iridium	Pt Platinum	Au Gold	Hg Mercury	Tl Thallium	Pb Lead	Bi Bismuth	Po Polonium	At Astatine	Rn Radon																			
7		87		88		103		104		105		106		107		108		109		110		111		112		113		114		115		116		117		118	
7	Fr Francium	Ra Radium	Lr Lawrencium	Rf Rutherfordium	Db Dubnium	Sg Seaborgium	Bh Bohrium	Hs Hassium	Mt Meitnerium	Ds Darmstadtium	Rg Roentgenium	Cn Copernicium	Nh Nihonium	Fl Flerovium	Mc Moscovium	Lv Livermorium	Ts Tennessine	Og Oganesson																			

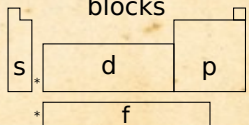
26 — atomic number

Fe

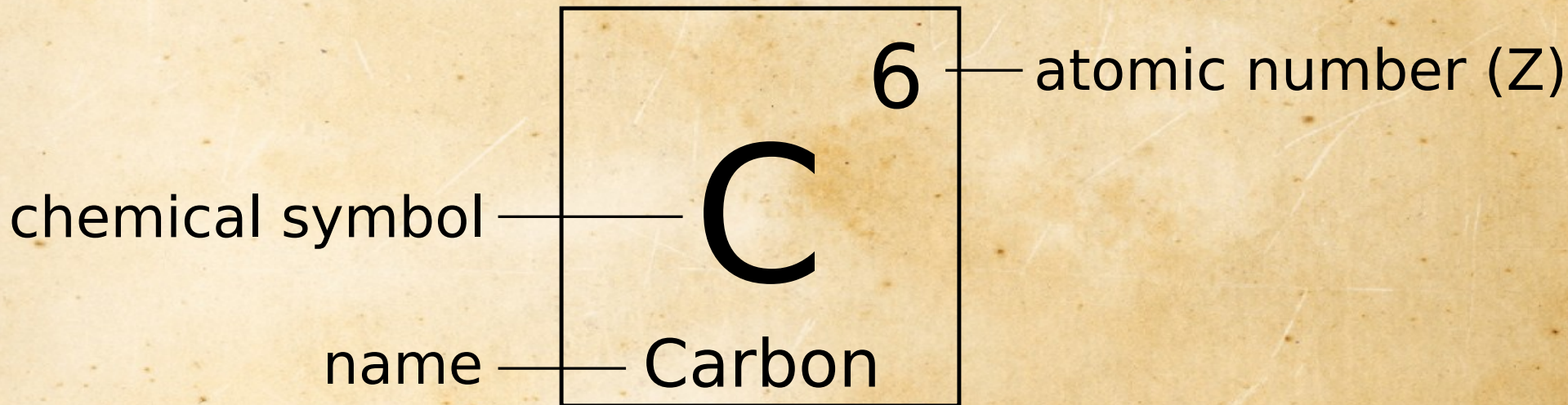
chemical symbol

name — Iron

Electron configuration blocks



57		58		59		60		61		62		63		64		65		66		67		68		69		70	
* La Lanthanum	Ce Cerium	Pr Praseodymium	Nd Neodymium	Pm Promethium	Sm Samarium	Eu Europium	Gd Gadolinium	Tb Terbium	Dy Dysprosium	Ho Holmium	Er Erbium	Tm Thulium	Yb Ytterbium														
89		90		91		92		93		94		95		96		97		98		99		100		101		102	
* Ac Actinium	Th Thorium	Pa Protactinium	U Uranium	Np Neptunium	Pu Plutonium	Am Americium	Cm Curium	Bk Berkelium	Cf Californium	Es Einsteinium	Fm Fermium	Md Mendelevium	No Nobelium														

