

Reference Tables for Physical Science: CHEMISTRY

2025 Edition

Periodic Table of the Elements

1

1

2

3

4

5

6

7

8

9

10

11

12

13

14

15

16

17

18

1

H

Hydrogen

1.01

3

Li

Lithium

6.94

11

Na

Sodium

22.99

19

K

Potassium

39.10

37

Rb

Rubidium

85.47

55

Cs

Cesium

132.91

87

Fr

Francium

2

Be

Beryllium

9.01

4

He

Helium

4.00

12

Mg

Magnesium

24.31

20

Ca

Calcium

40.08

38

Sr

Strontium

87.62

56

Ba

Barium

137.33

88

Ra

Radium

21

Sc

Scandium

44.96

39

Y

Yttrium

88.91

57

La

Lanthanum

138.91

89

Ac

Actinium

22

Ti

Titanium

47.87

40

Zr

Zirconium

91.22

72

Hf

Hafnium

178.49

104

Rf

Rutherfordium

23

V

Vanadium

50.94

41

Nb

Niobium

92.91

73

Ta

Tantalum

180.95

105

Db

Dubnium

24

Cr

Chromium

52.00

42

Mo

Molybdenum

95.95

74

W

Tungsten

183.84

106

Sg

Seaborgium

25

Mn

Manganese

54.94

43

Tc

Technetium

75

Re

Rhenium

186.21

107

Bh

Bohrium

26

Fe

Iron

55.85

44

Ru

Ruthenium

101.07

76

Os

Osmium

190.23

108

Hs

Hassium

27

Co

Cobalt

58.93

45

Rh

Rhodium

102.91

77

Ir

Iridium

192.22

109

Mt

Meitnerium

28

Ni

Nickel

58.69

46

Pd

Palladium

106.42

78

Pt

Platinum

195.08

110

Ds

Darmstadtium

29

Cu

Copper

63.55

47

Ag

Silver

107.87

79

Au

Gold

196.97

111

Rg

Roentgenium

30

Zn

Zinc

65.38

48

Cd

Cadmium

112.41

80

Hg

Mercury

200.59

112

Cn

Copernicium

31

Ga

Gallium

69.72

49

In

Indium

114.82

81

Tl

Thallium

204.38

113

Nh

Nihonium

32

Ge

Germanium

72.63

50

Sn

Tin

118.71

82

Pb

Lead

207.2

114

Fl

Flerovium

33

As

Arsenic

