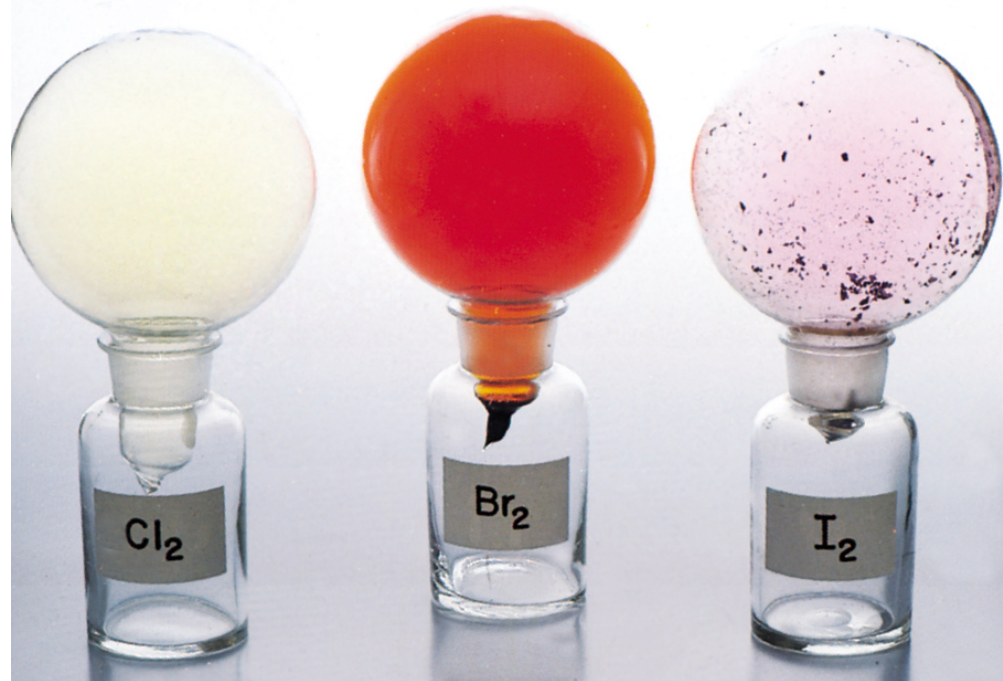


| ELEMENTS                                                                         |            |    |                                                                                   |           |     |
|----------------------------------------------------------------------------------|------------|----|-----------------------------------------------------------------------------------|-----------|-----|
|   | Hydrogen.  | 1  |   | Strontian | 46  |
|  | Azote      | 5  |  | Barytes   | 68  |
|  | Carbon     | 54 |  | Iron      | 50  |
|  | Oxygen     | 7  |  | Zinc      | 56  |
|  | Phosphorus | 9  |  | Copper    | 56  |
|  | Sulphur    | 13 |  | Lead      | 90  |
|  | Magnesia   | 20 |  | Silver    | 190 |
|  | Lime       | 24 |  | Gold      | 190 |
|  | Soda       | 28 |  | Platina   | 190 |
|  | Potash     | 42 |  | Mercury   | 167 |



# Relaciones periódicas entre los elementos

## Capítulo 8

# Cuándo se descubrieron los elementos

|                                                                                   |                  |                                                                                   |           |                                                                                   |           |                                                                                     |       |
|-----------------------------------------------------------------------------------|------------------|-----------------------------------------------------------------------------------|-----------|-----------------------------------------------------------------------------------|-----------|-------------------------------------------------------------------------------------|-------|
|   | Ancient times    |   | 1735–1843 |   | 1894–1918 |                                                                                     |       |
|  | Middle Ages–1700 |  | 1843–1886 |  | 1923–1961 |  | 1965– |

|          |          |          |           |           |           |           |           |           |           |           |          |          |           |           |           |           |          |
|----------|----------|----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|----------|----------|-----------|-----------|-----------|-----------|----------|
| 1<br>H   |          |          |           |           |           |           |           |           |           |           |          |          |           |           |           |           | 2<br>He  |
| 3<br>Li  | 4<br>Be  |          |           |           |           |           |           |           |           |           |          | 5<br>B   | 6<br>C    | 7<br>N    | 8<br>O    | 9<br>F    | 10<br>Ne |
| 11<br>Na | 12<br>Mg |          |           |           |           |           |           |           |           |           |          | 13<br>Al | 14<br>Si  | 15<br>P   | 16<br>S   | 17<br>Cl  | 18<br>Ar |
| 19<br>K  | 20<br>Ca | 21<br>Sc | 22<br>Ti  | 23<br>V   | 24<br>Cr  | 25<br>Mn  | 26<br>Fe  | 27<br>Co  | 28<br>Ni  | 29<br>Cu  | 30<br>Zn | 31<br>Ga | 32<br>Ge  | 33<br>As  | 34<br>Se  | 35<br>Br  | 36<br>Kr |
| 37<br>Rb | 38<br>Sr | 39<br>Y  | 40<br>Zr  | 41<br>Nb  | 42<br>Mo  | 43<br>Tc  | 44<br>Ru  | 45<br>Rh  | 46<br>Pd  | 47<br>Ag  | 48<br>Cd | 49<br>In | 50<br>Sn  | 51<br>Sb  | 52<br>Te  | 53<br>I   | 54<br>Xe |
| 55<br>Cs | 56<br>Ba | 57<br>La | 72<br>Hf  | 73<br>Ta  | 74<br>W   | 75<br>Re  | 76<br>Os  | 77<br>Ir  | 78<br>Pt  | 79<br>Au  | 80<br>Hg | 81<br>Tl | 82<br>Pb  | 83<br>Bi  | 84<br>Po  | 85<br>At  | 86<br>Rn |
| 87<br>Fr | 88<br>Ra | 89<br>Ac | 104<br>Rf | 105<br>Db | 106<br>Sg | 107<br>Bh | 108<br>Hs | 109<br>Mt | 110<br>Ds | 111<br>Rg | 112      | (113)    | 114       | (115)     | 116       | (117)     | (118)    |
|          |          |          |           |           |           |           |           |           |           |           |          |          |           |           |           |           |          |
|          |          |          | 58<br>Ce  | 59<br>Pr  | 60<br>Nd  | 61<br>Pm  | 62<br>Sm  | 63<br>Eu  | 64<br>Gd  | 65<br>Tb  | 66<br>Dy | 67<br>Ho | 68<br>Er  | 69<br>Tm  | 70<br>Yb  | 71<br>Lu  |          |
|          |          |          | 90<br>Th  | 91<br>Pa  | 92<br>U   | 93<br>Np  | 94<br>Pu  | 95<br>Am  | 96<br>Cm  | 97<br>Bk  | 98<br>Cf | 99<br>Es | 100<br>Fm | 101<br>Md | 102<br>No | 103<br>Lr |          |

# Configuración electrónica de los elementos en su estado natural

# Configuración electrónica de los elementos en su estado natural

|                  |                   |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |        |  |                   |                   |    |  |    |  |    |  |    |  |    |  |    |  |  |  |  |        |  |  |                      |                      |                      |                      |                      |                        |  |  |  |  |  |  |  |  |  |  |            |            |            |            |            |  |  |  |                    |                    |  |  |  |  |  |  |  |  |  |  |  |  |  |            |  |  |  |  |                        |                        |                       |                       |                        |                        |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                   |                    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                        |                        |                       |                        |                        |                        |                        |                        |                           |                           |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                        |                        |                        |                        |                        |                        |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                    |                    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                       |                        |                        |                        |                        |                        |                        |                       |                           |                           |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                        |                        |                        |                        |                       |                        |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                    |                    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                        |                        |                        |                       |                        |                        |                        |                        |                           |                           |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                        |                        |                        |                        |                        |                        |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                    |                    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                        |                         |                         |                         |                         |                         |                         |                         |                         |                            |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |       |     |       |     |       |       |
|------------------|-------------------|----|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--------|--|-------------------|-------------------|----|--|----|--|----|--|----|--|----|--|----|--|--|--|--|--------|--|--|----------------------|----------------------|----------------------|----------------------|----------------------|------------------------|--|--|--|--|--|--|--|--|--|--|------------|------------|------------|------------|------------|--|--|--|--------------------|--------------------|--|--|--|--|--|--|--|--|--|--|--|--|--|------------|--|--|--|--|------------------------|------------------------|-----------------------|-----------------------|------------------------|------------------------|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|-------------------|--------------------|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|------------------------|------------------------|-----------------------|------------------------|------------------------|------------------------|------------------------|------------------------|---------------------------|---------------------------|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|------------------------|------------------------|------------------------|------------------------|------------------------|------------------------|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--------------------|--------------------|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|-----------------------|------------------------|------------------------|------------------------|------------------------|------------------------|------------------------|-----------------------|---------------------------|---------------------------|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|------------------------|------------------------|------------------------|------------------------|-----------------------|------------------------|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--------------------|--------------------|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|------------------------|------------------------|------------------------|-----------------------|------------------------|------------------------|------------------------|------------------------|---------------------------|---------------------------|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|------------------------|------------------------|------------------------|------------------------|------------------------|------------------------|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--------------------|--------------------|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|------------------------|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|----------------------------|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|-------|-----|-------|-----|-------|-------|
|                  |                   |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | $ns^1$ |  |                   |                   |    |  |    |  |    |  |    |  |    |  |    |  |  |  |  | $ns^2$ |  |  |                      |                      |                      |                      |                      |                        |  |  |  |  |  |  |  |  |  |  | $ns^2np^1$ | $ns^2np^2$ | $ns^2np^3$ | $ns^2np^4$ | $ns^2np^5$ |  |  |  |                    |                    |  |  |  |  |  |  |  |  |  |  |  |  |  | $ns^2np^6$ |  |  |  |  |                        |                        |                       |                       |                        |                        |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                   |                    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                        |                        |                       |                        |                        |                        |                        |                        |                           |                           |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                        |                        |                        |                        |                        |                        |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                    |                    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                       |                        |                        |                        |                        |                        |                        |                       |                           |                           |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                        |                        |                        |                        |                       |                        |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                    |                    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                        |                        |                        |                       |                        |                        |                        |                        |                           |                           |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                        |                        |                        |                        |                        |                        |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                    |                    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                        |                         |                         |                         |                         |                         |                         |                         |                         |                            |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |       |     |       |     |       |       |
| 1A               |                   | 2A |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |        |  |                   |                   | 3A |  | 4A |  | 5A |  | 6A |  | 7A |  | 8A |  |  |  |  |        |  |  |                      |                      |                      |                      |                      |                        |  |  |  |  |  |  |  |  |  |  |            |            |            |            |            |  |  |  |                    |                    |  |  |  |  |  |  |  |  |  |  |  |  |  |            |  |  |  |  |                        |                        |                       |                       |                        |                        |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                   |                    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                        |                        |                       |                        |                        |                        |                        |                        |                           |                           |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                        |                        |                        |                        |                        |                        |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                    |                    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                       |                        |                        |                        |                        |                        |                        |                       |                           |                           |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                        |                        |                        |                        |                       |                        |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                    |                    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                        |                        |                        |                       |                        |                        |                        |                        |                           |                           |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                        |                        |                        |                        |                        |                        |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                    |                    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |                        |                         |                         |                         |                         |                         |                         |                         |                         |                            |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |       |     |       |     |       |       |
| 1<br>H<br>$1s^1$ | 2<br>He<br>$1s^2$ |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |        |  | 3<br>Li<br>$2s^1$ | 4<br>Be<br>$2s^2$ |    |  |    |  |    |  |    |  |    |  |    |  |  |  |  |        |  |  | 5<br>B<br>$2s^22p^1$ | 6<br>C<br>$2s^22p^2$ | 7<br>N<br>$2s^22p^3$ | 8<br>O<br>$2s^22p^4$ | 9<br>F<br>$2s^22p^5$ | 10<br>Ne<br>$2s^22p^6$ |  |  |  |  |  |  |  |  |  |  |            |            |            |            |            |  |  |  | 11<br>Na<br>$3s^1$ | 12<br>Mg<br>$3s^2$ |  |  |  |  |  |  |  |  |  |  |  |  |  |            |  |  |  |  | 13<br>Al<br>$3s^23p^1$ | 14<br>Si<br>$3s^23p^2$ | 15<br>P<br>$3s^23p^3$ | 16<br>S<br>$3s^23p^4$ | 17<br>Cl<br>$3s^23p^5$ | 18<br>Ar<br>$3s^23p^6$ |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 19<br>K<br>$4s^1$ | 20<br>Ca<br>$4s^2$ |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 21<br>Sc<br>$4s^23d^1$ | 22<br>Ti<br>$4s^23d^2$ | 23<br>V<br>$4s^23d^3$ | 24<br>Cr<br>$4s^13d^5$ | 25<br>Mn<br>$4s^23d^5$ | 26<br>Fe<br>$4s^23d^6$ | 27<br>Co<br>$4s^23d^7$ | 28<br>Ni<br>$4s^23d^8$ | 29<br>Cu<br>$4s^13d^{10}$ | 30<br>Zn<br>$4s^23d^{10}$ |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 31<br>Ga<br>$4s^24p^1$ | 32<br>Ge<br>$4s^24p^2$ | 33<br>As<br>$4s^24p^3$ | 34<br>Se<br>$4s^24p^4$ | 35<br>Br<br>$4s^24p^5$ | 36<br>Kr<br>$4s^24p^6$ |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 37<br>Rb<br>$5s^1$ | 38<br>Sr<br>$5s^2$ |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 39<br>Y<br>$5s^24d^1$ | 40<br>Zr<br>$5s^24d^2$ | 41<br>Nb<br>$5s^14d^4$ | 42<br>Mo<br>$5s^14d^5$ | 43<br>Tc<br>$5s^24d^5$ | 44<br>Ru<br>$5s^14d^7$ | 45<br>Rh<br>$5s^14d^8$ | 46<br>Pd<br>$4d^{10}$ | 47<br>Ag<br>$5s^14d^{10}$ | 48<br>Cd<br>$5s^24d^{10}$ |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 49<br>In<br>$5s^25p^1$ | 50<br>Sn<br>$5s^25p^2$ | 51<br>Sb<br>$5s^25p^3$ | 52<br>Te<br>$5s^25p^4$ | 53<br>I<br>$5s^25p^5$ | 54<br>Xe<br>$5s^25p^6$ |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 55<br>Cs<br>$6s^1$ | 56<br>Ba<br>$6s^2$ |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 57<br>La<br>$6s^25d^1$ | 72<br>Hf<br>$6s^25d^2$ | 73<br>Ta<br>$6s^25d^3$ | 74<br>W<br>$6s^25d^4$ | 75<br>Re<br>$6s^25d^5$ | 76<br>Os<br>$6s^25d^6$ | 77<br>Ir<br>$6s^25d^7$ | 78<br>Pt<br>$6s^15d^9$ | 79<br>Au<br>$6s^15d^{10}$ | 80<br>Hg<br>$6s^25d^{10}$ |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 81<br>Tl<br>$6s^26p^1$ | 82<br>Pb<br>$6s^26p^2$ | 83<br>Bi<br>$6s^26p^3$ | 84<br>Po<br>$6s^26p^4$ | 85<br>At<br>$6s^26p^5$ | 86<br>Rn<br>$6s^26p^6$ |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 87<br>Fr<br>$7s^1$ | 88<br>Ra<br>$7s^2$ |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 89<br>Ac<br>$7s^26d^1$ | 104<br>Rf<br>$7s^26d^2$ | 105<br>Db<br>$7s^26d^3$ | 106<br>Sg<br>$7s^26d^4$ | 107<br>Bh<br>$7s^26d^5$ | 108<br>Hs<br>$7s^26d^6$ | 109<br>Mt<br>$7s^26d^7$ | 110<br>Ds<br>$7s^26d^8$ | 111<br>Rg<br>$7s^26d^9$ | 112<br>Cn<br>$7s^26d^{10}$ |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | (113) | 114 | (115) | 116 | (117) | (118) |

