

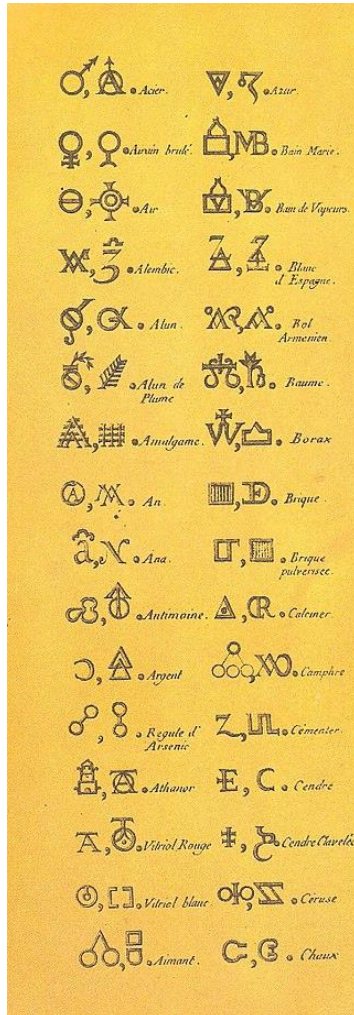
LC16 : Classification périodique

Mathieu Markovitch

La classification périodique

<p>H 1 Hydrogen Sun and Stars</p> <p>Li 3 Lithium Batteries</p> <p>Na 11 Sodium Salt</p>	<p>He 2 Helium Balloons</p> <p>Be 4 Beryllium Emeralds</p> <p>Mg 12 Magnesium Chlorophyll</p>	<p>B 5 Boron Sports Equipment</p> <p>C 6 Carbon Basis of Life's Molecules</p> <p>Al 13 Aluminum Airplanes</p>	<p>N 7 Nitrogen Protein</p> <p>O 8 Oxygen Air</p> <p>Si 14 Silicon Stone, Sand, and Soil</p>	<p>F 9 Fluorine Toothpaste</p> <p>P 15 Phosphorus Bones</p> <p>Ge 32 Germanium Semiconductor Electronics</p>	<p>Ne 10 Neon Advertising Signs</p> <p>S 16 Sulfur Egg Yolks</p> <p>As 33 Arsenic Poison</p>	<p>Ar 18 Argon Light Bulbs</p> <p>Br 35 Bromine Photography Film</p> <p>Sb 51 Antimony Car Batteries</p>	<p>K 19 Potassium Fruits and Vegetables</p> <p>Ca 20 Calcium Shells and Bones</p> <p>Rb 37 Rubidium Global Navigation</p>	<p>Sc 21 Scandium</p> <p>Ti 22 Titanium Aerospace</p> <p>Y 39 Yttrium Lasers</p>	<p>V 23 Vanadium Springs</p> <p>Cr 24 Chromium Stainless Steel</p> <p>Zr 40 Zirconium Chemical Pipelines</p>	<p>Mn 25 Manganese Earthmovers</p> <p>Fe 26 Iron Steel Structures</p> <p>Nb 41 Niobium Mag Lev Trains</p>	<p>Cu 29 Copper Electric Wires</p> <p>Ni 28 Nickel Coins</p> <p>Mo 42 Molybdenum Cutting Tools</p>	<p>Zn 30 Zinc Brass Instruments</p> <p>Co 27 Cobalt Magnets</p> <p>Tc 43 Technetium Radioactive Diagnosis</p>	<p>Ga 31 Gallium Light-Emitting Diodes (LEDs)</p> <p>Nd 60 Neodymium Laser Atom Traps</p>	<p>Ge 32 Germanium Semiconductor Electronics</p> <p>Pd 46 Palladium Jewelry</p>	<p>Se 34 Selenium Copiers</p> <p>Ag 47 Silver Jewelry</p>	<p>Br 35 Bromine Photography Film</p> <p>Cd 48 Cadmium Paint</p>	<p>Kr 36 Krypton Flashlights</p> <p>In 49 Indium Liquid Crystal Displays (LCDs)</p>	<p>Sr 38 Strontium Fireworks</p> <p>Cs 55 Cesium Atomic Clocks</p>	<p>Zn 30 Zinc Brass Instruments</p> <p>Ba 56 Barium X-Ray Diagnosis</p>	<p>Hf 72 Hafnium Nuclear Submarines</p> <p>La 57-71 Lanthanum</p>	<p>Ta 73 Tantalum Mobile Phones</p> <p>Hf 72 Hafnium Nuclear Submarines</p>	<p>W 74 Tungsten Lamp Filaments</p> <p>Rf 104 Rutherfordium</p>	<p>Re 75 Rhenium Rocket Engines</p> <p>Db 105 Dubnium</p>	<p>Os 76 Osmium Pen Points</p> <p>Sg 106 Seaborgium</p>	<p>Ir 77 Iridium Spark Plugs</p> <p>Bh 107 Bohrium</p>	<p>Pt 78 Platinum Labware</p> <p>Hs 108 Hassium</p>	<p>Au 79 Gold Jewelry</p> <p>Mt 109 Meitnerium</p>	<p>Hg 80 Mercury Thermometers</p> <p>Ds 110 Darmstadtium</p>	<p>Tl 81 Thallium Low-Temperature Thermometers</p> <p>Rg 111 Roentgenium</p>	<p>Pb 82 Lead Weights</p> <p>Cn 112 Copernicium</p>	<p>Bi 83 Bismuth Fire Sprinklers</p> <p>Nh 113 Nihonium</p>	<p>Po 84 Polonium</p> <p>Fl 114 Flerovium</p>	<p>At 85 Astatine</p> <p>Mc 115 Moscovium</p>	<p>Rn 86 Radon</p> <p>Lv 116 Livermorium</p>	<p>Ts 117 Tennessine</p> <p>Og 118 Oganesson</p>
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Historique



