

PERIODIC TABLE

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
|---|-----------------------------|------------------------------|-----------------------------|--------------------------------|-----------------------------|-------------------------------|------------------------------|------------------------------|-----------------------------|-------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|-----------------------------|----------------------------|
| 1 | S Block | | | | | | | | | | | | P Block | | | | | |
| | Atomic Number — 1 | | | | | | | | | | | | Atomic Mass | | | | | |
| | Element Symbol — H | | | | | | | | | | | | Element Name — Hydrogen | | | | | |
| | D Block | | | | | | | | | | | | | | | | | |
| 1 | 1 1.0078 H Hydrogen | | | | | | | | | | | | | | | | | 2 4.0026 He Helium |
| 2 | 3 6.9410 Li Lithium | 4 9.0122 Be Beryllium | | | | | | | | | | | 5 10.811 B Boron | 6 12.011 C Carbon | 7 14.007 N Nitrogen | 8 15.999 O Oxygen | 9 18.998 F Fluorine | 10 20.180 Ne Neon |
| 3 | 11 22.990 Na Sodium | 12 24.305 Mg Magnesium | | | | | | | | | | | 13 26.982 Al Aluminium | 14 28.086 Si Silicon | 15 30.974 P Phosphorus | 16 32.065 S Sulfur | 17 35.453 Cl Chlorine | 18 39.948 Ar Argon |
| 4 | 19 39.098 K Potassium | 20 40.078 Ca Calcium | 21 44.956 Sc Scandium | 22 47.867 Ti Titanium | 23 50.942 V Vanadium | 24 51.996 Cr Chromium | 25 54.938 Mn Manganese | 26 55.845 Fe Iron | 27 58.933 Co Cobalt | 28 58.693 Ni Nickel | 29 63.546 Cu Copper | 30 65.380 Zn Zinc | 31 69.723 Ga Gallium | 32 72.640 Ge Germanium | 33 74.922 As Arsenic | 34 78.960 Se Selenium | 35 79.904 Br Bromine | 36 83.798 Kr Krypton |
| 5 | 37 85.468 Rb Rubidium | 38 87.620 Sr Strontium | 39 88.906 Y Yttrium | 40 91.224 Zr Zirconium | 41 92.906 Nb Niobium | 42 95.950 Mo Molybdenum | 43 98 Tc Technetium | 44 101.07 Ru Ruthenium | 45 102.91 Rh Rhodium | 46 106.42 Pd Palladium | 47 107.87 Ag Silver | 48 112.41 Cd Cadmium | 49 114.82 In Indium | 50 118.71 Sn Tin | 51 121.76 Sb Antimony | 52 127.60 Te Tellurium | 53 126.90 I Iodine | 54 131.29 Xe Xenon |
| 6 | 55 132.91 Cs Caesium | 56 137.33 Ba Barium | 57 - 71 | 72 178.49 Hf Hafnium | 73 180.95 Ta Tantalum | 74 183.84 W Tungsten | 75 186.21 Re Rhenium | 76 190.23 Os Osmium | 77 192.22 Ir Iridium | 78 195.08 Pt Platinum | 79 196.97 Au Gold | 80 200.59 Hg Mercury | 81 204.38 Tl Thallium | 82 207.20 Pb Lead | 83 208.98 Bi Bismuth | 84 209 Po Polonium | 85 210 At Astatine | 86 222 Rn Radon |
| 7 | 87 223 Fr Francium | 88 226 Ra Radium | 89 - 103 | 104 261 Rf Rutherfordium | 105 262 Db Dubnium | 106 Sg Seaborgium | 107 264 Bh Bohrium | 108 269 Hs Hassium | 109 278 Mt Meitnerium | 110 281 Ds Darmstadtium | 111 282 Rg Roentgenium | 112 285 Cn Copernicium | 113 286 Nh Nihonium | 114 289 Fl Flerovium | 115 289 Mc Moscovium | 116 293 Lv Livermorium | 117 Ts Tennessine | 118 294 Og Oganesson |