4f

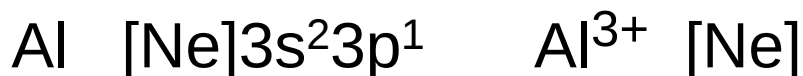
5f

|                            |                            |                           |                            |                        |                        |                            |                        |                           |                           |                            |                            |                            |                                |
|----------------------------|----------------------------|---------------------------|----------------------------|------------------------|------------------------|----------------------------|------------------------|---------------------------|---------------------------|----------------------------|----------------------------|----------------------------|--------------------------------|
| 58<br>Ce<br>$6s^24f^15d^1$ | 59<br>Pr<br>$6s^24f^3$     | 60<br>Nd<br>$6s^24f^4$    | 61<br>Pm<br>$6s^24f^5$     | 62<br>Sm<br>$6s^24f^6$ | 63<br>Eu<br>$6s^24f^7$ | 64<br>Gd<br>$6s^24f^75d^1$ | 65<br>Tb<br>$6s^24f^9$ | 66<br>Dy<br>$6s^24f^{10}$ | 67<br>Ho<br>$6s^24f^{11}$ | 68<br>Er<br>$6s^24f^{12}$  | 69<br>Tm<br>$6s^24f^{13}$  | 70<br>Yb<br>$6s^24f^{14}$  | 71<br>Lu<br>$6s^24f^{14}5d^1$  |
| 90<br>Th<br>$7s^26d^2$     | 91<br>Pa<br>$7s^25f^26d^1$ | 92<br>U<br>$7s^25f^36d^1$ | 93<br>Np<br>$7s^25f^46d^1$ | 94<br>Pu<br>$7s^25f^6$ | 95<br>Am<br>$7s^25f^7$ | 96<br>Cm<br>$7s^25f^76d^1$ | 97<br>Bk<br>$7s^25f^9$ | 98<br>Cf<br>$7s^25f^{10}$ | 99<br>Es<br>$7s^25f^{11}$ | 100<br>Fm<br>$7s^25f^{12}$ | 101<br>Md<br>$7s^25f^{13}$ | 102<br>No<br>$7s^25f^{14}$ | 103<br>Lr<br>$7s^25f^{14}6d^1$ |

# Clasificación de los elementos

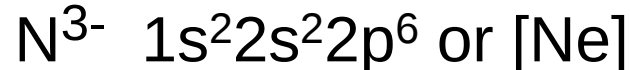
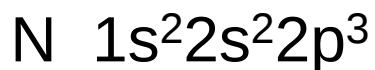
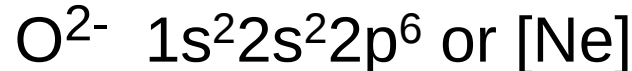
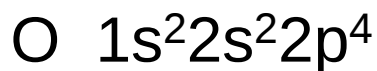
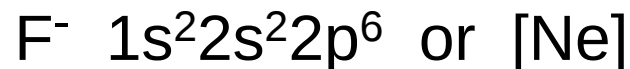
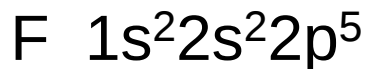
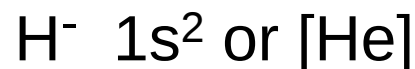
|          |          |          |           |           |           |           |           |           |           |           |          |          |          |          |          |          |                            |                      |                            |             |          |          |          |          |          |          |          |           |           |           |           |
|----------|----------|----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|----------|----------|----------|----------|----------|----------|----------------------------|----------------------|----------------------------|-------------|----------|----------|----------|----------|----------|----------|----------|-----------|-----------|-----------|-----------|
| 1<br>1A  |          |          |           |           |           |           |           |           |           |           |          |          |          |          |          |          | Representative<br>elements |                      | Zinc<br>Cadmium<br>Mercury |             | 18<br>8A |          |          |          |          |          |          |           |           |           |           |
| 1<br>H   | 2<br>2A  |          |           |           |           |           |           |           |           |           |          |          |          |          |          |          |                            | Noble gases          |                            | Lanthanides |          | 13<br>3A |          | 14<br>4A | 15<br>5A | 16<br>6A | 17<br>7A | 2<br>He   |           |           |           |
| 3<br>Li  | 4<br>Be  |          |           |           |           |           |           |           |           |           |          |          |          |          |          |          |                            | Transition<br>metals |                            | Actinides   |          | 5<br>B   |          | 6<br>C   | 7<br>N   | 8<br>O   | 9<br>F   | 10<br>Ne  |           |           |           |
| 11<br>Na | 12<br>Mg | 3<br>3B  | 4<br>4B   | 5<br>5B   | 6<br>6B   | 7<br>7B   | 8         | 9         | 10        | 11<br>1B  | 12<br>2B | 13<br>Al | 14<br>Si | 15<br>P  | 16<br>S  | 17<br>Cl | 18<br>Ar                   |                      |                            |             |          |          |          |          |          |          |          |           |           |           |           |
| 19<br>K  | 20<br>Ca | 21<br>Sc | 22<br>Ti  | 23<br>V   | 24<br>Cr  | 25<br>Mn  | 26<br>Fe  | 27<br>Co  | 28<br>Ni  | 29<br>Cu  | 30<br>Zn | 31<br>Ga | 32<br>Ge | 33<br>As | 34<br>Se | 35<br>Br | 36<br>Kr                   |                      |                            |             |          |          |          |          |          |          |          |           |           |           |           |
| 37<br>Rb | 38<br>Sr | 39<br>Y  | 40<br>Zr  | 41<br>Nb  | 42<br>Mo  | 43<br>Tc  | 44<br>Ru  | 45<br>Rh  | 46<br>Pd  | 47<br>Ag  | 48<br>Cd | 49<br>In | 50<br>Sn | 51<br>Sb | 52<br>Te | 53<br>I  | 54<br>Xe                   |                      |                            |             |          |          |          |          |          |          |          |           |           |           |           |
| 55<br>Cs | 56<br>Ba | 57<br>La | 72<br>Hf  | 73<br>Ta  | 74<br>W   | 75<br>Re  | 76<br>Os  | 77<br>Ir  | 78<br>Pt  | 79<br>Au  | 80<br>Hg | 81<br>Tl | 82<br>Pb | 83<br>Bi | 84<br>Po | 85<br>At | 86<br>Rn                   |                      |                            |             |          |          |          |          |          |          |          |           |           |           |           |
| 87<br>Fr | 88<br>Ra | 89<br>Ac | 104<br>Rf | 105<br>Db | 106<br>Sg | 107<br>Bh | 108<br>Hs | 109<br>Mt | 110<br>Ds | 111<br>Rg | 112      | (113)    | 114      | (115)    | 116      | (117)    | (118)                      |                      |                            |             |          |          |          |          |          |          |          |           |           |           |           |
|          |          |          |           |           |           |           |           |           |           |           |          |          |          |          |          |          |                            | 58<br>Ce             | 59<br>Pr                   | 60<br>Nd    | 61<br>Pm | 62<br>Sm | 63<br>Eu | 64<br>Gd | 65<br>Tb | 66<br>Dy | 67<br>Ho | 68<br>Er  | 69<br>Tm  | 70<br>Yb  | 71<br>Lu  |
|          |          |          |           |           |           |           |           |           |           |           |          |          |          |          |          |          |                            | 90<br>Th             | 91<br>Pa                   | 92<br>U     | 93<br>Np | 94<br>Pu | 95<br>Am | 96<br>Cm | 97<br>Bk | 98<br>Cf | 99<br>Es | 100<br>Fm | 101<br>Md | 102<br>No | 103<br>Lr |

# Configuraciones electrónicas de cationes y aniones de elementos representativos



Los átomos ceden electrones de modo que los cationes adquieren la configuración electrónica de un gas noble.

Los átomos aceptan electrones de modo que los aniones adquieren la configuración electrónica de un gas noble.



# Aniones y cationes de los elementos representativos

|   |                    |                    |                         |                          |                          |                          |                          |                          |                          |                          |                            |                             |                         |                          |                         |                          |                         |                         |
|---|--------------------|--------------------|-------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|----------------------------|-----------------------------|-------------------------|--------------------------|-------------------------|--------------------------|-------------------------|-------------------------|
|   | <b>+1</b>          | <b>+2</b>          |                         |                          |                          |                          |                          |                          |                          |                          |                            |                             | <b>+3</b>               |                          | <b>+3</b>               | <b>-2</b>                | <b>-1</b>               |                         |
|   | 1A                 | 2A                 |                         |                          |                          |                          |                          |                          |                          |                          |                            |                             | 3A                      | 4A                       | 5A                      | 6A                       | 7A                      | 8A                      |
| 1 | 1<br>H<br>$1s^1$   | 2<br>He<br>$1s^2$  |                         |                          |                          |                          |                          |                          |                          |                          |                            |                             |                         |                          |                         |                          |                         |                         |
| 2 | 3<br>Li<br>$2s^1$  | 4<br>Be<br>$2s^2$  |                         |                          |                          |                          |                          |                          |                          |                          |                            |                             | 5<br>B<br>$2s^2 2p^1$   | 6<br>C<br>$2s^2 2p^2$    | 7<br>N<br>$2s^2 2p^3$   | 8<br>O<br>$2s^2 2p^4$    | 9<br>F<br>$2s^2 2p^5$   | 10<br>Ne<br>$2s^2 2p^6$ |
| 3 | 11<br>Na<br>$3s^1$ | 12<br>Mg<br>$3s^2$ | 13<br>Al<br>$3s^2 3p^1$ | 14<br>Si<br>$3s^2 3p^2$  | 15<br>P<br>$3s^2 3p^3$   | 16<br>S<br>$3s^2 3p^4$   | 17<br>Cl<br>$3s^2 3p^5$  | 18<br>Ar<br>$3s^2 3p^6$  |                          |                          |                            |                             |                         |                          |                         |                          |                         |                         |
| 4 | 19<br>K<br>$4s^1$  | 20<br>Ca<br>$4s^2$ | 21<br>Sc<br>$4s^2 3d^1$ | 22<br>Ti<br>$4s^2 3d^2$  | 23<br>V<br>$4s^2 3d^3$   | 24<br>Cr<br>$4s^1 3d^5$  | 25<br>Mn<br>$4s^2 3d^5$  | 26<br>Fe<br>$4s^2 3d^6$  | 27<br>Co<br>$4s^2 3d^7$  | 28<br>Ni<br>$4s^2 3d^8$  | 29<br>Cu<br>$4s^1 3d^{10}$ | 30<br>Zn<br>$4s^2 3d^{10}$  | 31<br>Ga<br>$4s^2 4p^1$ | 32<br>Ge<br>$4s^2 4p^2$  | 33<br>As<br>$4s^2 4p^3$ | 34<br>Se<br>$4s^2 4p^4$  | 35<br>Br<br>$4s^2 4p^5$ | 36<br>Kr<br>$4s^2 4p^6$ |
| 5 | 37<br>Rb<br>$5s^1$ | 38<br>Sr<br>$5s^2$ | 39<br>Y<br>$5s^2 4d^1$  | 40<br>Zr<br>$5s^2 4d^2$  | 41<br>Nb<br>$5s^1 4d^4$  | 42<br>Mo<br>$5s^1 4d^5$  | 43<br>Tc<br>$5s^2 4d^5$  | 44<br>Ru<br>$5s^1 4d^7$  | 45<br>Rh<br>$5s^1 4d^8$  | 46<br>Pd<br>$4d^{10}$    | 47<br>Ag<br>$5s^1 4d^{10}$ | 48<br>Cd<br>$5s^2 4d^{10}$  | 49<br>In<br>$5s^2 5p^1$ | 50<br>Sn<br>$5s^2 5p^2$  | 51<br>Sb<br>$5s^2 5p^3$ | 52<br>Te<br>$5s^2 5p^4$  | 53<br>I<br>$5s^2 5p^5$  | 54<br>Xe<br>$5s^2 5p^6$ |
| 6 | 55<br>Cs<br>$6s^1$ | 56<br>Ba<br>$6s^2$ | 57<br>La<br>$6s^2 5d^1$ | 72<br>Hf<br>$6s^2 5d^2$  | 73<br>Ta<br>$6s^2 5d^3$  | 74<br>W<br>$6s^2 5d^4$   | 75<br>Re<br>$6s^2 5d^5$  | 76<br>Os<br>$6s^2 5d^6$  | 77<br>Ir<br>$6s^2 5d^7$  | 78<br>Pt<br>$6s^1 5d^9$  | 79<br>Au<br>$6s^1 5d^{10}$ | 80<br>Hg<br>$6s^2 5d^{10}$  | 81<br>Tl<br>$6s^2 6p^1$ | 82<br>Pb<br>$6s^2 6p^2$  | 83<br>Bi<br>$6s^2 6p^3$ | 84<br>Po<br>$6s^2 6p^4$  | 85<br>At<br>$6s^2 6p^5$ | 86<br>Rn<br>$6s^2 6p^6$ |
| 7 | 87<br>Fr<br>$7s^1$ | 88<br>Ra<br>$7s^2$ | 89<br>Ac<br>$7s^2 6d^1$ | 104<br>Rf<br>$7s^2 6d^2$ | 105<br>Db<br>$7s^2 6d^3$ | 106<br>Sg<br>$7s^2 6d^4$ | 107<br>Bh<br>$7s^2 6d^5$ | 108<br>Hs<br>$7s^2 6d^6$ | 109<br>Mt<br>$7s^2 6d^7$ | 110<br>Ds<br>$7s^2 6d^8$ | 111<br>Rg<br>$7s^2 6d^9$   | 112<br>Cn<br>$7s^2 6d^{10}$ | (113)                   | 114<br>Fl<br>$7s^2 7p^2$ | (115)                   | 116<br>Lv<br>$7s^2 7p^4$ | (117)                   | (118)                   |

