

# The Periodic Table

|                         |                         |                    |                    |                    |                    |                   |                    |                    |                    |                    |                    |                         |                          |                          |                          |                         |                          |                     |                   |                     |                    |                     |                     |                     |                    |                     |                   |                     |                   |                   |                   |
|-------------------------|-------------------------|--------------------|--------------------|--------------------|--------------------|-------------------|--------------------|--------------------|--------------------|--------------------|--------------------|-------------------------|--------------------------|--------------------------|--------------------------|-------------------------|--------------------------|---------------------|-------------------|---------------------|--------------------|---------------------|---------------------|---------------------|--------------------|---------------------|-------------------|---------------------|-------------------|-------------------|-------------------|
| (1)<br>1<br>H<br>1.008  | (2)<br>2<br>He<br>4.003 |                    |                    |                    |                    |                   |                    |                    |                    |                    |                    | (13)<br>3<br>B<br>10.81 | (14)<br>4<br>C<br>12.011 | (15)<br>5<br>N<br>14.007 | (16)<br>6<br>O<br>15.999 | (17)<br>7<br>F<br>19.00 | (18)<br>8<br>Ne<br>20.18 |                     |                   |                     |                    |                     |                     |                     |                    |                     |                   |                     |                   |                   |                   |
| 2<br>3<br>Li<br>6.941   | 4<br>4<br>Be<br>9.012   |                    |                    |                    |                    |                   |                    |                    |                    |                    |                    | 5<br>B<br>10.81         | 6<br>C<br>12.011         | 7<br>N<br>14.007         | 8<br>O<br>15.999         | 9<br>F<br>19.00         | 10<br>Ne<br>20.18        |                     |                   |                     |                    |                     |                     |                     |                    |                     |                   |                     |                   |                   |                   |
| 3<br>11<br>Na<br>22.99  | 12<br>Mg<br>24.30       | (3)                | (4)                | (5)                | (6)                | (7)               | (8)                | (9)                | (10)               | (11)               | (12)               | 13<br>Al<br>26.98       | 14<br>Si<br>28.09        | 15<br>P<br>30.97         | 16<br>S<br>32.06         | 17<br>Cl<br>35.45       | 18<br>Ar<br>39.95        |                     |                   |                     |                    |                     |                     |                     |                    |                     |                   |                     |                   |                   |                   |
| 4<br>19<br>K<br>39.10   | 20<br>Ca<br>40.08       | 21<br>Sc<br>44.96  | 22<br>Ti<br>47.88  | 23<br>V<br>50.94   | 24<br>Cr<br>52.00  | 25<br>Mn<br>54.94 | 26<br>Fe<br>55.85  | 27<br>Co<br>58.93  | 28<br>Ni<br>58.71  | 29<br>Cu<br>63.55  | 30<br>Zn<br>65.38  | 31<br>Ga<br>69.72       | 32<br>Ge<br>72.59        | 33<br>As<br>74.92        | 34<br>Se<br>78.96        | 35<br>Br<br>79.90       | 36<br>Kr<br>83.80        |                     |                   |                     |                    |                     |                     |                     |                    |                     |                   |                     |                   |                   |                   |
| 5<br>37<br>Rb<br>85.47  | 38<br>Sr<br>87.62       | 39<br>Y<br>88.91   | 40<br>Zr<br>91.22  | 41<br>Nb<br>92.91  | 42<br>Mo<br>95.94  | 43<br>Tc<br>(99)  | 44<br>Ru<br>101.1  | 45<br>Rh<br>102.91 | 46<br>Pd<br>106.4  | 47<br>Ag<br>107.87 | 48<br>Cd<br>112.40 | 49<br>In<br>114.82      | 50<br>Sn<br>118.69       | 51<br>Sb<br>121.75       | 52<br>Te<br>127.6        | 53<br>I<br>126.9        | 54<br>Xe<br>131.30       |                     |                   |                     |                    |                     |                     |                     |                    |                     |                   |                     |                   |                   |                   |
| 6<br>55<br>Cs<br>132.91 | 56<br>Ba<br>137.34      | 57<br>La<br>138.90 | 58<br>Ce<br>140.12 | 59<br>Pr<br>140.91 | 60<br>Nd<br>144.24 | 61<br>Pm<br>(145) | 62<br>Sm<br>150.36 | 63<br>Eu<br>151.96 | 64<br>Gd<br>157.25 | 65<br>Tb<br>158.93 | 66<br>Dy<br>162.50 | 67<br>Ho<br>164.93      | 68<br>Er<br>167.26       | 69<br>Tm<br>168.93       | 70<br>Yb<br>173.05       | 71<br>Lu<br>174.967     | 72<br>Hf<br>178.49       | 73<br>Ta<br>180.948 | 74<br>W<br>183.84 | 75<br>Re<br>186.207 | 76<br>Os<br>190.23 | 77<br>Ir<br>192.225 | 78<br>Pt<br>195.084 | 79<br>Au<br>196.967 | 80<br>Hg<br>200.59 | 81<br>Tl<br>204.387 | 82<br>Pb<br>207.2 | 83<br>Bi<br>208.980 | 84<br>Po<br>(210) | 85<br>At<br>(210) | 86<br>Rn<br>(222) |
| 7<br>87<br>Fr<br>(223)  | 88<br>Ra<br>(226.025)   | 89<br>Ac<br>(227)  | 90<br>Th<br>(232)  | 91<br>Pa<br>(231)  | 92<br>U<br>(238)   | 93<br>Np<br>(237) | 94<br>Pu<br>(244)  | 95<br>Am<br>(243)  | 96<br>Cm<br>(247)  | 97<br>Bk<br>(247)  | 98<br>Cf<br>(251)  | 99<br>Es<br>(252)       | 100<br>Fm<br>(257)       | 101<br>Md<br>(258)       | 102<br>No<br>(259)       | 103<br>Lr<br>(262)      |                          |                     |                   |                     |                    |                     |                     |                     |                    |                     |                   |                     |                   |                   |                   |