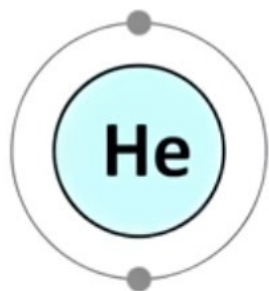
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|---------|-------------------|---|------------------------------|----------------------------|---------------------------------|------------------------------|------------------------------|-----------------------------|-----------------------------|-------------------------------|----------------------------|------------------------------|-----------------------------|---------------------------|------------------------------|------------------------------|-----------------------------|
| F Block | Lanthanide Series | 6 | 57 138.91 La Lanthanum | 58 140.12 Ce Cerium | 59 140.91 Pr Praseodymium | 60 144.24 Nd Neodymium | 61 145 Pm Promethium | 62 150.36 Sm Samarium | 63 151.96 Eu Europium | 64 157.25 Gd Gadolinium | 65 158.93 Tb Terbium | 66 162.5 Dy Dysprosium | 67 164.93 Ho Holmium | 68 167.26 Er Erbium | 69 168.93 Tm Thulium | 70 173.04 Yb Ytterbium | 71 174.97 Lu Lutetium |
| | Actinide Series | 7 | 89 227 Ac Actinium | 90 232.04 Th Thorium | 91 231.04 Pa Protactinium | 92 238.03 U Uranium | 93 237.05 Np Neptunium | 94 244 Pu Plutonium | 95 243 Am Americium | 96 247 Cm Curium | 97 247 Bk Berkelium | 98 251 Cf Californium | 99 252 Es Einsteinium | 100 257 Fm Fermium | 101 258 Md Mendelevium | 102 259 No Nobelium | 103 262 Lr Lawrencium |

- Transition metals
- Alkaline-earth metals
- Nonmetals
- Post-transition metals
- Actinoid
- Noble gas
- Alkali metals
- Metalloids
- Rare earth elements (21, 39, 57-71) and lanthanoid elements (57-71 only)