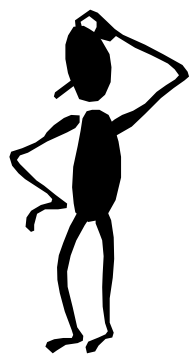
  

|                              |                              |                             |                              |                         |                         |                              |                         |                            |                            |                             |                             |                             |                                  |
|------------------------------|------------------------------|-----------------------------|------------------------------|-------------------------|-------------------------|------------------------------|-------------------------|----------------------------|----------------------------|-----------------------------|-----------------------------|-----------------------------|----------------------------------|
| 58<br>Ce<br>$6s^2 4f^7 5d^1$ | 59<br>Pr<br>$6s^2 4f^6$      | 60<br>Nd<br>$6s^2 4f^4$     | 61<br>Pm<br>$6s^2 4f^5$      | 62<br>Sm<br>$6s^2 4f^6$ | 63<br>Eu<br>$6s^2 4f^7$ | 64<br>Gd<br>$6s^2 4f^7 5d^1$ | 65<br>Tb<br>$6s^2 4f^9$ | 66<br>Dy<br>$6s^2 4f^{10}$ | 67<br>Ho<br>$6s^2 4f^{11}$ | 68<br>Er<br>$6s^2 4f^{12}$  | 69<br>Tm<br>$6s^2 4f^{13}$  | 70<br>Yb<br>$6s^2 4f^{14}$  | 71<br>Lu<br>$6s^2 4f^{14} 5d^1$  |
| 90<br>Th<br>$7s^2 6d^2$      | 91<br>Pa<br>$7s^2 5f^2 6d^1$ | 92<br>U<br>$7s^2 5f^3 6d^1$ | 93<br>Np<br>$7s^2 5f^4 6d^1$ | 94<br>Pu<br>$7s^2 5f^6$ | 95<br>Am<br>$7s^2 5f^7$ | 96<br>Cm<br>$7s^2 5f^7 6d^1$ | 97<br>Bk<br>$7s^2 5f^9$ | 98<br>Cf<br>$7s^2 5f^{10}$ | 99<br>Es<br>$7s^2 5f^{11}$ | 100<br>Fm<br>$7s^2 5f^{12}$ | 101<br>Md<br>$7s^2 5f^{13}$ | 102<br>No<br>$7s^2 5f^{14}$ | 103<br>Lr<br>$7s^2 5f^{14} 6d^1$ |

$\text{Na}^+$ :  $[\text{Ne}]$        $\text{Al}^{3+}$ :  $[\text{Ne}]$        $\text{F}^-$ :  $1s^2 2s^2 2p^6$  or  $[\text{Ne}]$

$\text{O}^{2-}$ :  $1s^2 2s^2 2p^6$  or  $[\text{Ne}]$        $\text{N}^{3-}$ :  $1s^2 2s^2 2p^6$  or  $[\text{Ne}]$

$\text{Na}^+$ ,  $\text{Al}^{3+}$ ,  $\text{F}^-$ ,  $\text{O}^{2-}$ , y  $\text{N}^{3-}$  son todos ***isoelectrónicos*** con Ne



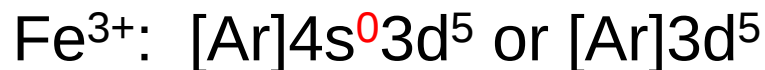
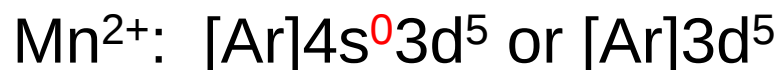
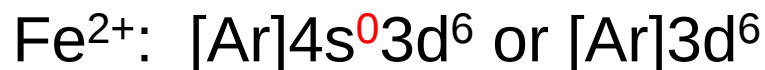
¿Qué átomo neutro es isoelectrónico con  $\text{H}^-$  ?

$\text{H}^-$ :  $1s^2$

La misma configuración electrónica  
que el He.

# Configuración electrónica de cationes de metales de transición

Cuando un átomo metálico se transforma en un catión los electrones primeramente son retirados del orbital  $ns$  y después de los orbitales  $(n - 1)d$ .



**Carga nuclear efectiva** ( $Z_{\text{efectiva}}$ ) es la “carga positiva” que siente un electrón.

$$Z_{\text{efectiva}} = Z - \sigma \quad 0 < \sigma < Z \quad (\sigma = \text{constante de shielding})$$

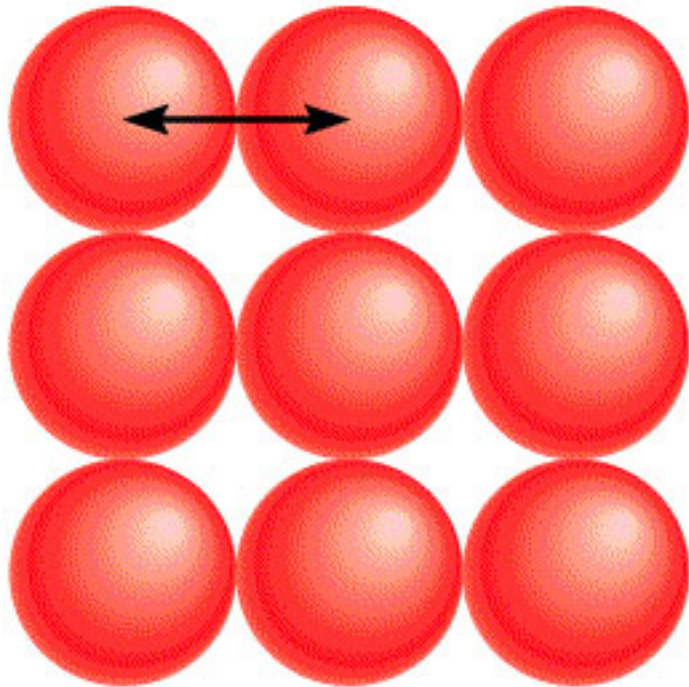
$$Z_{\text{efectiva}} \approx Z - \text{número de electrones internos o de base}$$

|    | <u>Z</u> | <u>Base</u> | <u>Z<sub>efectiva</sub></u> | <u>Radio (pm)</u> |
|----|----------|-------------|-----------------------------|-------------------|
| Na | 11       | 10          | 1                           | 186               |
| Mg | 12       | 10          | 2                           | 160               |
| Al | 13       | 10          | 3                           | 143               |
| Si | 14       | 10          | 4                           | 132               |

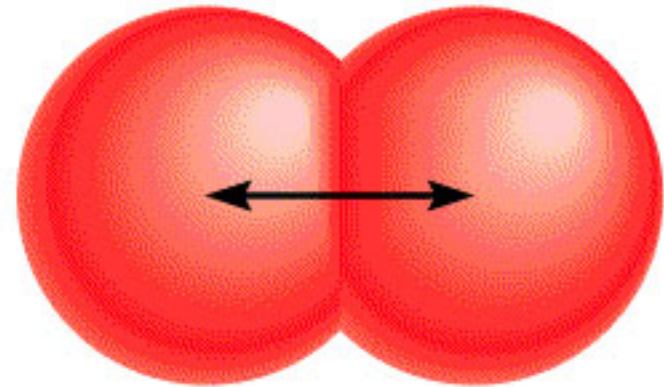
# Carga nuclear efectiva ( $Z_{\text{efectiva}}$ )