Nomenclature chimique
de Lavoisier (1787)

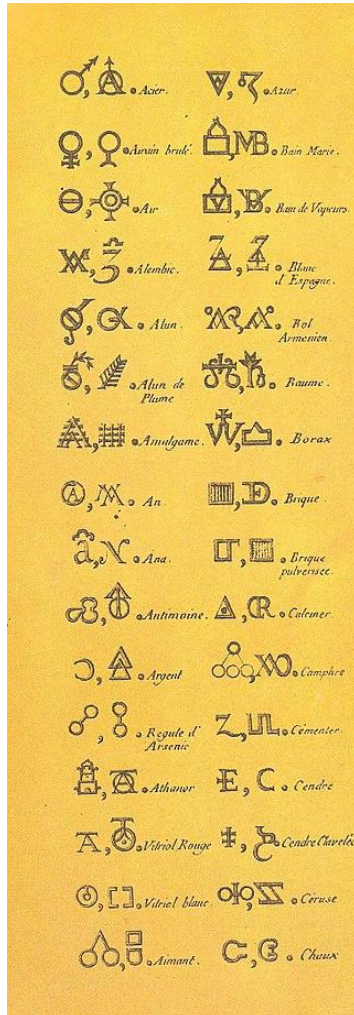


Travaux de Dalton (1804) et Avogadro (1811)

Triades de
Döbereiner (1817)

- **Alcalino-terreux:** $Sr(88) = [Ca(40) + Ba(137)]/2$
Propriétés: Blancs argentés, brillants, chimiquement assez réactifs à température et pression ambiantes.
- **Métaux Alcalins:** $Na(23) = [Li(7) + K(39)]/2$
Propriétés: Brillants, mous, très réactifs à température et pression ambiantes.
- **Halogènes:** $Br(80) = [Cl(35,5) + I(127)]/2$

Historique



Nomenclature chimique
de Lavoisier (1787)