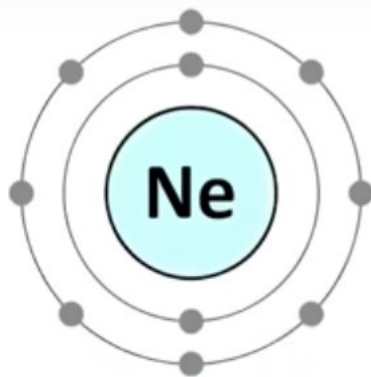
| Closed shells | | Alkaline earths | | | | | | | | | | Rare Halogens gases | | | | | | | | | | | | |
|-----------------------------|-------------|-----------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|------------------------|------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|----------------|----------------|----------------|----------------|----------------|---------------------|
| Alkalis | | | | | | | | | | | | | | | | | | | | | | | | |
| Groups: | 1 | 2 | Transition elements | | | | | | | | | | 13 | 14 | 15 | 16 | 17 | 18 | | | | | | |
| | 1 | | | | | | | | | | | | | | | | | | 2 | | | | | |
| | H | | | | | | | | | | | | | | | | | | He | | | | | |
| | $1s$ | | | | | | | | | | | | | | | | | | $1s^2$ | | | | | |
| $1s^2$ | 3 | 4 | | | | | | | | | | | 5 | 6 | 7 | 8 | 9 | 10 | | | | | | |
| | Li | Be | | | | | | | | | | | B | C | N | O | F | Ne | | | | | | |
| | $2s^1$ | $2s^2$ | | | | | | | | | | | $2s^2 2p^1$ | $2s^2 2p^2$ | $2s^2 2p^3$ | $2s^2 2p^4$ | $2s^2 2p^5$ | $2s^2 2p^6$ | | | | | | |
| $2s^2 2p^6$ | 11 | 12 | | | | | | | | | | | 13 | 14 | 15 | 16 | 17 | 18 | | | | | | |
| | Na | Mg | | | | | | | | | | | Al | Si | P | S | Cl | Ar | | | | | | |
| | $3s^1$ | $3s^2$ | | | | | | | | | | | $3s^2 3p^1$ | $3s^2 3p^2$ | $3s^2 3p^3$ | $3s^2 3p^4$ | $3s^2 3p^5$ | $3s^2 3p^6$ | | | | | | |
| $3s^2 3p^6$ | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | | | | | | |
| | K | Ca | Sc | Ti | V | Cr | Mn | Fe | Co | Ni | Cu | Zn | Ga | Ge | As | Se | Br | Kr | | | | | | |
| | $4s^1$ | $4s^2$ | $3d^1 4s^2$ | $3d^2 4s^2$ | $3d^3 4s^2$ | $3d^5 4s^1$ | $3d^5 4s^2$ | $3d^6 4s^2$ | $3d^7 4s^2$ | $3d^8 4s^2$ | $3d^{10} 4s^1$ | $3d^{10} 4s^2$ | $3d^{10} 4s^2$ | $3d^{10} 4s^2$ | $3d^{10} 4s^2$ | $3d^{10} 4s^2$ | $3d^{10} 4s^2$ | $3d^{10} 4s^2$ | | | | | | |
| $3d^{10} 4s^2 4p^6$ | 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 | 51 | 52 | 53 | 54 | | | | | | |
| | Rb | Sr | Y | Zr | Nb | Mo | Tc | Ru | Rh | Pd | Ag | Cd | In | Sn | Sb | Te | I | Xe | | | | | | |
| | $5s^1$ | $5s^2$ | $4d^1 5s^2$ | $4d^2 5s^2$ | $4d^4 5s^1$ | $4d^5 5s^1$ | $4d^6 5s^1$ | $4d^7 5s^1$ | $4d^8 5s^1$ | $4d^{10}$ | $4d^{10} 5s^1$ | $4d^{10} 5s^2$ | $4d^{10} 5s^2$ | $4d^{10} 5s^2$ | $4d^{10} 5s^2$ | $4d^{10} 5s^2$ | $4d^{10} 5s^2$ | $4d^{10} 5s^2$ | | | | | | |
| $4d^{10} 5s^2 5p^6$ | 55 | 56 | 57 | 72 | 73 | 74 | 75 | 76 | 77 | 78 | 79 | 80 | 81 | 82 | 83 | 84 | 85 | 86 | | | | | | |
| | Cs | Ba | La | Hf | Ta | W | Re | Os | Ir | Pt | Au | Hg | Tl | Pb | Bi | Po | At | Rn | | | | | | |
| | $6s^1$ | $6s^2$ | $5d^1 6s^2$ | $4f^{14} 5d^2 6s^2$ | $4f^{14} 5d^3 6s^2$ | $4f^{14} 5d^4 6s^2$ | $4f^{14} 5d^5 6s^2$ | $4f^{14} 5d^6 6s^2$ | $4f^{14} 5d^7 6s^1$ | $4f^{14} 5d^9 6s^1$ | $4f^{14} 5d^{10} 6s^1$ | $4f^{14} 5d^{10} 6s^2$ | $4f^{14} 5d^{10} 6s^2 6p^1$ | $4f^{14} 5d^{10} 6s^2 6p^2$ | $4f^{14} 5d^{10} 6s^2 6p^3$ | $4f^{14} 5d^{10} 6s^2 6p^4$ | $4f^{14} 5d^{10} 6s^2 6p^5$ | $4f^{14} 5d^{10} 6s^2 6p^6$ | | | | | | |
| $4f^{14} 5d^{10} 6s^2 6p^6$ | 87 | 88 | 89 | 104 | 105 | 106 | 107 | 108 | 109 | 110 | 111 | 112 | | | | | | | | | | | | |
| | Fr | Ra | Ac | Rf | Db | Sg | Bh | Hs | Mt | Ds | Rg | Cn | | | | | | | | | | | | |
| | $7s^1$ | $7s^2$ | $6d^1 7s^2$ | $5f^{14} 6d^2 7s^2$ | $5f^{14} 6d^3 7s^2$ | $5f^{14} 6d^4 7s^2$ | $5f^{14} 6d^5 7s^2$ | $5f^{14} 6d^6 7s^2$ | $5f^{14} 6d^7 7s^1$ | $5f^{14} 6d^9 7s^1$ | $5f^{14} 6d^{10} 7s^1$ | $5f^{14} 6d^{10} 7s^2$ | | | | | | | | | | | | |
| | Lanthanides | | | | | | | | | | 58 | 59 | 60 | 61 | 62 | 63 | 64 | 65 | 66 | 67 | 68 | 69 | 70 | 71 |
| | | | | | | | | | | | Ce | Pr | Nd | Pm | Sm | Eu | Gd | Tb | Dy | Ho | Er | Tm | Yb | Lu |
| | | | | | | | | | | | $4f^2 6s^2$ | $4f^3 6s^2$ | $4f^4 6s^2$ | $4f^5 6s^2$ | $4f^6 6s^2$ | $4f^7 6s^2$ | $4f^7 6s^2$ | $4f^9 6s^2$ | $4f^{10} 6s^2$ | $4f^{11} 6s^2$ | $4f^{12} 6s^2$ | $4f^{13} 6s^2$ | $4f^{14} 6s^2$ | $4f^{14} 5d^1 6s^2$ |
| | Actinides | | | | | | | | | | 90 | 91 | 92 | 93 | 94 | 95 | 96 | 97 | 98 | 99 | 100 | 101 | 102 | 103 |
| | | | | | | | | | | | Th | Pa | U | Np | Pu | Am | Cm | Bk | Cf | Es | Fm | Md | No | Lr |
| | | | | | | | | | | | $6d^2 7s^2$ | $5f^2 6d^1 7s^2$ | $5f^3 6d^1 7s^2$ | $5f^4 6d^1 7s^2$ | $5f^6 7s^2$ | $5f^7 7s^2$ | $5f^7 6d^1 7s^2$ | $5f^8 6d^1 7s^2$ | $5f^{10} 7s^2$ | $5f^{11} 7s^2$ | $5f^{12} 7s^2$ | $5f^{13} 7s^2$ | $5f^{14} 7s^2$ | $5f^{14} 6d^1 7s^2$ |