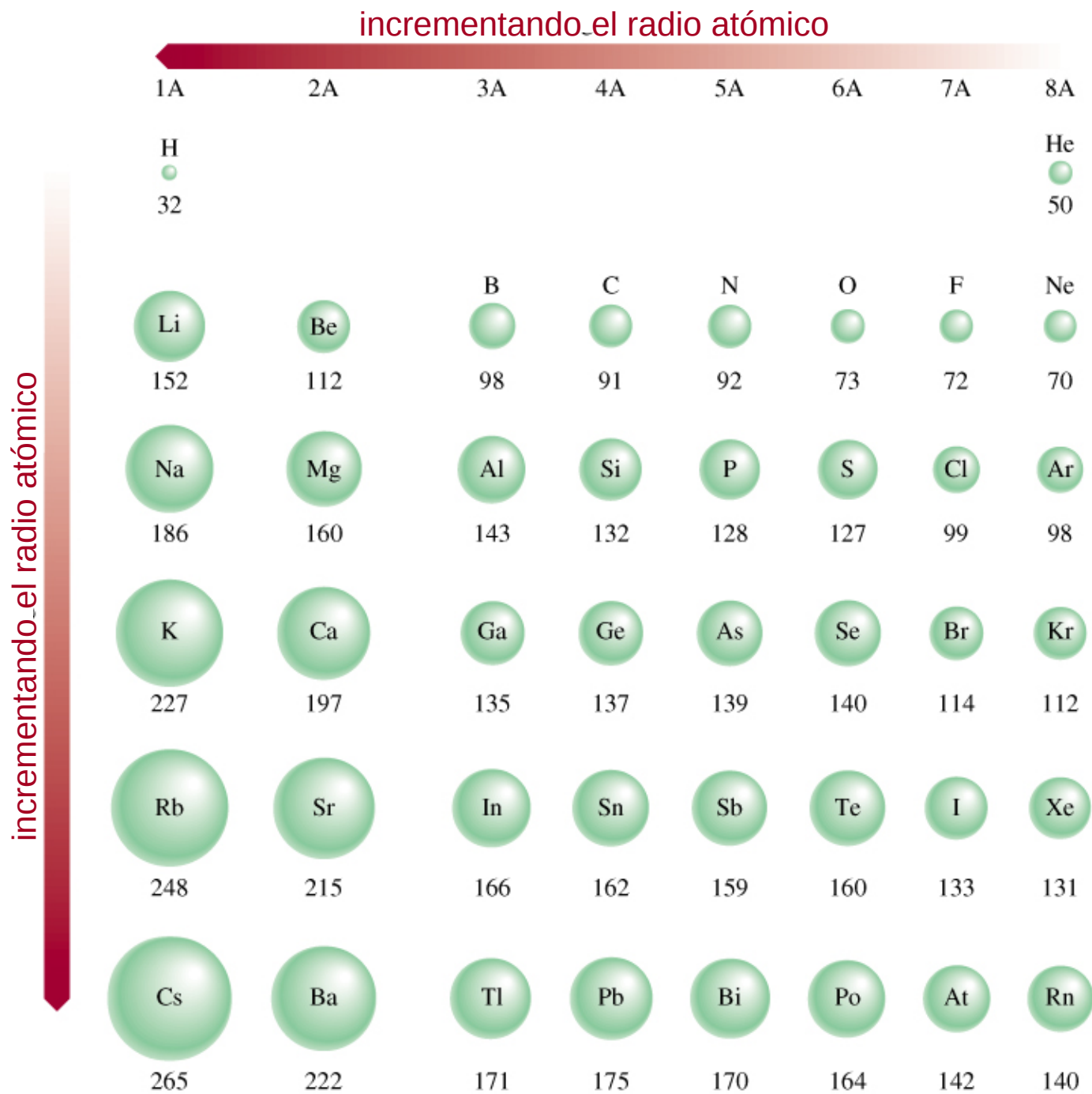
## Radio atómico



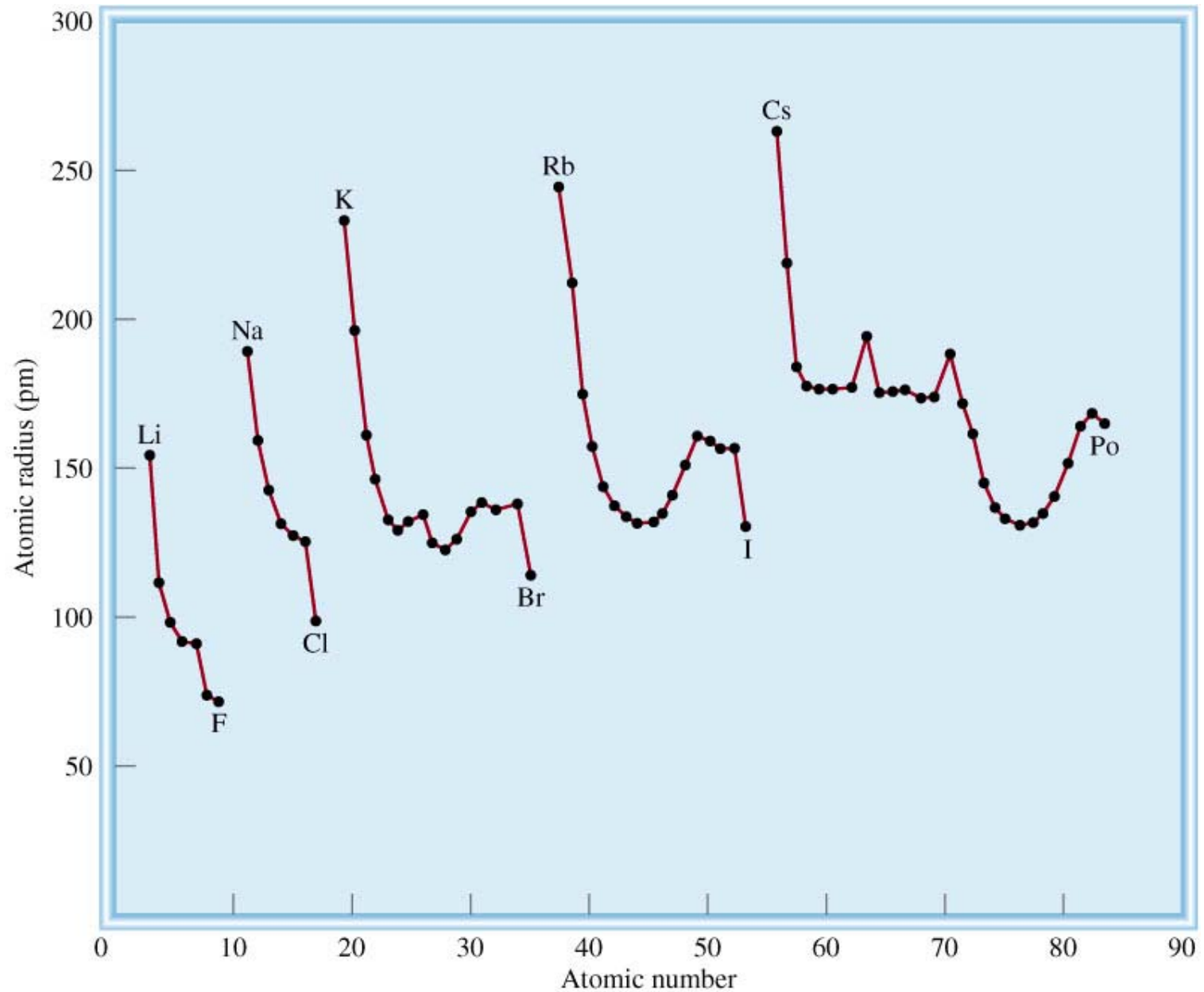
(a)



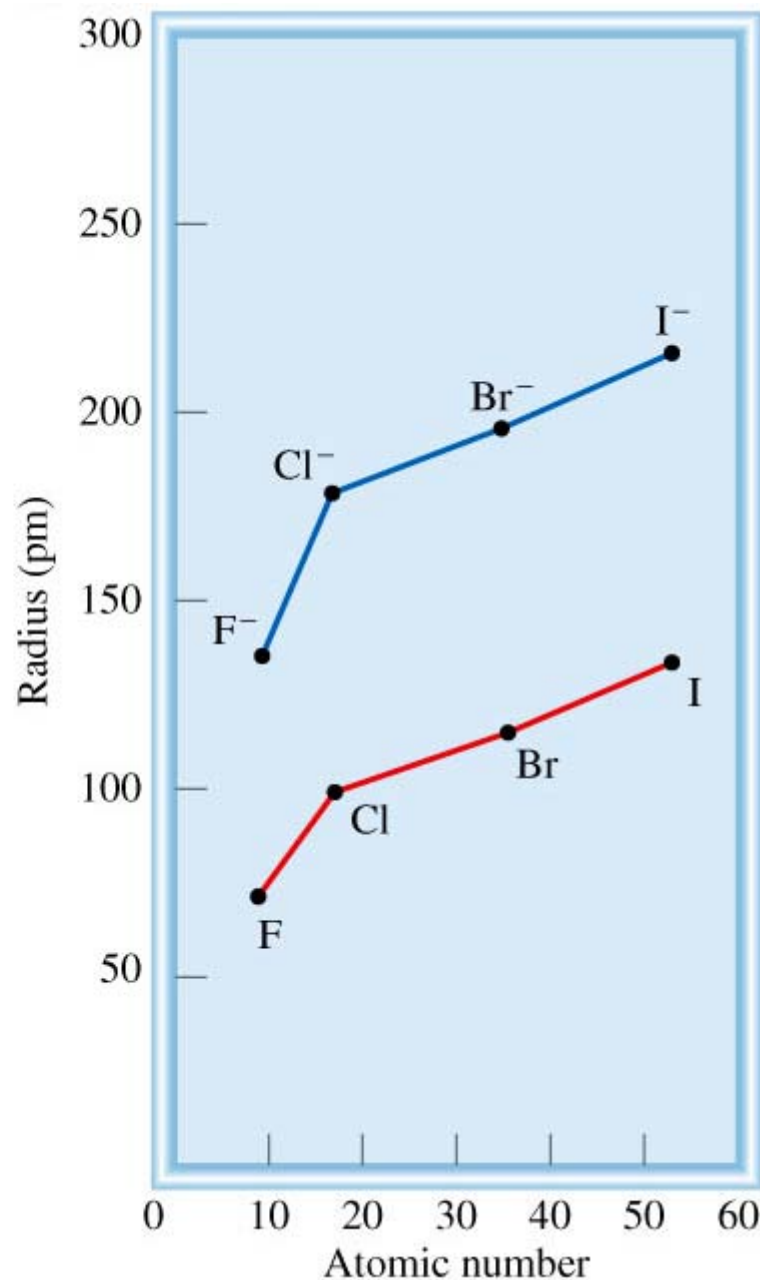
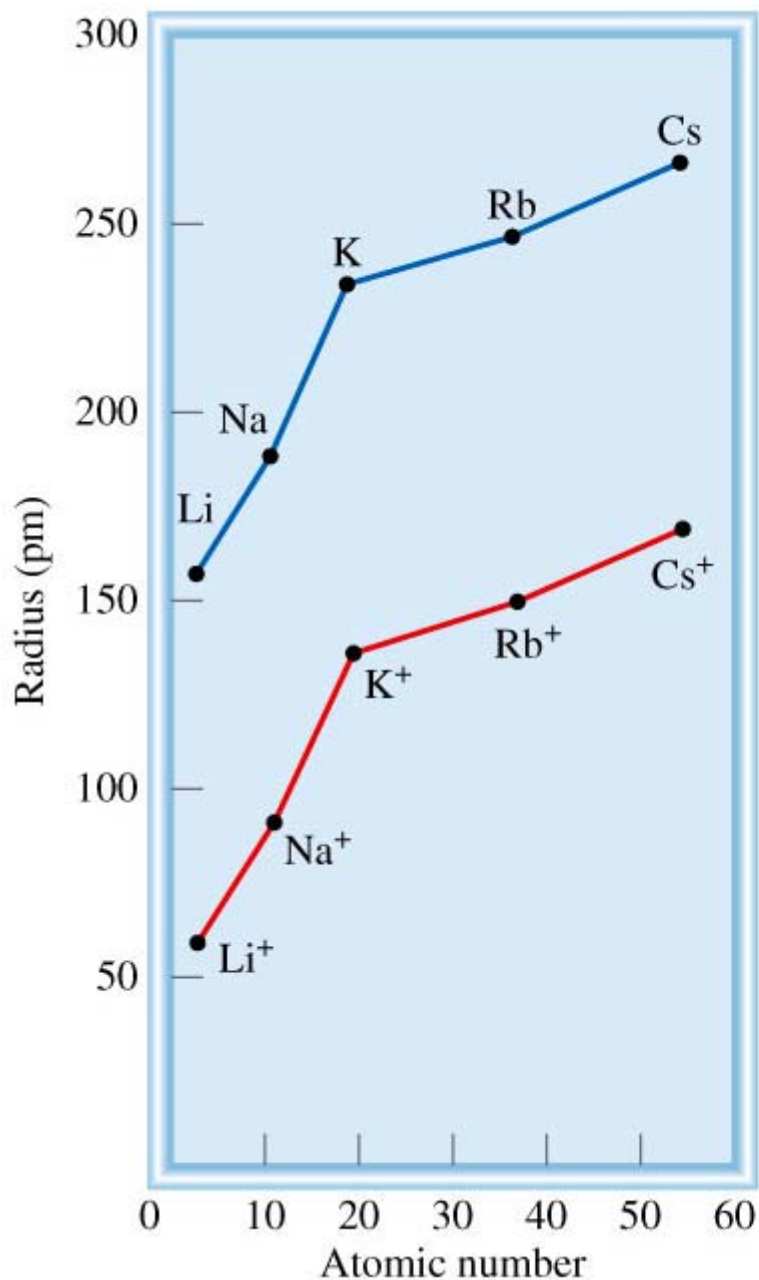
(b)