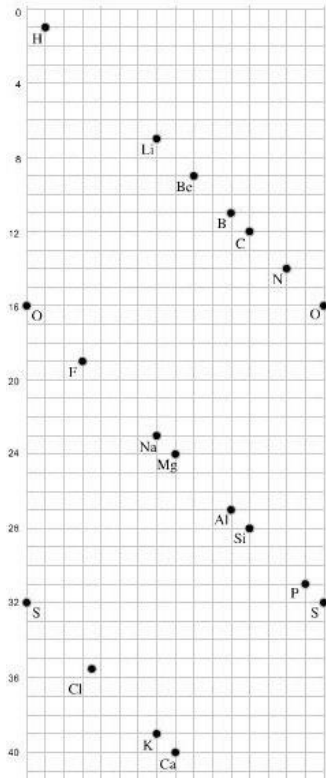


Travaux de Dalton (1804) et Avogadro (1811)

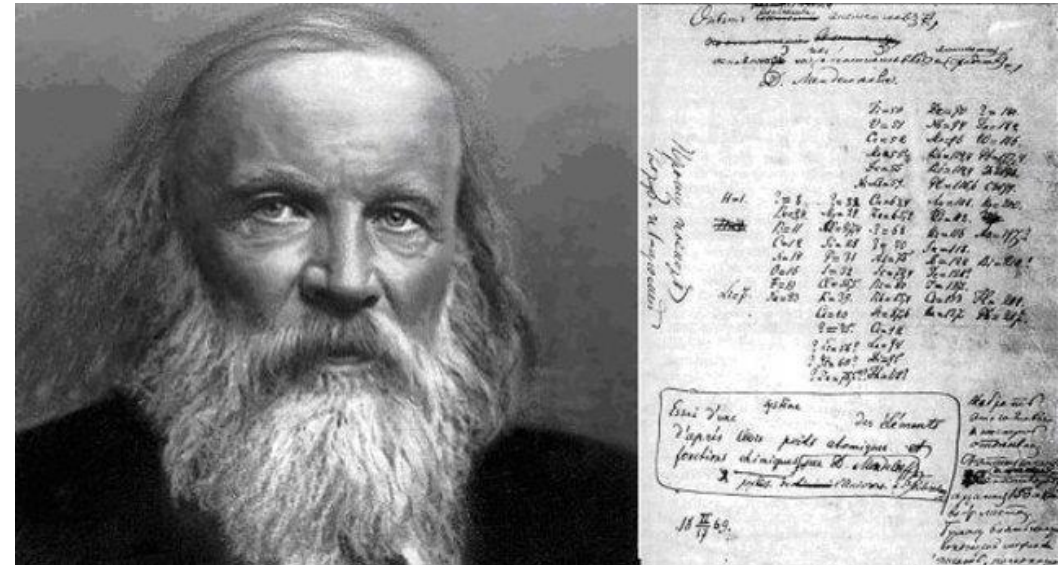
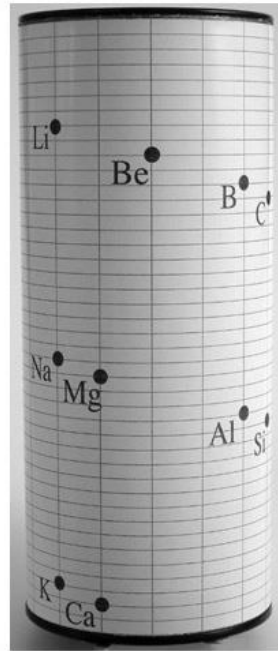
Triades de
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Propriétés: Brillants, mous, très réactifs à température et pression ambiantes.
- **Halogènes:** $Br(80) = [Cl(35,5) + I(127)]/2$
Propriété : Formation d'anions qui précipitent avec Ag^+ .