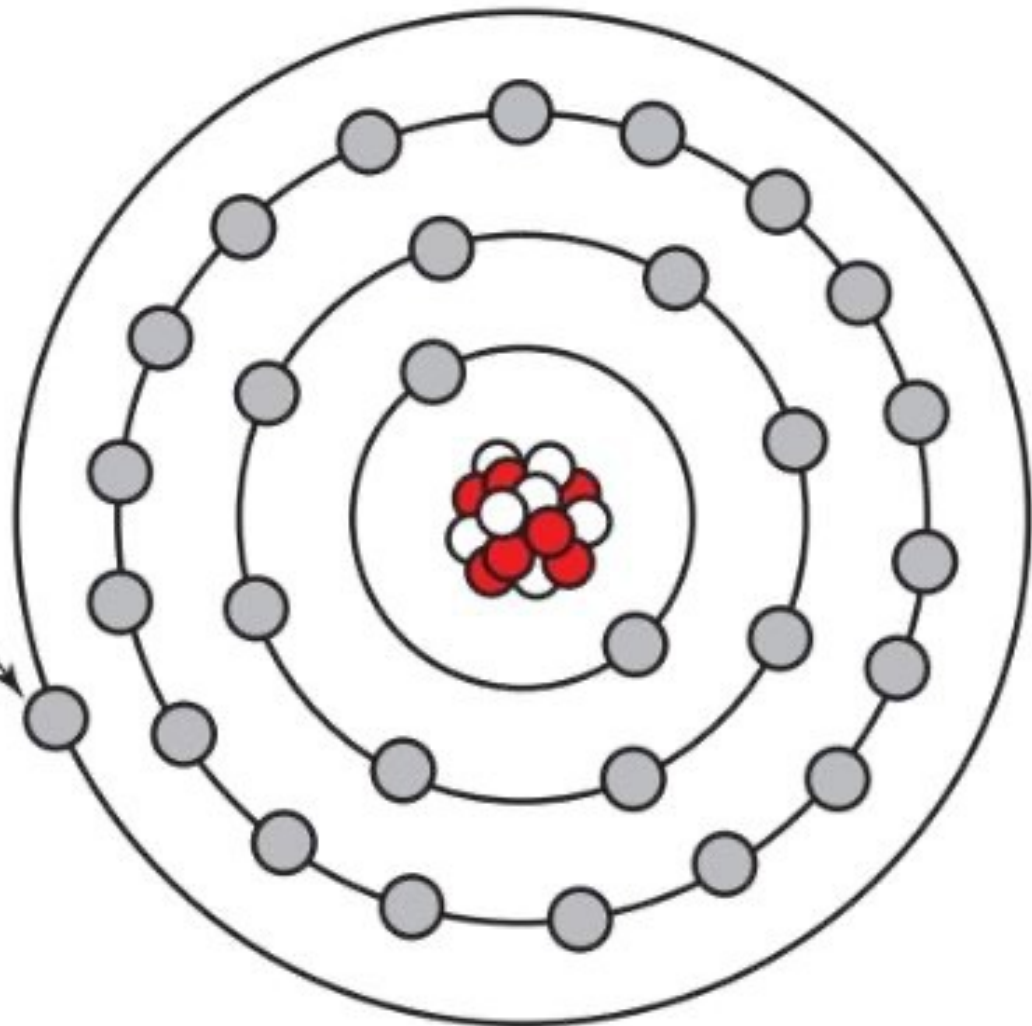


Transition metals in periodic table

<p>Atomic number → 1</p> <p>Symbol → H</p> <p>Name → Hydrogen</p> <p>Atomic weight → 1.008</p> <p>Electrons per shell → 1</p>																	
<p>Subcategory metals, nonmetals, and metalloids</p> <ul style="list-style-type: none"> Alkali metals Alkaline earth metals Transition metals Lanthanides Actinides Post transition metals Metalloids Reactive non metals Noble gases Unknown properties 																	
1 H Hydrogen 1.008 1																	18 He Helium 4.0026 2
3 Li Lithium 6.94 2-1	4 Be Beryllium 9.013 2-1																
11 Na Sodium 22.98 2-8-1	12 Mg Magnesium 24.32 2-8-2																
19 K Potassium 39.10 2-8-8-1	20 Ca Calcium 40.08 2-8-8-2	21 Sc Scandium 44.96 2-8-9-2	22 Ti Titanium 47.87 2-8-10-2	23 V Vanadium 50.94 2-8-11-2	24 Cr Chromium 51.996 2-8-13-1	25 Mn Manganese 54.94 2-8-13-2	26 Fe Iron 55.84 2-8-14-2	27 Co Cobalt 58.93 2-8-15-2	28 Ni Nickel 58.69 2-8-16-2	29 Cu Copper 63.55 2-8-18-1	30 Zn Zinc 65.38 2-8-18-2	31 Ga Gallium 69.72 2-8-18-3	32 Ge Germanium 72.63 2-8-18-4	33 As Arsenic 74.92 2-8-18-5	34 Se Selenium 78.96 2-8-18-6	35 Br Bromine 79.90 2-8-18-7	36 Kr Krypton 83.80 2-8-18-8
37 Rb Rubidium 85.47 2-8-18-8-1	38 Sr Strontium 87.62 2-8-18-8-2	39 Y Yttrium 88.90 2-8-18-9-2	40 Zr Zirconium 91.22 2-8-18-10-2	41 Nb Niobium 92.90 2-8-18-12-1	42 Mo Molybdenum 95.95 2-8-18-13-1	43 Tc Technetium [98] 2-8-18-13-2	44 Ru Ruthenium 101.07 2-8-18-15-1	45 Rh Rhodium 102.91 2-8-18-16-1	46 Pd Palladium 106.42 2-8-18-18	47 Ag Silver 107.87 2-8-18-18-1	48 Cd Cadmium 112.41 2-8-18-18-2	49 In Indium 114.82 2-8-18-18-3	50 Sn Tin 118.71 2-8-18-18-4	51 Sb Antimony 121.76 2-8-18-18-5	52 Te Tellurium 127.60 2-8-18-18-6	53 I Iodine 126.90 2-8-18-18-7	54 Xe Xenon 131.29 2-8-18-18-8