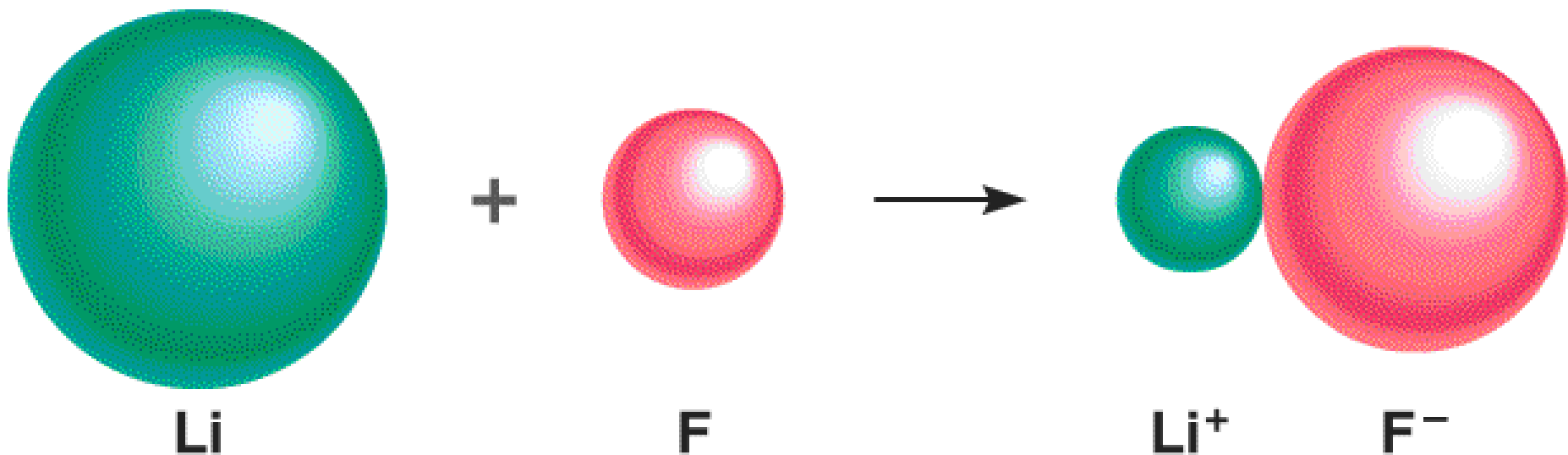


# Radios atómicos



# Comparación de radios atómicos con radios iónicos

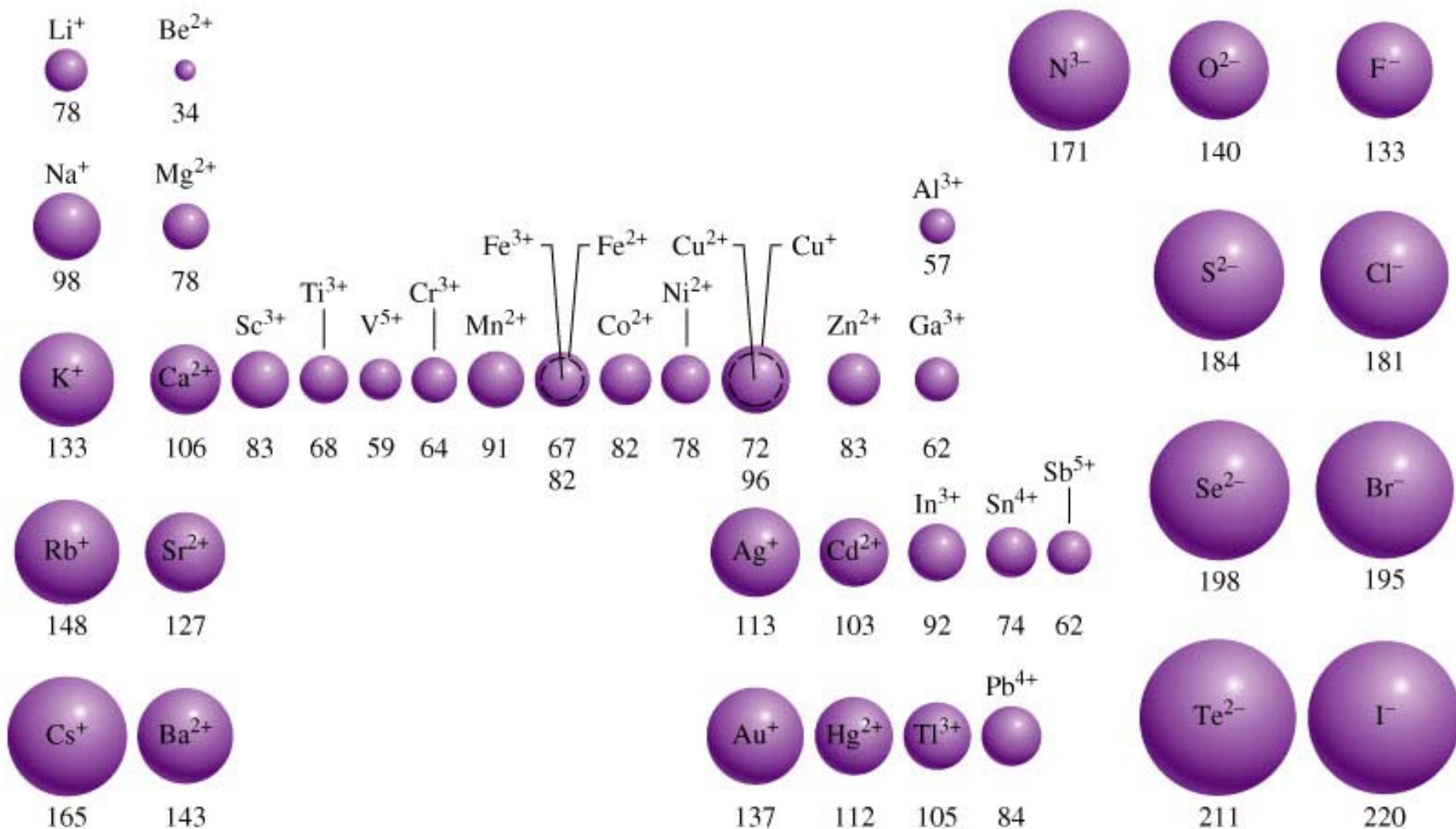




El **cación** siempre es **más pequeño** que el átomo a partir del cual se formó.

El **anión** siempre es **más grande** que el átomo a partir del cual se formó.

# Radios de iones (en pm) de elementos familiares

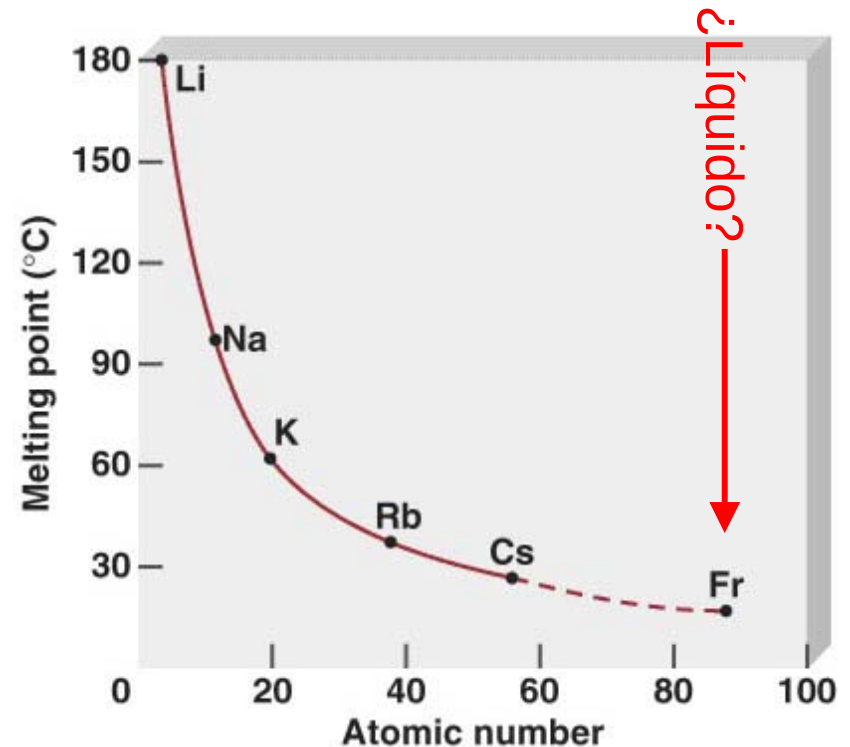
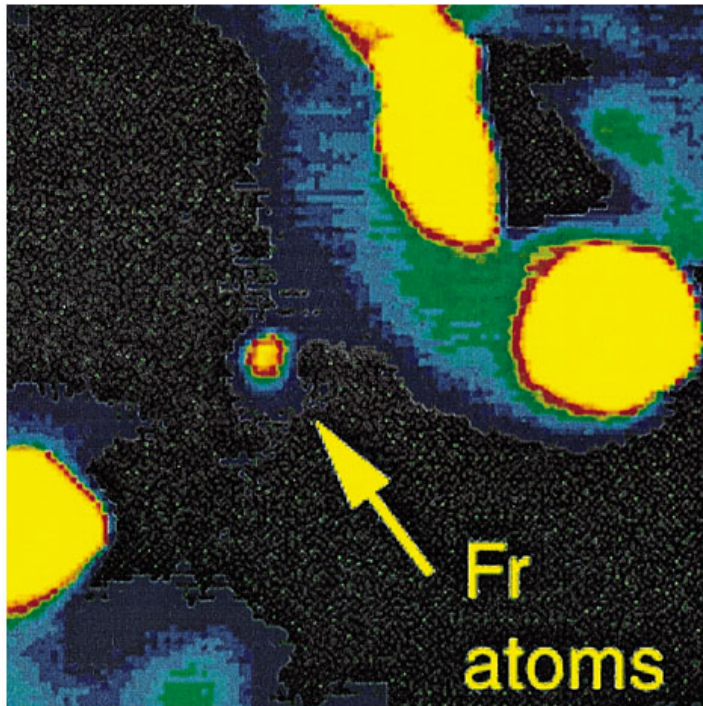


# La química en acción:

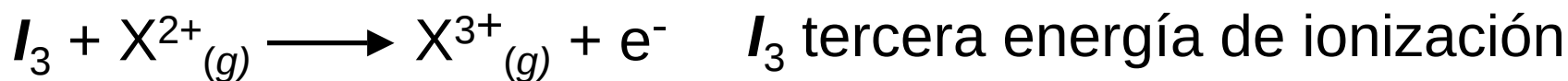
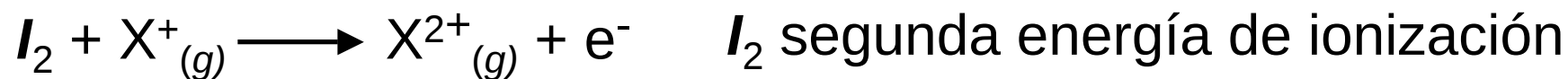
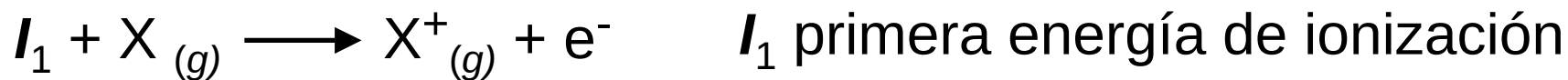
## ¿El 3<sup>er</sup> elemento líquido?

113 elementos, 2 son líquidos a 25°C – Br<sub>2</sub> y Hg

$^{223}\text{Fr}$ ,  $t_{1/2} = 21$  minutos



La **energía de ionización** es la energía mínima (kJ/mol) requerida para remover un electrón de un átomo gaseoso en su estado natural.

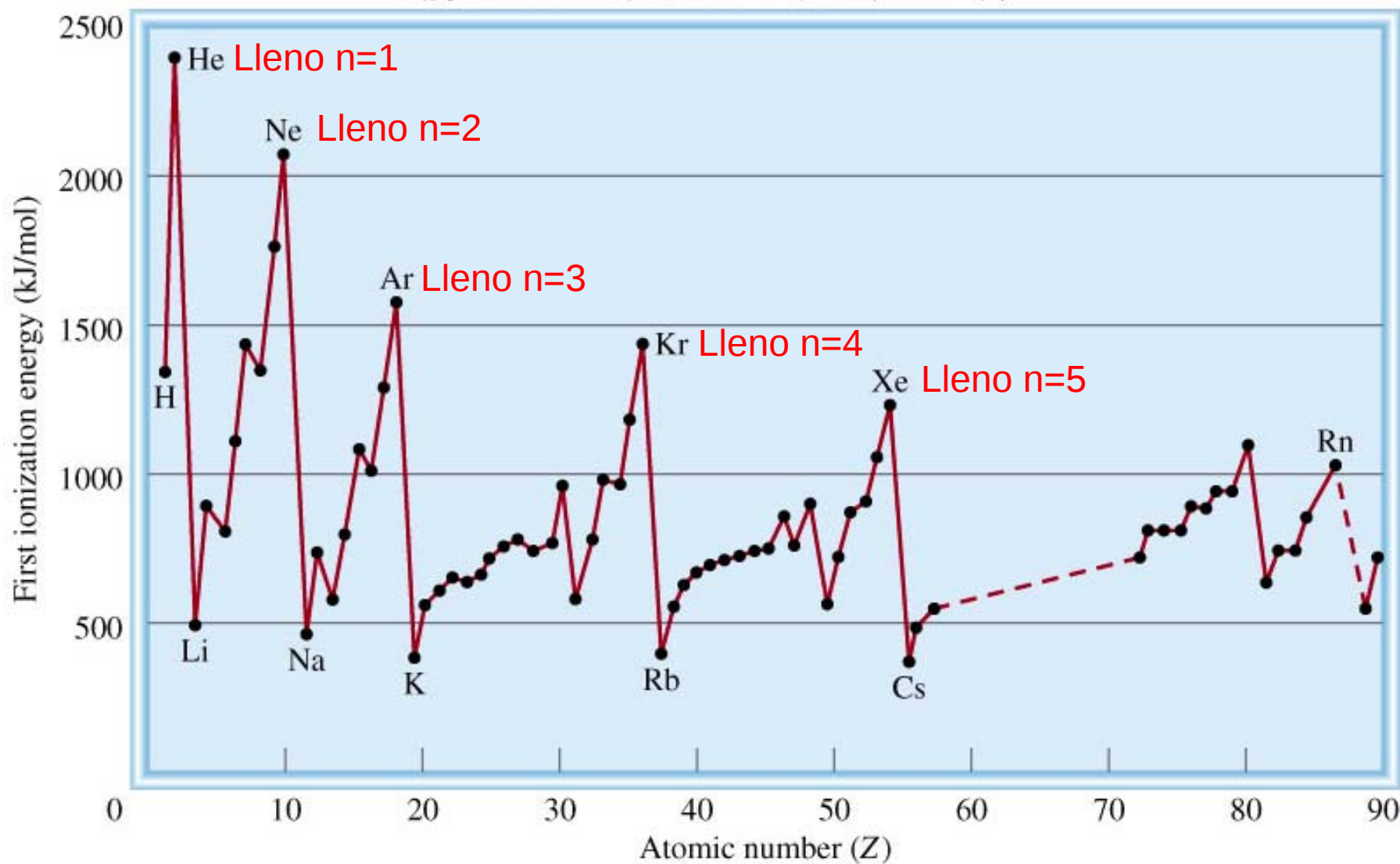


$$I_1 < I_2 < I_3$$

# Energías de ionización de los primeros 20 elementos

| Z  | Element | First | Second | Third  | Fourth | Fifth  | Sixth  |
|----|---------|-------|--------|--------|--------|--------|--------|
| 1  | H       | 1,312 |        |        |        |        |        |
| 2  | He      | 2,373 | 5,251  |        |        |        |        |
| 3  | Li      | 520   | 7,300  | 11,815 |        |        |        |
| 4  | Be      | 899   | 1,757  | 14,850 | 21,005 |        |        |
| 5  | B       | 801   | 2,430  | 3,660  | 25,000 | 32,820 |        |
| 6  | C       | 1,086 | 2,350  | 4,620  | 6,220  | 38,000 | 47,261 |
| 7  | N       | 1,400 | 2,860  | 4,580  | 7,500  | 9,400  | 53,000 |
| 8  | O       | 1,314 | 3,390  | 5,300  | 7,470  | 11,000 | 13,000 |
| 9  | F       | 1,680 | 3,370  | 6,050  | 8,400  | 11,000 | 15,200 |
| 10 | Ne      | 2,080 | 3,950  | 6,120  | 9,370  | 12,200 | 15,000 |
| 11 | Na      | 495.9 | 4,560  | 6,900  | 9,540  | 13,400 | 16,600 |
| 12 | Mg      | 738.1 | 1,450  | 7,730  | 10,500 | 13,600 | 18,000 |
| 13 | Al      | 577.9 | 1,820  | 2,750  | 11,600 | 14,800 | 18,400 |
| 14 | Si      | 786.3 | 1,580  | 3,230  | 4,360  | 16,000 | 20,000 |
| 15 | P       | 1,012 | 1,904  | 2,910  | 4,960  | 6,240  | 21,000 |
| 16 | S       | 999.5 | 2,250  | 3,360  | 4,660  | 6,990  | 8,500  |
| 17 | Cl      | 1,251 | 2,297  | 3,820  | 5,160  | 6,540  | 9,300  |
| 18 | Ar      | 1,521 | 2,666  | 3,900  | 5,770  | 7,240  | 8,800  |
| 19 | K       | 418.7 | 3,052  | 4,410  | 5,900  | 8,000  | 9,600  |
| 20 | Ca      | 589.5 | 1,145  | 4,900  | 6,500  | 8,100  | 11,000 |