Historique



Vis tellurique de Chancourtois (1862)



Classification de Mendeleïev (1869)

Classification et configuration électronique

Bloc s

H	
Li	Be
Na	Mg
K	Ca
Rb	Sr
Cs	Ba
Fr	Ra

Bloc d

Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn
Y	Sr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd
La	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg
Ac									

Bloc p

					He
B	C	N	O	F	Ne
Al	Si	P	S	Cl	Ar
Ga	Ge	As	Se	Br	Kr
In	Sb	Te	I	Xe	
Tl	Pb	Bi	Po	At	Rn

Ce	Pr	Nd	Pm	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu
Th	Pa	U	Np	Pu	Am	Cm	Bk	Cf	Es	Em	Md	No	Lr

Bloc f

























































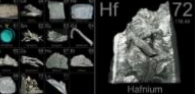

































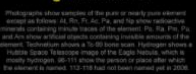





























Electronégativité

1 H 2,20 2,21 2,20																	2 He 3,20 3,00 ----
3 Li 0,97 0,84 0,98	4 Be 1,47 1,40 1,57											5 B 2,01 1,93 2,04	6 C 2,50 2,48 2,55	7 N 3,07 2,33 3,04	8 O 3,50 3,17 3,44	9 F 4,10 3,90 3,98	10 Ne 5,10 ----
11 Na 1,01 0,74 0,93	12 Mg 1,23 1,17 1,31											13 Al 1,47 1,64 1,61	14 Si 1,74 2,25 1,93	15 P 2,06 1,84 2,19	16 S 2,44 2,28 2,58	17 Cl 2,83 2,95 3,16	18 Ar 3,30 ----
19 K 0,91 0,77 0,82	20 Ca 1,04 0,99 1,00	21 Sc 1,20 ---- 1,36	22 Ti 1,32 ---- 1,54	23 V 1,45 ---- 1,63	24 Cr 1,56 ---- 1,66	25 Mn 1,60 ---- 1,55	26 Fe 1,64 ---- 1,83	27 Co ---- ---- 1,88	28 Ni ---- ---- 1,91	29 Cu 1,75 1,36 1,90	30 Zn 1,66 1,49 1,65	31 Ga 1,82 1,82 1,81	32 Ge 2,02 2,50 2,01	33 As 2,20 1,59 2,18	34 Se 2,48 2,18 2,55	35 Br 2,74 2,62 2,96	36 Kr 3,10 ---- 2,91
37 Rb 0,89 0,50 0,82	38 Sr 0,99 0,85 0,95	39 Y 1,11 ---- 1,22	40 Zr 1,22 ---- 1,33	41 Nb 1,23 ---- 1,64	42 Mo 1,30 ---- 2,16	43 Tc 1,36 ---- 1,92	44 Ru 1,42 ---- 2,18	45 Rh 1,45 ---- 2,28	46 Pd 1,35 ---- 2,20	47 Ag 1,42 ---- 1,93	48 Cd 1,46 ---- 1,69	49 In 1,49 1,57 1,78	50 Sn 1,72 2,44 1,80	51 Sb 1,82 1,46 2,05	52 Te 2,01 2,08 2,09	53 I 2,21 2,52 2,66	54 Xe 2,4 ---- 2,60
55 Cs 0,86 ---- 0,79	56 Ba 0,97 ---- 0,89	57 La 1,08 ---- 1,10	72 Hf 1,23 ---- 1,29	73 Ta 1,33 ---- 1,50	74 W 1,40 ---- 2,26	75 Re 1,46 ---- 1,94	76 Os 1,52 ---- 2,18	77 Ir 1,55 ---- 2,20	78 Pt 1,44 ---- 2,28	79 Au 1,42 ---- 2,54	80 Hg 1,44 ---- 2,00	81 Tl 1,44 ---- 1,62	82 Pb 1,55 ---- 1,87	83 Bi 1,67 ---- 2,02	84 Po 1,76 ---- 2,00	85 At 1,90 ---- 2,20	86 Rn ---- ---- ----
87 Fr 0,86 ---- 0,70	88 Ra 0,97 ---- 0,90	89 Ac 1,00 ---- 1,10															
58 Ce 1,06 1,12 ----	59 Pr 1,07 1,13 ----	60 Nd 1,07 1,14 ----	61 Pm 1,07 ---- ----	62 Sm 1,07 1,17 ----	63 Eu 1,01 ---- ----	64 Gd 1,11 1,20 ----	65 Tb 1,10 ---- ----	66 Dy 1,10 1,22 ----	67 Ho 1,10 1,23 ----	68 Er 1,11 1,24 ----	69 Tm 1,11 1,25 ----	70 Yb 1,06 ---- ----	71 Lu 1,14 1,27 ----				
90 Th 1,11 ----	91 Pa 1,14 ----	92 U 1,22 1,38 ----	93 Np 1,22 1,36 ----	94 Pu 1,20 1,28 ----	95 Am 1,20 ---- ----	96 Cm 1,20 ---- ----	97 Bk 1,20 ---- ----	98 Cf 1,20 ---- ----	99 Es 1,20 ---- ----	100 Fm 1,20 ---- ----	101 Md 1,20 ---- ----	102 No 1,20 ---- ----	103 Lr 1,20 ---- ----				