Figure 8.2 The atomic number and element symbol are given in the top of each box. The electron configuration for each element is specified by giving the values of the principal quantum numbers n , the angular momentum quantum numbers ℓ (s , p , d , or f), and the number of elec-

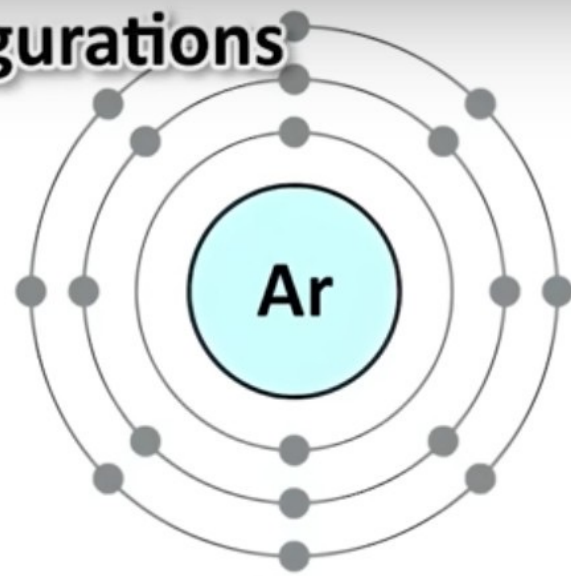
Stable electron orbital configurations



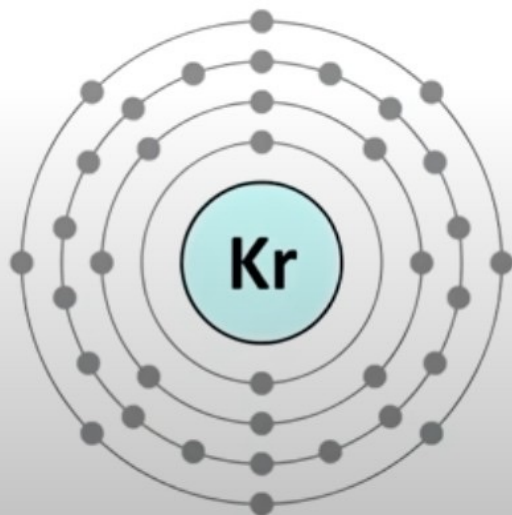
2



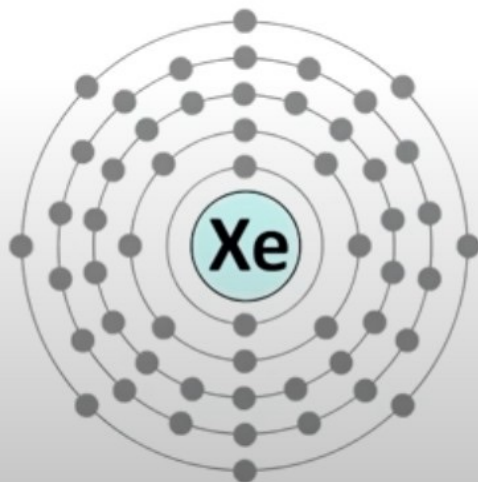
10



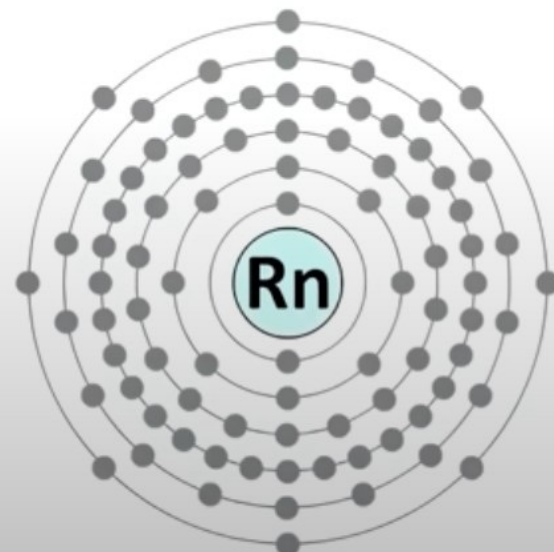
18



36



54



86