# Variación de la primera energía de ionización con número atómico

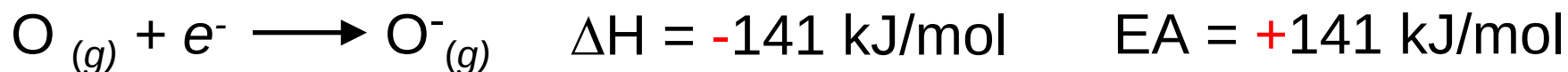
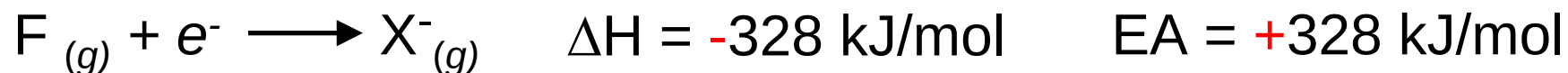
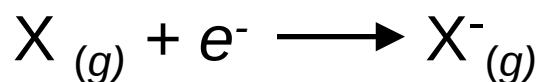


Al incrementar la primera energía de ionización

Al incrementar la primera energía de ionización

|          |          |          |          |          |          |          |          |          |          |           |           |           |           |
|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-----------|-----------|-----------|-----------|
| 58<br>Ce | 59<br>Pr | 60<br>Nd | 61<br>Pm | 62<br>Sm | 63<br>Eu | 64<br>Gd | 65<br>Tb | 66<br>Dy | 67<br>Ho | 68<br>Er  | 69<br>Tm  | 70<br>Yb  | 71<br>Lu  |
| 90<br>Th | 91<br>Pa | 92<br>U  | 93<br>Np | 94<br>Pu | 95<br>Am | 96<br>Cm | 97<br>Bk | 98<br>Cf | 99<br>Es | 100<br>Fm | 101<br>Md | 102<br>No | 103<br>Lr |

***Afinidad electrónica*** es el cambio de energía que ocurre cuando un electrón es aceptado por un átomo en estado gaseoso para formar un anión.

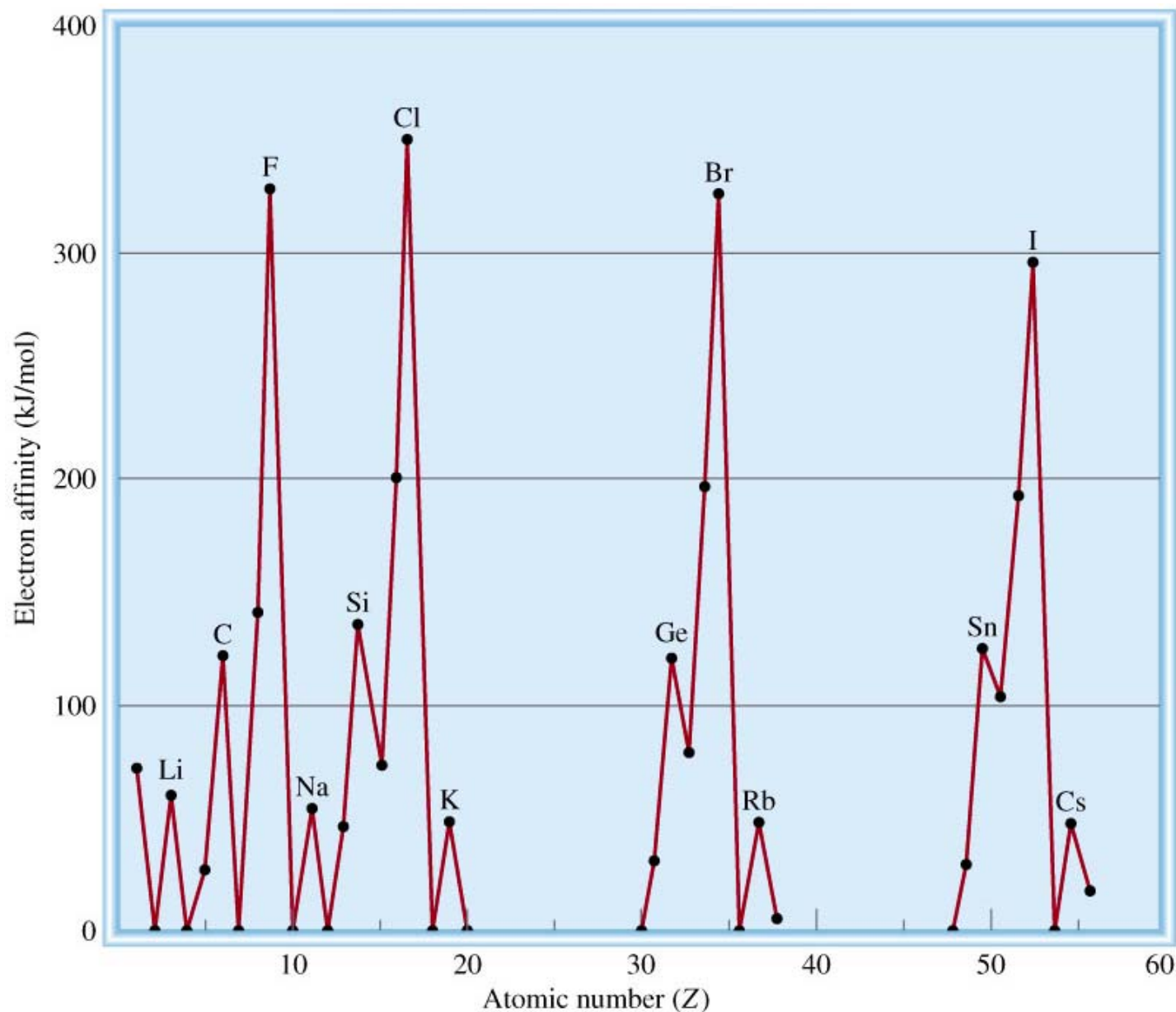


## Afinidades electrónicas (kJ/mol) de algunos elementos representativos y de los gases nobles

| 1A | 2A  | 3A | 4A  | 5A  | 6A  | 7A  | 8A |
|----|-----|----|-----|-----|-----|-----|----|
| H  |     |    |     |     |     |     | He |
| 73 |     |    |     |     |     |     | <0 |
| Li | Be  | B  | C   | N   | O   | F   | Ne |
| 60 | ≤ 0 | 27 | 122 | 0   | 141 | 328 | <0 |
| Na | Mg  | Al | Si  | P   | S   | Cl  | Ar |
| 53 | ≤ 0 | 44 | 134 | 72  | 200 | 349 | <0 |
| K  | Ca  | Ga | Ge  | As  | Se  | Br  | Kr |
| 48 | 2.4 | 29 | 118 | 77  | 195 | 325 | <0 |
| Rb | Sr  | In | Sn  | Sb  | Te  | I   | Xe |
| 47 | 4.7 | 29 | 121 | 101 | 190 | 295 | <0 |
| Cs | Ba  | Tl | Pb  | Bi  | Po  | At  | Rn |
| 45 | 14  | 30 | 110 | 110 | ?   | ?   | <0 |

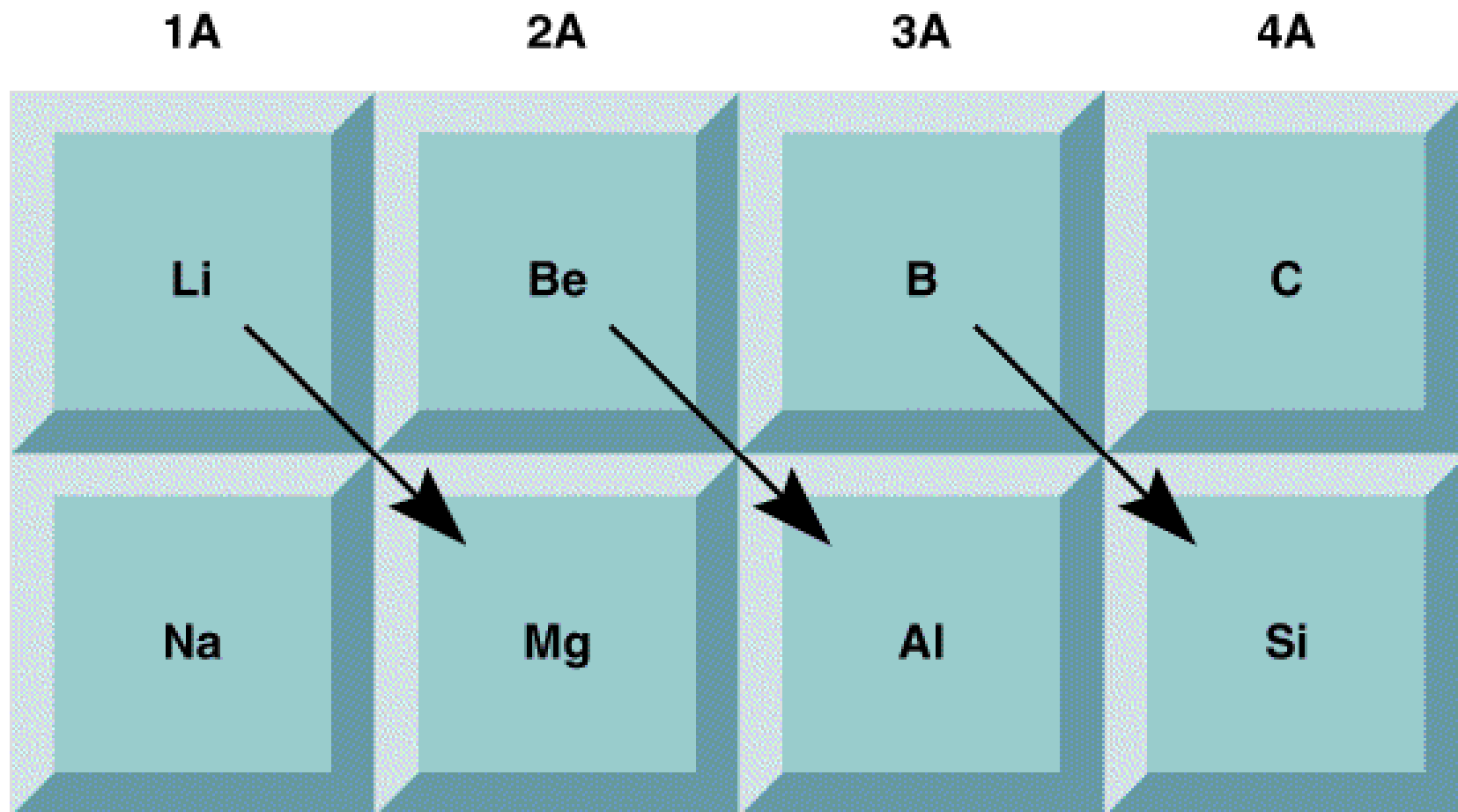
\*The electron affinities of the noble gases, Be, and Mg have not been determined experimentally, but are believed to be close to zero or negative.

# Variación de la afinidad electrónica con el número atómico (H – Ba)



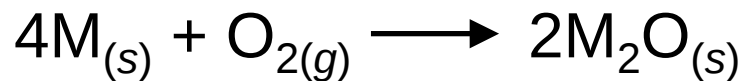
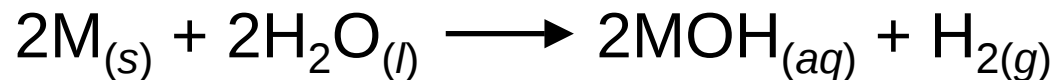
# Relaciones diagonales en la Tabla Periódica

| 1A | 2A | 3A | 4A |
|----|----|----|----|
| Li | Be | B  | C  |
| Na | Mg | Al | Si |



The diagram illustrates diagonal relationships in the periodic table. It shows a 2x4 grid of elements. The columns are labeled 1A, 2A, 3A, and 4A at the top. The elements are arranged as follows: Li (1A, top row), Be (2A, top row), B (3A, top row), C (4A, top row), Na (1A, bottom row), Mg (2A, bottom row), Al (3A, bottom row), and Si (4A, bottom row). Arrows indicate diagonal relationships from the top row to the bottom row: from Li to Mg, from Be to Al, from B to Si, and from C to Si.