55 Cs Cesium 132.91 2-8-18-18-8-1	56 Ba Barium 137.33 2-8-18-18-8-2	57-71 Ln Lanthanides	72 Hf Hafnium 178.49 2-8-18-32-10-2	73 Ta Tantalum 180.95 2-8-18-32-11-2	74 W Tungsten 183.84 2-8-18-32-12-2	75 Re Rhenium 186.21 2-8-18-32-13-2	76 Os Osmium 190.23 2-8-18-32-14-2	77 Ir Iridium 192.22 2-8-18-32-15-2	78 Pt Platinum 195.08 2-8-18-32-17-1	80 Au Gold 196.97 2-8-18-32-18-1	80 Hg Mercury 200.59 2-8-18-32-18-2	81 Tl Thallium 204.38 2-8-18-32-18-3	82 Pb Lead 207.2 2-8-18-32-18-4	83 Bi Bismuth 208.98 2-8-18-32-18-5	84 Po Polonium [209] 2-8-18-32-18-6	85 At Astatine [210] 2-8-18-32-18-7	86 Rn Radon [222] 2-8-18-32-18-8
87 Fr Francium [223] 2-8-18-32-18-8-1	88 Ra Radium [226] 2-8-18-32-18-8-2	89-103 Ac Actinides	104 Rf Rutherfordium [267] 2-8-18-32-32-10-2	105 Db Dubnium [268] 2-8-18-32-32-11-2	106 Sg Seaborgium [269] 2-8-18-32-32-12-2	107 Bh Bohrium [270] 2-8-18-32-32-13-2	108 Hs Hassium [277] 2-8-18-32-32-14-2	109 Mt Meitnerium [278] 2-8-18-32-32-15-2	110 Ds Darmstadtium [281] 2-8-18-32-32-16-2	111 Rg Roentgenium [282] 2-8-18-32-32-17-2	112 Cn Copernicium [285] 2-8-18-32-32-18-2	113 Nh Nihonium [286] 2-8-18-32-32-18-3	114 Fl Flerovium [289] 2-8-18-32-32-18-4	115 Mc Moscovium [290] 2-8-18-32-32-18-5	116 Lv Livermorium [293] 2-8-18-32-32-18-6	117 Ts Tennessine [294] 2-8-18-32-32-18-7	118 Og Oganesson [294] 2-8-18-32-32-18-8

