

Guide to Selecting the Most Suitable Technique

Selecting a technique requires consideration of a variety of important criteria, such as: detection limits, analytical working range, and elements of interest. The tables below provide detection limit ranges for ICP-OES and ICP-MS for various elements. If detection limit ranges are not provided for an element, analysis may not be feasible by the specified technique.

Elements Measureable by ICP-OES

| Hydrogen 1 H 1.0079 | | Elements Measureable by ICP-OES | | | | | | | | | | | | | | | | | | Helium 2 He 4.0026 | | | | | |
|--------------------------------|---------------------------------|-------------------------------------|---------------------------------|----------------------------------|---------------------------------|-----------------------------------|-----------------------------------|--------------------------------|-----------------------------------|-------------------------------|--------------------------------|-------------------------------|--------------------------------|--------------------------------|--------------------------------|-------------------------------|-------------------------------|--|--|--------------------------------|-------------------------------|---------------------------------|-----------------------------|--------------------------------|-----------------------------|
| Lithium 3 Li 6.941 | Beryllium 4 Be 9.0122 | | | | | | | | | | | | | | | | | | | Boron 5 B 10.81 | Carbon 6 C 12.011 | Nitrogen 7 N 14.007 | Oxygen 8 O 15.999 | Fluorine 9 F 18.998 | Neon 10 Ne 20.180 |
| Sodium 11 Na 22.990 | Magnesium 12 Mg 24.305 | | | | | | | | | | | | | | | | | | | Aluminum 13 Al 26.982 | Silicon 14 Si 28.086 | Phosphorus 15 P 30.974 | Sulfur 16 S 32.065 | Chlorine 17 Cl 35.453 | Argon 18 Ar 39.948 |
| Potassium 19 K 39.098 | Calcium 20 Ca 40.078 | Scandium 21 Sc 44.956 | Titanium 22 Ti 47.88 | Vanadium 23 V 50.942 | Chromium 24 Cr 51.996 | Manganese 25 Mn 54.938 | Iron 26 Fe 55.845 | Cobalt 27 Co 58.933 | Nickel 28 Ni 58.693 | Copper 29 Cu 63.546 | Zinc 30 Zn 65.38 | Gallium 31 Ga 69.723 | Germanium 32 Ge 72.64 | Arsenic 33 As 74.922 | Selenium 34 Se 78.96 | Bromine 35 Br 79.904 | Krypton 36 Kr 83.798 | | | | | | | | |
| Rubidium 37 Rb 85.468 | Sr 38 Sr 87.62 | Yttrium 39 Y 88.906 | Zirconium 40 Zr 91.224 | Niobium 41 Nb 92.906 | Molybdenum 42 Mo 95.94 | Technetium 43 Tc 98.906 | Ruthenium 44 Ru 101.07 | Rhodium 45 Rh 102.91 | Palladium 46 Pd 106.42 | Silver 47 Ag 107.87 | Cadmium 48 Cd 112.41 | Indium 49 In 114.82 | Tin 50 Sn 118.71 | Antimony 51 Sb 121.76 | Tellurium 52 Te 127.6 | Iodine 53 I 126.90 | Xenon 54 Xe 131.29 | | | | | | | | |
| Cesium 55 Cs 132.91 | Barium 56 Ba 137.33 | Hafnium 72 Hf 178.49 | Tantalum 73 Ta 180.95 | Tungsten 74 W 183.84 | Rhenium 75 Re 186.21 | Osmium 76 Os 190.23 | Iridium 77 Ir 192.22 | Platinum 78 Pt 195.08 | Gold 79 Au 196.97 | Mercury 80 Hg 200.59 | Thallium 81 Tl 204.38 | Lead 82 Pb 207.2 | Bismuth 83 Bi 208.98 | Polonium 84 Po [209] | Astatine 85 At [210] | Radon 86 Rn [222] | | | | | | | | | |
| Francium 87 Fr [223] | Radium 88 Ra [226] | Rutherfordium 104 Rf [261] | Dubnium 105 Db [262] | Seaborgium 106 Sg [266] | Berkelium 107 Bk [267] | Californium 108 Cf [271] | Einsteinium 109 Es [272] | Fermium 110 Fm [277] | Mendelevium 111 Md [281] | | | | | | | | | | | | | | | | |

Detection Limit Ranges

- < 0.1 ppb (µg/L)
- 0.1 - 1 ppb (µg/L)
- 1 - 10 ppb (µg/L)