## Elementos del Grupo 1A ( $ns^1$ , $n \geq 2$ )

[illegible]

# Elementos del Grupo 1A ( $ns^1$ , $n \geq 2$ )



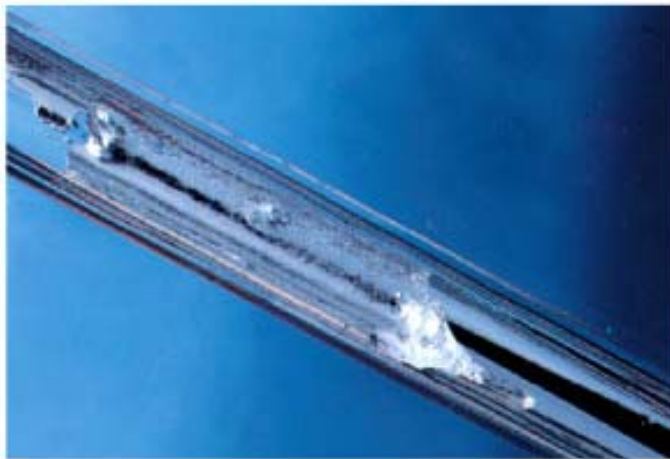
Lithium (Li)



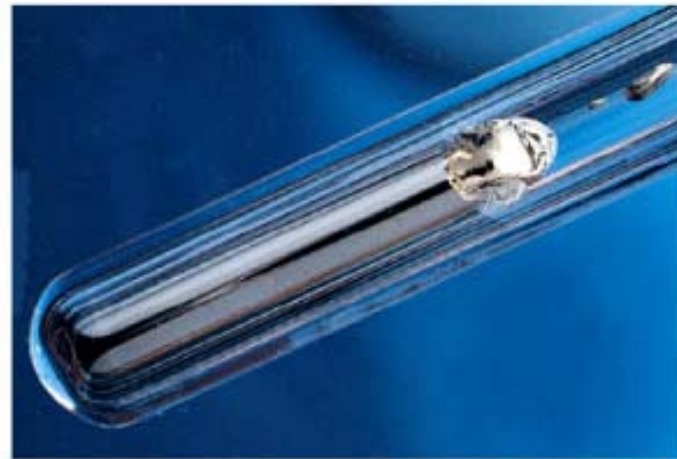
Sodium (Na)



Potassium (K)

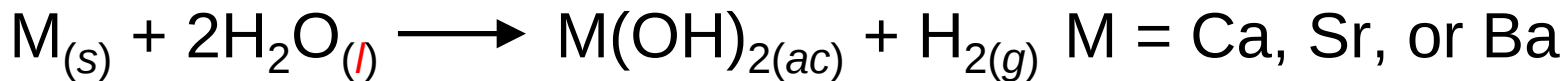
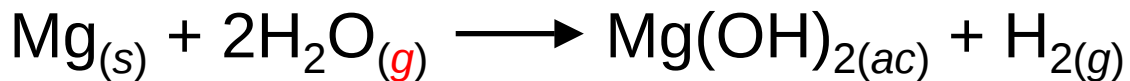
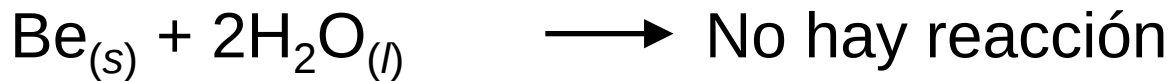


Rubidium (Rb)

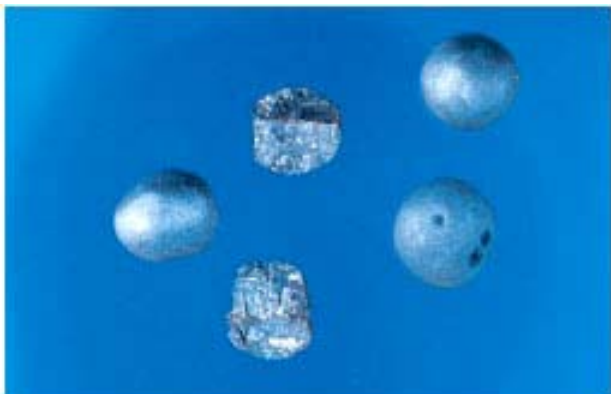


Cesium (Cs)

# Elementos del Grupo 2A ( $ns^2$ , $n \geq 2$ )

[illegible]

# Elementos del Grupo 2A ( $ns^2$ , $n \geq 2$ )



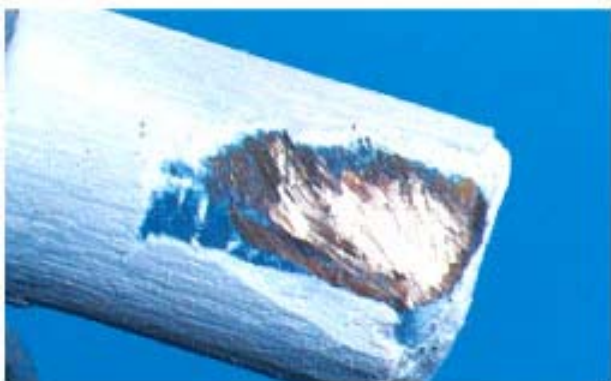
Beryllium (Be)



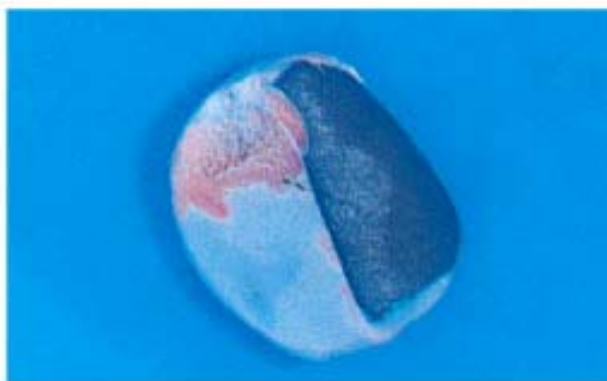
Magnesium (Mg)



Calcium (Ca)



Strontium (Sr)

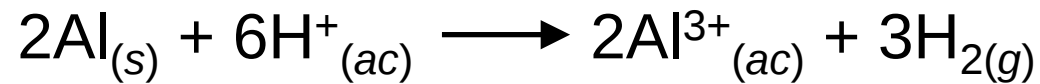
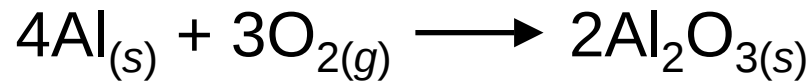


Barium (Ba)

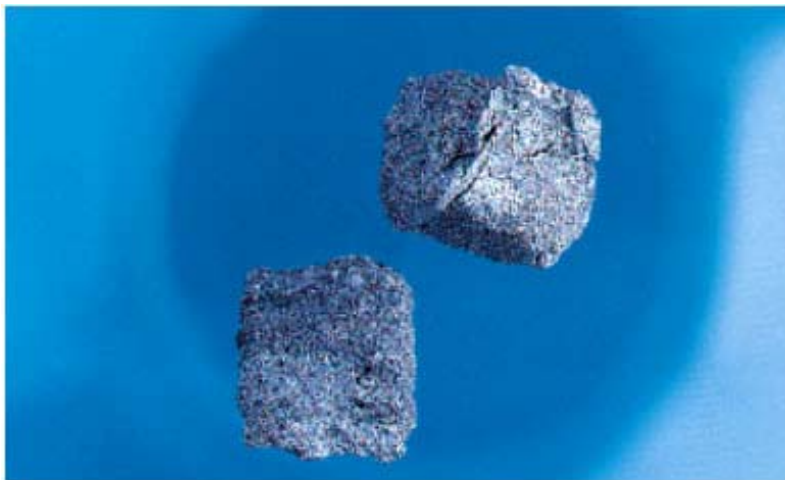


Radium (Ra)

## Elementos del Grupo 3A ( $ns^2np^1$ , $n \geq 2$ )

[illegible]

# Elementos del Grupo 3A ( $ns^2np^1$ , $n \geq 2$ )



Boron (B)



Aluminum (Al)

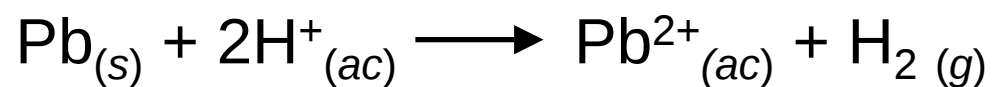
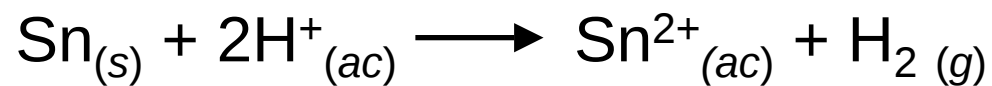


Gallium (Ga)



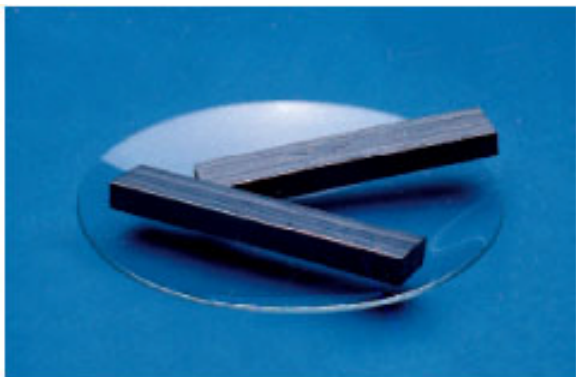
Indium (In)

# Elementos del Grupo 4A ( $ns^2np^2$ , $n \geq 2$ )

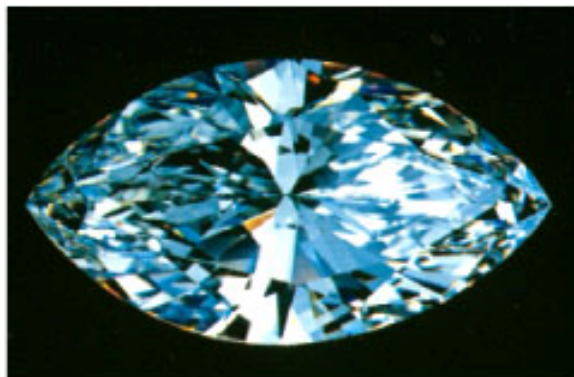


| 1A | 2A |  |  |  |  |  |  |  |  |  |  | 3A | 4A | 5A | 6A | 7A | 8A |
|----|----|--|--|--|--|--|--|--|--|--|--|----|----|----|----|----|----|
|    |    |  |  |  |  |  |  |  |  |  |  |    | C  |    |    |    |    |
|    |    |  |  |  |  |  |  |  |  |  |  |    | Si |    |    |    |    |
|    |    |  |  |  |  |  |  |  |  |  |  |    | Ge |    |    |    |    |
|    |    |  |  |  |  |  |  |  |  |  |  |    | Sn |    |    |    |    |
|    |    |  |  |  |  |  |  |  |  |  |  |    | Pb |    |    |    |    |
|    |    |  |  |  |  |  |  |  |  |  |  |    |    |    |    |    |    |

# Elementos del Grupo 4A ( $ns^2np^2$ , $n \geq 2$ )



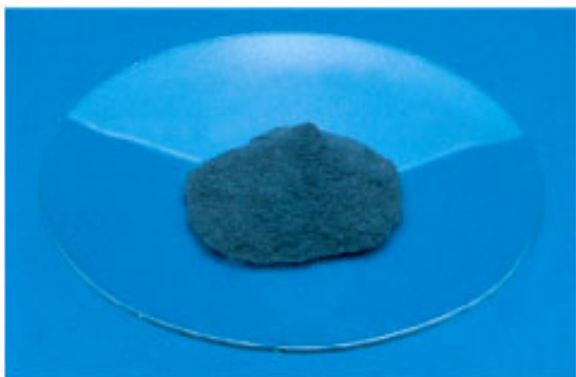
Carbon (graphite)



Carbon (diamond)



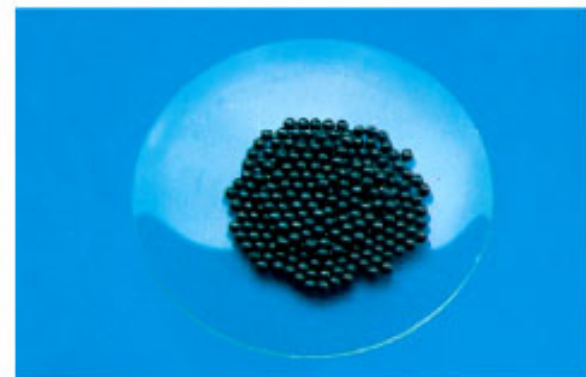
Silicon (Si)