NOTE: the rare earth elements, the actinides and lanthanides, are missing from this table.

metals, metalloids, nonmetals  
(semimetals)

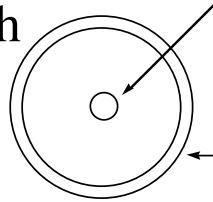
|                         |                         |                    |                    |                    |                    |                   |                    |                    |                    |                    |                    |                         |                          |                          |                          |                         |                          |                     |                   |                     |                    |                     |                     |                     |                    |                     |                   |                     |                   |                   |                   |
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NOTE: the rare earth elements, the actinides and lanthanides, are missing from this table.



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# Mother Earth



Solid Core  
large mass occupying a small volume;  
particles packed closely

$$D = \frac{10 \text{ g}}{1 \text{ cm}^3}$$

Gaseous Atmosphere  
small mass occupying a large volume;  
particles packed far apart

$$D = \frac{1 \text{ g}}{1000 \text{ cm}^3}$$

| Location   | Composition by Mass   | Density   |
|------------|---|---|
| Core       | Fe (iron) >> Ni (nickel) >>> Co (cobalt)                        | 10-15 g/cm <sup>3</sup><br><b>large mass,</b><br><b>small volume</b>                                |
| Mantel     | O (oxygen) > Si (silicon) > Mg (magnesium) > Fe > Al (aluminum) | 4-6 g/cm <sup>3</sup>   |
| Crust      | O > Si > Al > Fe  | 2.8 g/cm <sup>3</sup>   |
| Atmosphere | N (nitrogen) > O (oxygen) > Ar (argon) > C (carbon)             | ~0.001 g/cm <sup>3</sup> @<br>1 atmosphere of pressure<br><b>small mass,</b><br><b>large volume</b> |

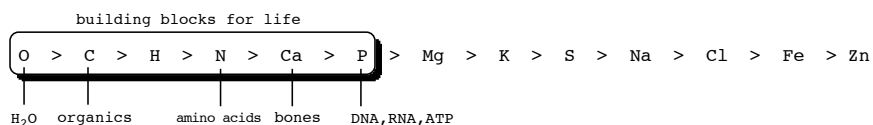
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# Our Universe

| Location | Composition by Mass        |
|----------|----------------------------|
| Sun      | H (hydrogen) > He (helium) |
| Space    | H (hydrogen) > He (helium) |

## Common Elements in the Human Body - Composition by Mass

$O_u$  CH N<sub>o</sub> Ca P



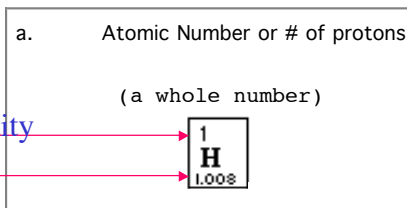
Ca = calcium      S = sulfur      Fe = iron  
P = phosphorus    Na = sodium    Zn = zinc  
Mg = magnesium    Cl = chlorine  
K = potassium

## Our Friend - PT

- A. A periodic table ALWAYS will be made available in class for you to reference when taking an exam or quiz.
- B. A 118 elements are arranged according to atomic number in horizontal rows and vertical columns .

Atomic# & # of proton  
#protons give physical identity

Average atomic mass (amu)  
atomic mass unit



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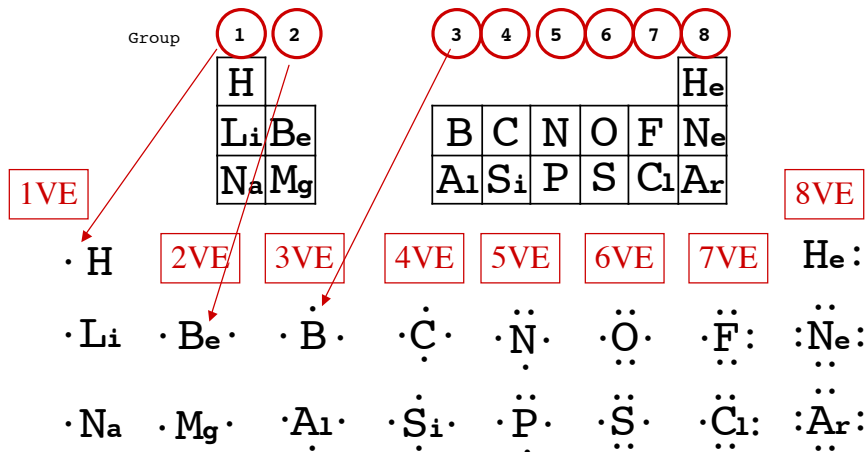
Periods  $n^{\text{th}}$  (horizontal rows)    Groups or family (vertical columns)