Z	X	électronégativité de ALLRED-ROCHOW
1,23	1,17	électronégativité de MULLIKEN
1,33	1,33	électronégativité de PAULING

Conclusion

The Elements

 <div>1</div> <div>Hydrogen</div>																		 <div>2</div> <div>Helium</div>					
 <div>3</div> <div>Lithium</div>	 <div>4</div> <div>Beryllium</div>																	 <div>5</div> <div>Boron</div>	 <div>6</div> <div>Carbon</div>	 <div>7</div> <div>Nitrogen</div>	 <div>8</div> <div>Oxygen</div>	 <div>9</div> <div>Fluorine</div>	 <div>10</div> <div>Neon</div>
 <div>11</div> <div>Sodium</div>	 <div>12</div> <div>Magnesium</div>																	 <div>13</div> <div>Aluminum</div>	 <div>14</div> <div>Silicon</div>	 <div>15</div> <div>Phosphorus</div>	 <div>16</div> <div>Sulfur</div>	 <div>17</div> <div>Chlorine</div>	 <div>18</div> <div>Argon</div>
 <div>19</div> <div>Potassium</div>	 <div>20</div> <div>Calcium</div>	 <div>21</div> <div>Scandium</div>	 <div>22</div> <div>Titanium</div>	 <div>23</div> <div>Vanadium</div>	 <div>24</div> <div>Chromium</div>	 <div>25</div> <div>Manganese</div>	 <div>26</div> <div>Iron</div>	 <div>27</div> <div>Cobalt</div>	 <div>28</div> <div>Nickel</div>	 <div>29</div> <div>Copper</div>	 <div>30</div> <div>Zinc</div>	 <div>31</div> <div>Gallium</div>	 <div>32</div> <div>Germanium</div>	 <div>33</div> <div>Arsenic</div>	 <div>34</div> <div>Selenium</div>	 <div>35</div> <div>Bromine</div>	 <div>36</div> <div>Krypton</div>						
 <div>37</div> <div>Rubidium</div>	 <div>38</div> <div>Strontium</div>	 <div>39</div> <div>Yttrium</div>	 <div>40</div> <div>Zirconium</div>	 <div>41</div> <div>Niobium</div>	 <div>42</div> <div>Molybdenum</div>	 <div>43</div> <div>Technetium</div>	 <div>44</div> <div>Ruthenium</div>	 <div>45</div> <div>Rhodium</div>	 <div>46</div> <div>Palladium</div>	 <div>47</div> <div>Silver</div>	 <div>48</div> <div>Cadmium</div>	 <div>49</div> <div>Indium</div>	 <div>50</div> <div>Tin</div>	 <div>51</div> <div>Antimony</div>	 <div>52</div> <div>Tellurium</div>	 <div>53</div> <div>Iodine</div>	 <div>54</div> <div>Xenon</div>						
 <div>55</div> <div>Cesium</div>	 <div>56</div> <div>Barium</div>	 <div>57</div> <div>Lanthanum</div>		 <div>72</div> <div>Hafnium</div>	 <div>73</div> <div>Tantalum</div>	 <div>74</div> <div>Tungsten</div>	 <div>75</div> <div>Rhenium</div>	 <div>76</div> <div>Osmium</div>	 <div>77</div> <div>Iridium</div>	 <div>78</div> <div>Platinum</div>	 <div>79</div> <div>Gold</div>	 <div>80</div> <div>Mercury</div>	 <div>81</div> <div>Thallium</div>	 <div>82</div> <div>Lead</div>	 <div>83</div> <div>Bismuth</div>	 <div>84</div> <div>Polonium</div>	 <div>85</div> <div>Astatine</div>	 <div>86</div> <div>Radon</div>					