57 La Lanthanum 138.91 2-8-18-19-9-2	58 Ce Cerium 140.12 2-8-18-19-9-2	59 Pr Praseodymium 140.91 2-8-18-21-8-2	60 Nd Neodymium 144.24 2-8-18-22-8-2	61 Pm Promethium [145] 2-8-18-23-8-2	62 Sm Samarium 150.36 2-8-18-24-8-2	63 Eu Europium 151.96 2-8-18-25-8-2	64 Gd Gadolinium 157.25 2-8-18-25-9-2	65 Tb Terbium 158.93 2-8-18-27-8-2	66 Dy Dysprosium 162.50 2-8-18-28-8-2	67 Ho Holmium 164.93 2-8-18-29-8-2	68 Er Erbium 167.26 2-8-18-30-8-2	69 Tm Thulium 168.93 2-8-18-31-8-2	70 Yb Ytterbium 173.05 2-8-18-32-8-2	71 Lu Lutetium 174.97 2-8-18-32-9-2
89 Ac Actinium [227] 2-8-18-32-18-9-2	90 Th Thorium 232.04 2-8-18-32-18-10-2	91 Pa Protactinium 231.04 2-8-18-32-20-9-2	92 U Uranium 238.03 2-8-18-32-21-9-2	93 Np Neptunium [237] 2-8-18-32-22-9-2	94 Pu Plutonium [244] 2-8-18-32-24-8-2	95 Am Americium [243] 2-8-18-32-25-8-2	96 Cm Curium [247] 2-8-18-32-25-9-2	97 Bk Berkelium [247] 2-8-18-32-27-8-2	98 Cf Californium [251] 2-8-18-32-28-8-2	99 Es Einsteinium [252] 2-8-18-32-29-8-2	100 Fm Fermium [257] 2-8-18-32-30-8-2	101 Md Mendelevium [258] 2-8-18-32-31-8-2	102 No Nobelium [259] 2-8-18-32-32-8-2	103 Lw Lawrencium [266] 2-8-18-32-32-8-3