Germanium (Ge)

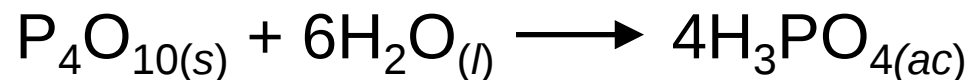
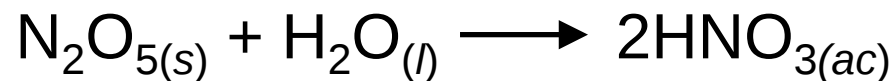


Tin (Sn)



Lead (Pb)

# Elementos del Grupo 5A ( $ns^2np^3$ , $n \geq 2$ )



| 1A | 2A |  |  |  |  |  |  |  |  |  |  |  | 3A | 4A | 5A | 6A | 7A | 8A |
|----|----|--|--|--|--|--|--|--|--|--|--|--|----|----|----|----|----|----|
|    |    |  |  |  |  |  |  |  |  |  |  |  |    |    | N  |    |    |    |
|    |    |  |  |  |  |  |  |  |  |  |  |  |    |    | P  |    |    |    |
|    |    |  |  |  |  |  |  |  |  |  |  |  |    |    | As |    |    |    |
|    |    |  |  |  |  |  |  |  |  |  |  |  |    |    | Sb |    |    |    |
|    |    |  |  |  |  |  |  |  |  |  |  |  |    |    | Bi |    |    |    |
|    |    |  |  |  |  |  |  |  |  |  |  |  |    |    |    |    |    |    |

# Elementos del Grupo 5A ( $ns^2np^3$ , $n \geq 2$ )



Nitrogen ( $N_2$ )



White and red phosphorus (P)



Arsenic (As)

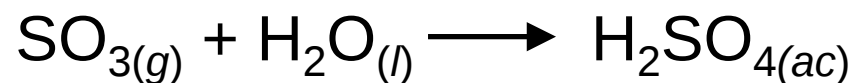


Antimony (Sb)



Bismuth (Bi)

# Elementos del Grupo 6A ( $ns^2np^4$ , $n \geq 2$ )



| 1A | 2A |  |  |  |  |  |  |  |  |  |  |  | 3A | 4A | 5A | 6A | 7A | 8A |
|----|----|--|--|--|--|--|--|--|--|--|--|--|----|----|----|----|----|----|
|    |    |  |  |  |  |  |  |  |  |  |  |  |    |    |    | O  |    |    |
|    |    |  |  |  |  |  |  |  |  |  |  |  |    |    |    | S  |    |    |
|    |    |  |  |  |  |  |  |  |  |  |  |  |    |    |    | Se |    |    |
|    |    |  |  |  |  |  |  |  |  |  |  |  |    |    |    | Te |    |    |
|    |    |  |  |  |  |  |  |  |  |  |  |  |    |    |    | Po |    |    |
|    |    |  |  |  |  |  |  |  |  |  |  |  |    |    |    |    |    |    |

# Elementos del Grupo 6A ( $ns^2np^4$ , $n \geq 2$ )



Sulfur (S<sub>8</sub>)

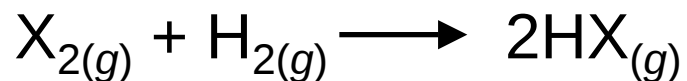
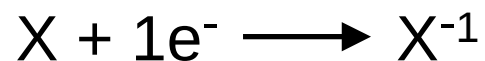


Selenium (Se<sub>8</sub>)



Tellurium (Te)

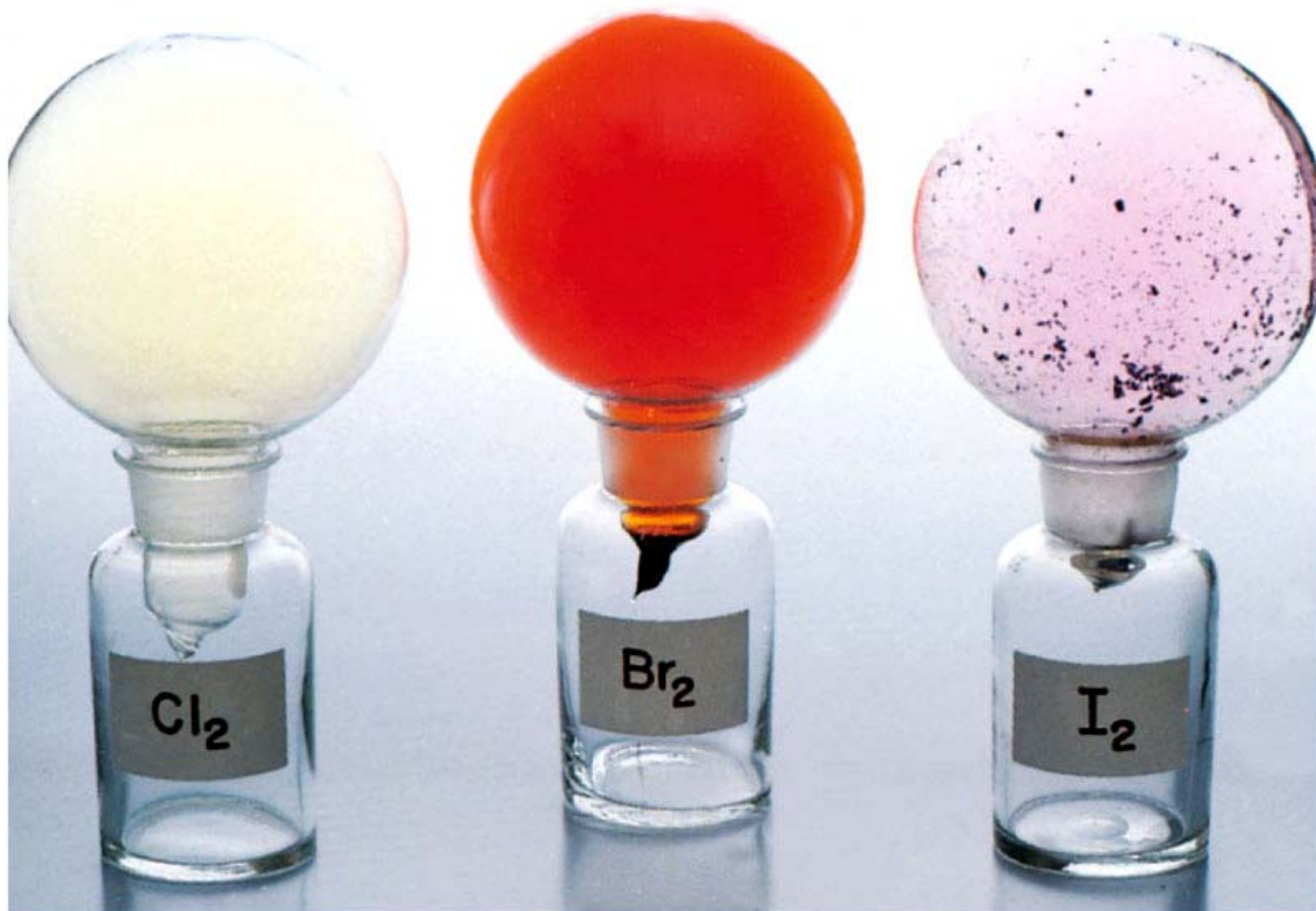
# Elementos del Grupo 7A ( $ns^2np^5$ , $n \geq 2$ )



| 1A | 2A |  |  |  |  |  |  |  |  |  |  | 3A | 4A | 5A | 6A | 7A | 8A |
|----|----|--|--|--|--|--|--|--|--|--|--|----|----|----|----|----|----|
|    |    |  |  |  |  |  |  |  |  |  |  |    |    |    |    | F  |    |
|    |    |  |  |  |  |  |  |  |  |  |  |    |    |    |    | Cl |    |
|    |    |  |  |  |  |  |  |  |  |  |  |    |    |    |    | Br |    |
|    |    |  |  |  |  |  |  |  |  |  |  |    |    |    |    | I  |    |
|    |    |  |  |  |  |  |  |  |  |  |  |    |    |    |    | At |    |
|    |    |  |  |  |  |  |  |  |  |  |  |    |    |    |    |    |    |
|    |    |  |  |  |  |  |  |  |  |  |  |    |    |    |    |    |    |

Increasing reactivity ↑

# Elementos del Grupo 7A ( $ns^2np^5$ , $n \geq 2$ )



# Elementos del Grupo 8A ( $ns^2np^6$ , $n \geq 2$ )



Niveles  $ns$  y subniveles  $np$  completamente llenos. Energías de ionización más altas que todos los elementos.

No tienden a aceptar electrones extras.

| 1A | 2A |  |  |  |  |  |  |  |  |  |  | 3A | 4A | 5A | 6A | 7A | 8A |
|----|----|--|--|--|--|--|--|--|--|--|--|----|----|----|----|----|----|
|    |    |  |  |  |  |  |  |  |  |  |  |    |    |    |    |    | He |
|    |    |  |  |  |  |  |  |  |  |  |  |    |    |    |    |    | Ne |
|    |    |  |  |  |  |  |  |  |  |  |  |    |    |    |    |    | Ar |
|    |    |  |  |  |  |  |  |  |  |  |  |    |    |    |    |    | Kr |
|    |    |  |  |  |  |  |  |  |  |  |  |    |    |    |    |    | Xe |
|    |    |  |  |  |  |  |  |  |  |  |  |    |    |    |    |    | Rn |
|    |    |  |  |  |  |  |  |  |  |  |  |    |    |    |    |    |    |
|    |    |  |  |  |  |  |  |  |  |  |  |    |    |    |    |    |    |

# Propiedades de los óxidos a través de un período

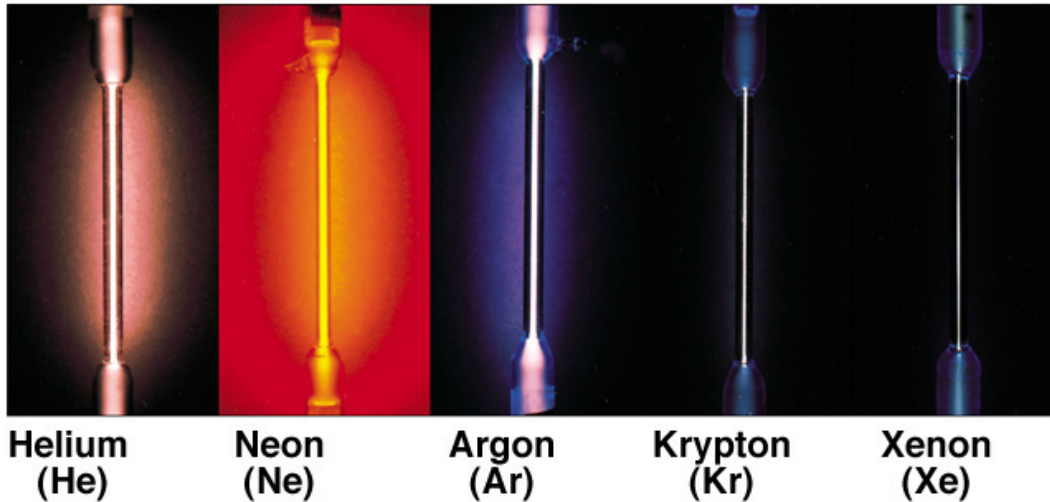
| 1A      | 2A |  |  |  |  |  |  |  |  |  |  |  |  | 3A | 4A | 5A | 6A     | 7A | 8A |
|---------|----|--|--|--|--|--|--|--|--|--|--|--|--|----|----|----|--------|----|----|
| básicos |    |  |  |  |  |  |  |  |  |  |  |  |  |    |    |    | ácidos |    |    |
|         |    |  |  |  |  |  |  |  |  |  |  |  |  |    |    |    |        |    |    |
|         |    |  |  |  |  |  |  |  |  |  |  |  |  |    |    |    |        |    |    |
|         |    |  |  |  |  |  |  |  |  |  |  |  |  |    |    |    |        |    |    |
|         |    |  |  |  |  |  |  |  |  |  |  |  |  |    |    |    |        |    |    |
|         |    |  |  |  |  |  |  |  |  |  |  |  |  |    |    |    |        |    |    |

## Algunas propiedades de los óxidos del tercer período

|                    | Na <sub>2</sub> O                   | MgO   | Al <sub>2</sub> O <sub>3</sub> | SiO <sub>2</sub>  | P <sub>4</sub> O <sub>10</sub> | SO <sub>3</sub> | Cl <sub>2</sub> O <sub>7</sub> |
|--------------------|-------------------------------------|-------|--------------------------------|-------------------|--------------------------------|-----------------|--------------------------------|
| Type of compound   | ←—— Ionic ——→                       |       |                                | ←—— Molecular ——→ |                                |                 |                                |
| Structure          | ←—— Extensive three-dimensional ——→ |       |                                |                   | ←—— Discrete ——→               |                 |                                |
|                    |                                     |       |                                |                   | molecular units                |                 |                                |
| Melting point (°C) | 1275                                | 2800  | 2045                           | 1610              | 580                            | 16.8            | −91.5                          |
| Boiling point (°C) | ?                                   | 3600  | 2980                           | 2230              | ?                              | 44.8            | 82                             |
| Acid-base nature   | Basic                               | Basic | Amphoteric                     | ←—— Acidic ——→    |                                |                 |                                |

# La química en acción:

## El descubrimiento de los gases nobles



Sir William Ramsay