 <div>87</div> <div>Francium</div>	 <div>88</div> <div>Radium</div>	 <div>89</div> <div>Actinium</div>		 <div>104</div> <div>Rutherfordium</div>	 <div>105</div> <div>Dubnium</div>	 <div>106</div> <div>Seaborgium</div>	 <div>107</div> <div>Berkelium</div>	 <div>108</div> <div>Hassium</div>	 <div>109</div> <div>Meitnerium</div>	 <div>110</div> <div>Darmstadtium</div>	 <div>111</div> <div>Roentgenium</div>	 <div>112</div> <div>Ununbium</div>	 <div>113</div> <div>Ununtrium</div>	 <div>114</div> <div>Ununquadium</div>	 <div>115</div> <div>Ununpentium</div>	 <div>116</div> <div>Ununhexium</div>	 <div>117</div> <div>Ununseptium</div>	 <div>118</div> <div>Ununoctium</div>					
 <div>57-71</div>		 <div>58</div> <div>Cerium</div>	 <div>59</div> <div>Praseodymium</div>	 <div>60</div> <div>Neodymium</div>	 <div>61</div> <div>Promethium</div>	 <div>62</div> <div>Samarium</div>	 <div>63</div> <div>Europium</div>	 <div>64</div> <div>Gadolinium</div>	 <div>65</div> <div>Terbium</div>	 <div>66</div> <div>Dysprosium</div>	 <div>67</div> <div>Holmium</div>	 <div>68</div> <div>Erbium</div>	 <div>69</div> <div>Thulium</div>	 <div>70</div> <div>Ytterbium</div>	 <div>71</div> <div>Lutetium</div>								
 <div>89</div> <div>Actinium</div>	 <div>90</div> <div>Thorium</div>	 <div>91</div> <div>Protactinium</div>	 <div>92</div> <div>Uranium</div>	 <div>93</div> <div>Neptunium</div>	 <div>94</div> <div>Plutonium</div>	 <div>95</div> <div>Americium</div>	 <div>96</div> <div>Curium</div>	 <div>97</div> <div>Berkelium</div>	 <div>98</div> <div>Californium</div>	 <div>99</div> <div>Einsteinium</div>	 <div>100</div> <div>Fermium</div>	 <div>101</div> <div>Mendelevium</div>	 <div>102</div> <div>Nobelium</div>	 <div>103</div> <div>Lawrencium</div>									

Photographs show samples of the pure or nearly pure element, except for Francium, Actinium, and the actinides. The color and texture of the elements are shown. The elements are arranged in order of increasing atomic number. The elements are shown in their standard state at room temperature and pressure. The elements are shown in their standard state at room temperature and pressure. The elements are shown in their standard state at room temperature and pressure. The elements are shown in their standard state at room temperature and pressure. The elements are shown in their standard state at room temperature and pressure. The elements are shown in their standard state at room temperature and pressure. The elements are shown in their standard state at room temperature and pressure. The elements are shown in their standard state at room temperature and pressure. The elements are shown in their standard state at room temperature and pressure. 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