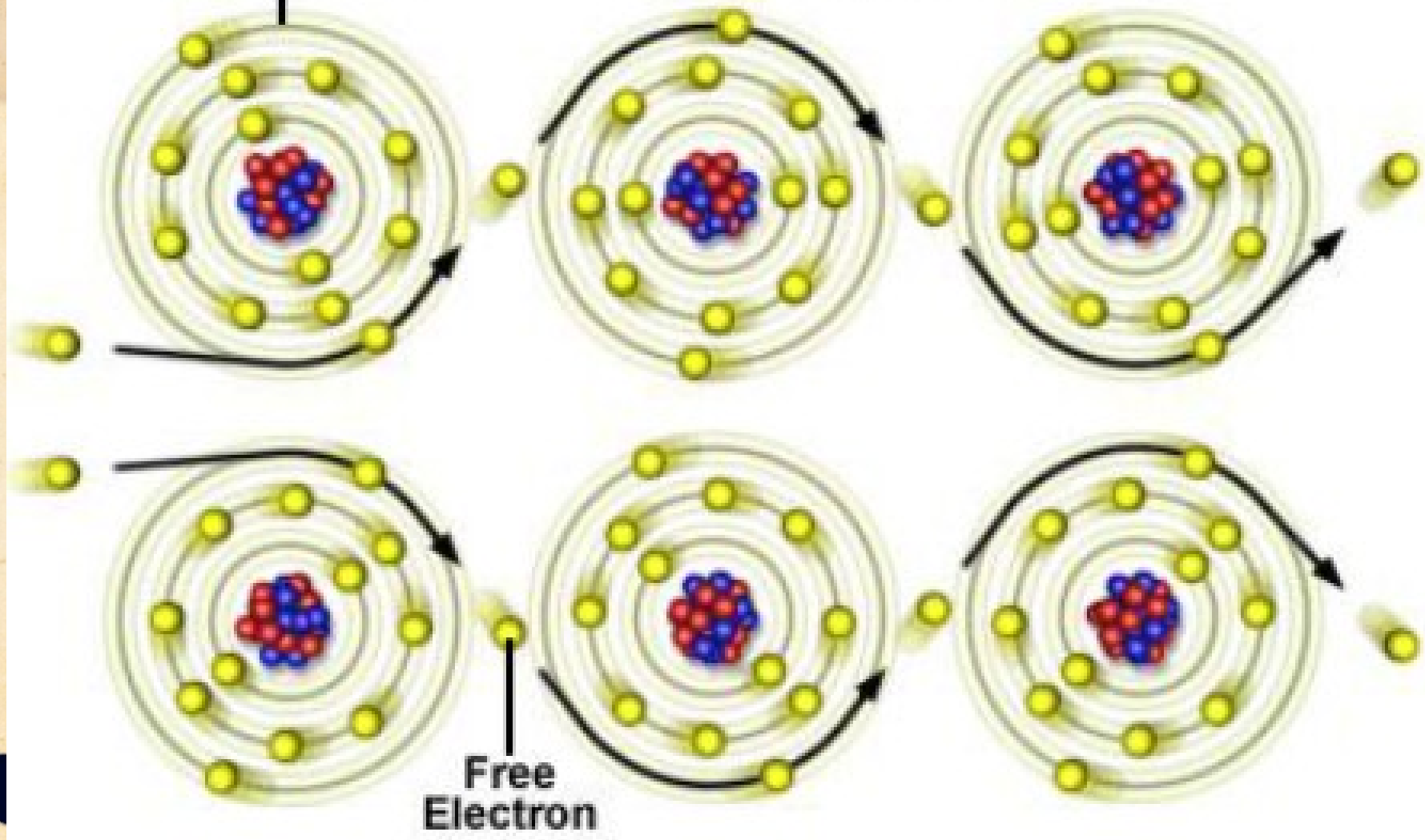
Single electron in
the outer orbit
of copper atom