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|---------------------------------|-------------------------------|------------------------------------|---------------------------------|---------------------------------|--------------------------------|--------------------------------|----------------------------------|--------------------------------|----------------------------------|----------------------------------|-------------------------------|-----------------------------------|---------------------------------|--------------------------------|
| Lanthanum 57 La 138.91 | Cerium 58 Ce 140.12 | Praseodymium 59 Pr 140.91 | Neodymium 60 Nd 144.24 | Promethium 61 Pm [145] | Samarium 62 Sm 150.36 | Europium 63 Eu 151.96 | Gadolinium 64 Gd 157.25 | Terbium 65 Tb 158.93 | Dysprosium 66 Dy 162.50 | Holmium 67 Ho 164.93 | Erbium 68 Er 167.26 | Thulium 69 Tm 168.93 | Ytterbium 70 Yb 173.05 | Lutetium 71 Lu 174.97 |
| Actinium 89 Ac [227] | Thorium 90 Th 232.04 | Protactinium 91 Pa 231.04 | Uranium 92 U 238.03 | Neptunium 93 Np [237] | Plutonium 94 Pu [244] | Americium 95 Am [243] | Curium 96 Cm [247] | Berkelium 97 Bk [247] | Californium 98 Cf [251] | Einsteinium 99 Es [252] | Fermium 100 Fm [257] | Mendelevium 101 Md [258] | Nobelium 102 No [259] | Lr 103 Lr [262] |

Elements Measureable by ICP-MS

| Hydrogen 1 H 1.0079 | | Elements Measureable by ICP-MS | | | | | | | | | | | | | | | | | | Helium 2 He 4.0026 | | | | | |
|--------------------------------|---------------------------------|-------------------------------------|---------------------------------|----------------------------------|---------------------------------|-----------------------------------|-----------------------------------|--------------------------------|-----------------------------------|-------------------------------|--------------------------------|-------------------------------|--------------------------------|--------------------------------|--------------------------------|-------------------------------|-------------------------------|--|--|--------------------------------|-------------------------------|---------------------------------|-----------------------------|--------------------------------|-----------------------------|
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| Sodium 11 Na 22.990 | Magnesium 12 Mg 24.305 | | | | | | | | | | | | | | | | | | | Aluminum 13 Al 26.982 | Silicon 14 Si 28.086 | Phosphorus 15 P 30.974 | Sulfur 16 S 32.065 | Chlorine 17 Cl 35.453 | Argon 18 Ar 39.948 |
| Potassium 19 K 39.098 | Calcium 20 Ca 40.078 | Scandium 21 Sc 44.956 | Titanium 22 Ti 47.88 | Vanadium 23 V 50.942 | Chromium 24 Cr 51.996 | Manganese 25 Mn 54.938 | Iron 26 Fe 55.845 | Cobalt 27 Co 58.933 | Nickel 28 Ni 58.693 | Copper 29 Cu 63.546 | Zinc 30 Zn 65.38 | Gallium 31 Ga 69.723 | Germanium 32 Ge 72.64 | Arsenic 33 As 74.922 | Selenium 34 Se 78.96 | Bromine 35 Br 79.904 | Krypton 36 Kr 83.798 | | | | | | | | |
| Rubidium 37 Rb 85.468 | Sr 38 Sr 87.62 | Yttrium 39 Y 88.906 | Zirconium 40 Zr 91.224 | Niobium 41 Nb 92.906 | Molybdenum 42 Mo 95.94 | Technetium 43 Tc 98.906 | Ruthenium 44 Ru 101.07 | Rhodium 45 Rh 102.91 | Palladium 46 Pd 106.42 | Silver 47 Ag 107.87 | Cadmium 48 Cd 112.41 | Indium 49 In 114.82 | Tin 50 Sn 118.71 | Antimony 51 Sb 121.76 | Tellurium 52 Te 127.6 | Iodine 53 I 126.90 | Xenon 54 Xe 131.29 | | | | | | | | |
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Detection Limit Ranges

- < 0.1 - 1 ppt (ng/L)
- 1 - 10 ppt (ng/L)
- 10 - 100 ppt (ng/L)
- 0.1 - 1 ppb (µg/L)
- 1 - 10 ppb (µg/L)

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|---------------------------------|-------------------------------|------------------------------------|---------------------------------|---------------------------------|--------------------------------|--------------------------------|----------------------------------|--------------------------------|----------------------------------|----------------------------------|-------------------------------|-----------------------------------|---------------------------------|--------------------------------|
| Lanthanum 57 La 138.91 | Cerium 58 Ce 140.12 | Praseodymium 59 Pr 140.91 | Neodymium 60 Nd 144.24 | Promethium 61 Pm [145] | Samarium 62 Sm 150.36 | Europium 63 Eu 151.96 | Gadolinium 64 Gd 157.25 | Terbium 65 Tb 158.93 | Dysprosium 66 Dy 162.50 | Holmium 67 Ho 164.93 | Erbium 68 Er 167.26 | Thulium 69 Tm 168.93 | Ytterbium 70 Yb 173.05 | Lutetium 71 Lu 174.97 |
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