Group 2, two parts to its family name  
alkali    alkaline earth    halide or halogens    noble gases

| "n <sup>th</sup> " row | 1  | 2  | 3 | 4  | 5  | 6 | 7 | 8  | Group |
|------------------------|----|----|---|----|----|---|---|----|-------|
| n = 1                  | H  |    |   |    |    |   |   | He |       |
| n = 2                  | Li | Be |   | B  | C  | N | O | F  | Ne    |
| n = 3                  | Na | Mg |   | Al | Si | P | S | Cl | Ar    |
| n = 4                  | K  | Ca |   |    |    |   |   |    |       |

Electron Dot Structure = Group Number = Valence Electron (outermost)

## Chemical Reactivity



**chemical reactivity** - outermost valence electrons afford chemical reactivity

Have No Fear of Ice Cold Beer

## Seven Diatomic Molecules

|          |
|----------|
| (1)      |
| 1        |
| <b>H</b> |
| 1.008    |

hydrogen H<sub>2</sub> @ room temp is a (g)  
 nitrogen N<sub>2</sub> @ room temp is a (g)  
 oxygen O<sub>2</sub> @ room temp is a (g)  
 fluorine F<sub>2</sub> @ room temp is a (g)  
 chlorine Cl<sub>2</sub> @ room temp is a (g)  
 bromine Br<sub>2</sub> @ room temp is a (l)  
 iodine I<sub>2</sub> @ room temp is a (s)

|          |          |           |
|----------|----------|-----------|
| (15)     | (16)     | (17)      |
| 5        | 6        | 7         |
| 7        | 8        | 9         |
| <b>N</b> | <b>O</b> | <b>F</b>  |
| 14.007   | 15.999   | 18.998    |
|          |          | 17        |
|          |          | <b>Cl</b> |
|          |          | 35.45     |
|          |          | 35        |
|          |          | <b>Br</b> |
|          |          | 79.90     |
|          |          | 53        |
|          |          | <b>I</b>  |
|          |          | 126.9     |

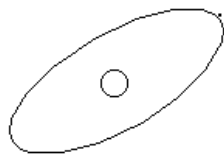
The air we breath is a homogenous mixture of

80% nitrogen N<sub>2</sub>  
 20% oxygen O<sub>2</sub>

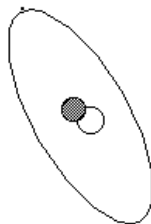
Supplemental packet page 34 - nuclear chemistry deals with the atomic nucleus

Isotopes of Hydrogen & Nuclear Fusion  
 Dr. Gergens - Mesa College

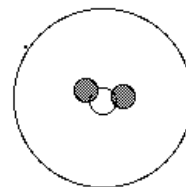
- neutron (n) mass ≈ 1 amu (atomic mass unit)
- proton (p) mass = 1 amu
- electron (e) mass = 1/2000 amu



hydrogen, H  
 hydrogen-1  
 most stable form  
 most abundant  
 99% naturally occurring



deuterium, D  
 hydrogen-2  
 stable form  
 but twice as heavy as H  
 1% naturally occurring



tritium, T  
 hydrogen-3  
 least stable form  
 radioactive  
 synthetically made

Mass Number = the number of neutrons plus the number of protons

Mass Number =  ${}^1_1\text{H}$

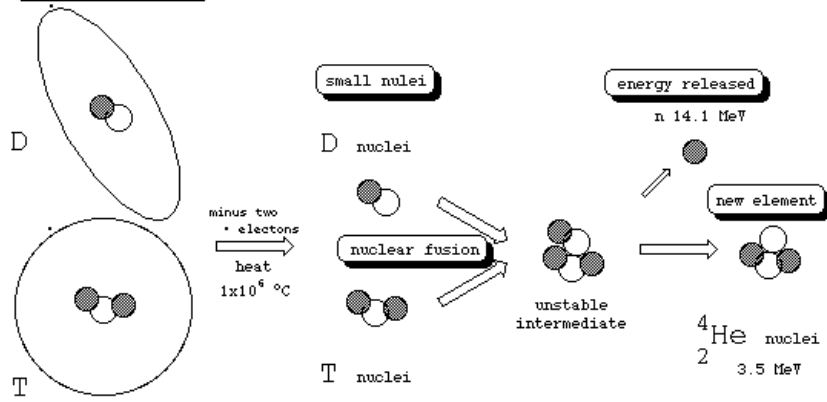
${}^2_1\text{H}$

${}^3_1\text{H}$

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**Nuclear fusion is the combining of small nuclei into a large one.**

isotopes of hydrogen



Nuclear fission is the reverse process of nuclear fusion