Copper atom

Valence Orbit

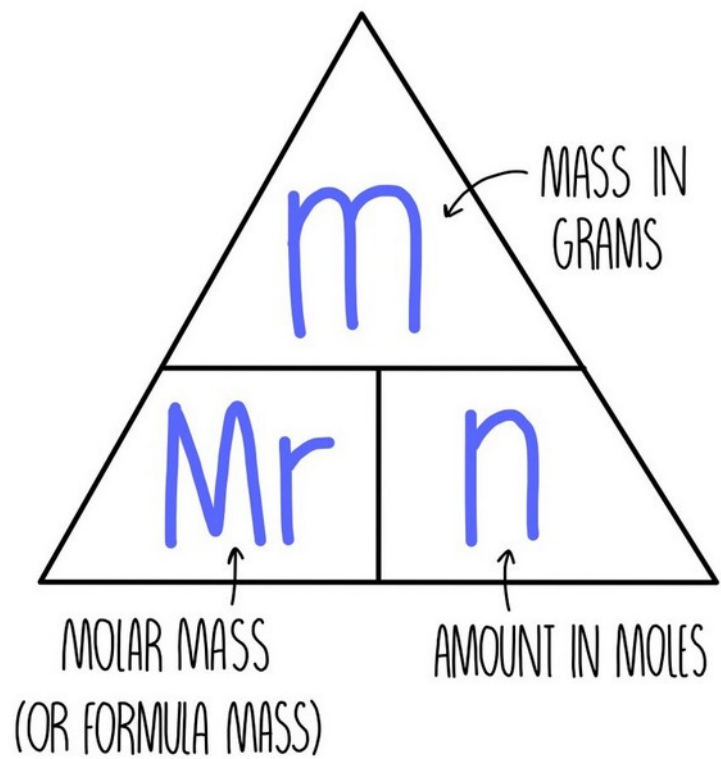
Direction of Current →



Free Electron

Chemistry – Avogadro's number

- N_A – Avogadro's number
 - $6.02214076 \times 10^{23}$ particles / mole

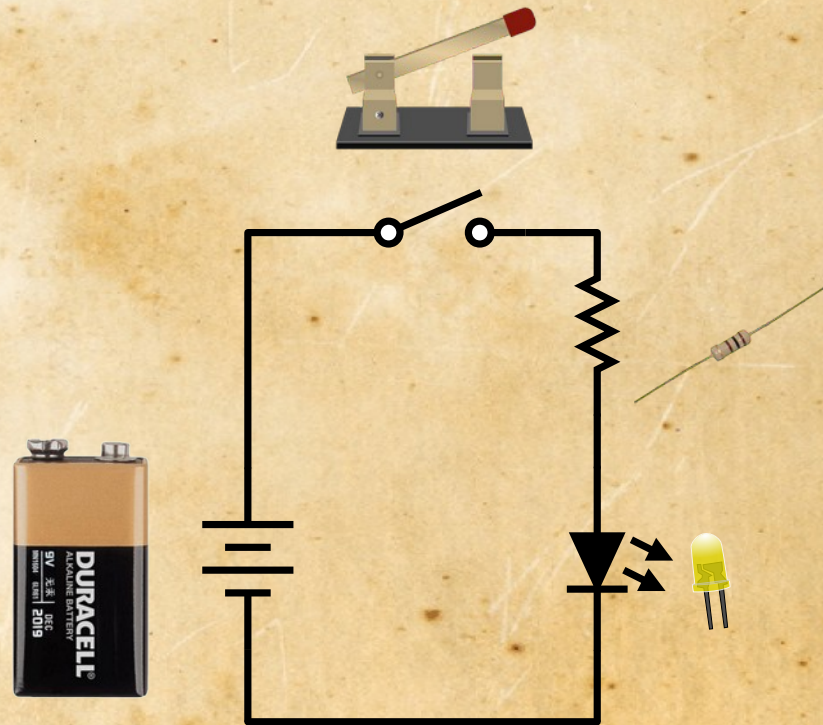
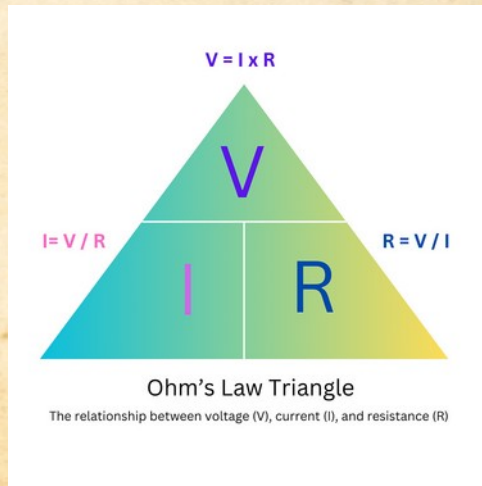


Electronics – Coulomb

- Avogadro's Number, $N_A = 6.02214076 \times 10^{23}$ particles / mole
- **Charge:** 1 Coulomb of charge per 6.24150975^{18} electrons
 - 1 electron has a charge of **$1.60217646 \times 10^{-19}$ Coulombs**
- **Current:** 1 Ampere = 1 Coulomb per second

Current and Voltage

- **Current** is the amount of charge (the number of electrons) flowing through the circuit per unit time
- **Voltage** is the strength with which those electrons are pushed.



Basic Electronics

Electronics

Introduction to Electronics