74.92

51

Sb

Antimony

121.76

83

Bi

Bismuth

208.98

115

Mc

Moscovium

34

Se

Selenium

78.97

52

Te

Tellurium

127.60

84

Po

Polonium

116

Lv

Livermorium

35

Br

Bromine

79.90

53

I

Iodine

126.90

85

At

Astatine

117

Ts

Tennessine

36

Kr

Krypton

83.80

54

Xe

Xenon

131.29

86

Rn

Radon

118

Og

Oganesson

50

Sn

Tin

118.71

Atomic number

Element symbol

Element name

Average atomic mass

58

Ce

Cerium

140.12

90

Th

Thorium

232.04

59

Pr

Praseodymium

140.91

91

Pa

Protactinium

231.04

60

Nd

Neodymium

144.24

92

U

Uranium

238.03

61

Pm

Promethium

93

Np

Neptunium

62

Sm

Samarium

150.36

94

Pu

Plutonium

63

Eu

Europium

151.96

95

Am

Americium

64

Gd

Gadolinium

157.25

96

Cm

Curium

65

Tb

Terbium

158.93

97

Bk

Berkelium

66

Dy

Dysprosium

162.50

98

Cf

Californium

67

Ho

Holmium

164.93

99

Es

Einsteinium

68

Er

Erbium

167.26

100

Fm

Fermium

69

Tm

Thulium

168.93

101

Md

Mendelevium

70

Yb

Ytterbium

173.04

102

No

Nobelium

71

Lu

Lutetium

174.97

103

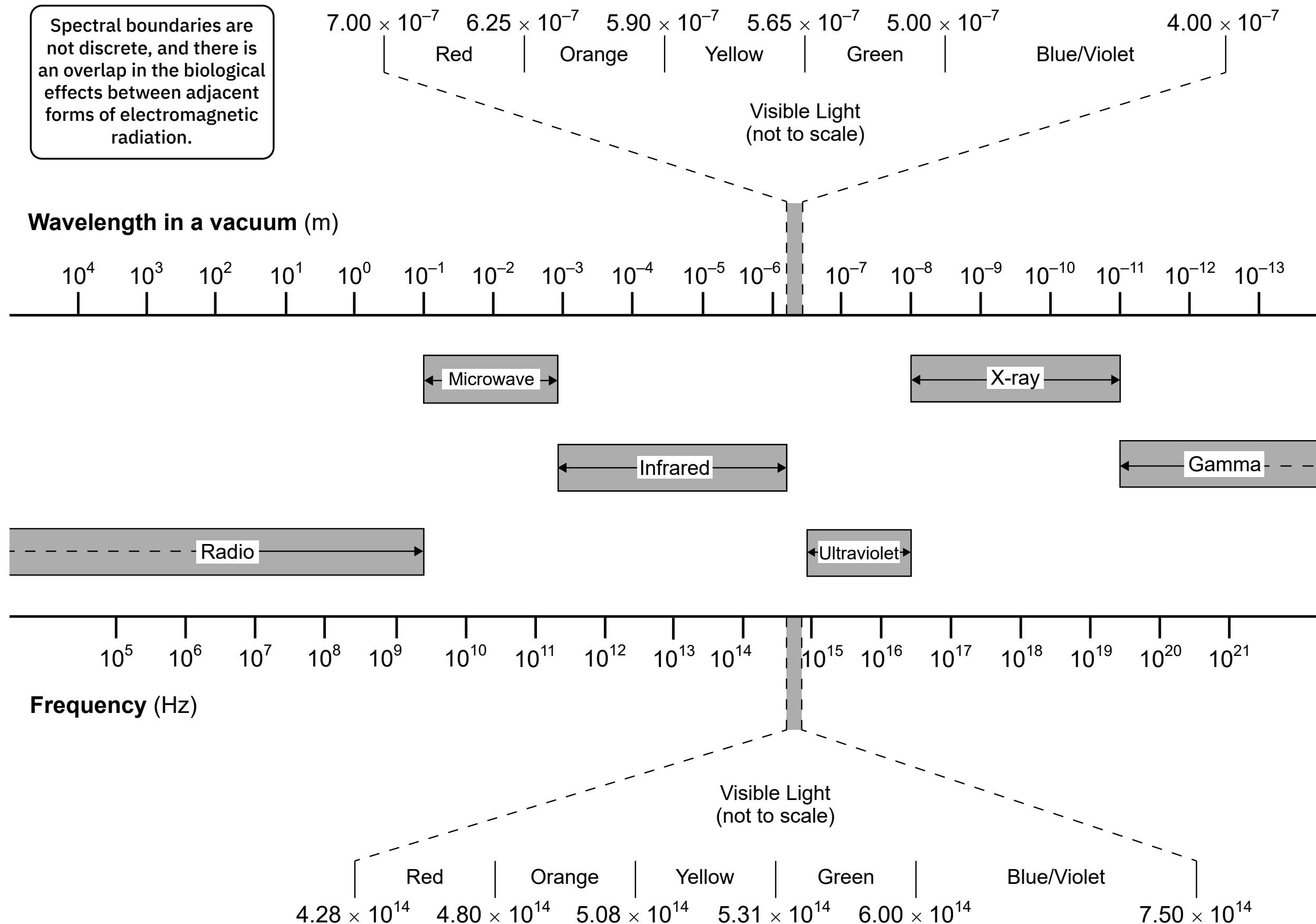
Lr

Lawrencium

Source: CRC Handbook of Chemistry and Physics, 104th ed., 2023–2024, CRC Press

The Electromagnetic Spectrum

Spectral boundaries are not discrete, and there is an overlap in the biological effects between adjacent forms of electromagnetic radiation.



Symbols Used in Nuclear Chemistry	
Name	Notation
alpha	${}^4_2\text{He}$ or ${}^4_2\alpha$
beta	${}^0_{-1}\text{e}$ or ${}^0_{-1}\beta$
gamma	${}^0_0\gamma$
neutron	${}^1_0\text{n}$
positron	${}^0_{+1}\text{e}$ or ${}^0_{+1}\beta$
proton	${}^1_1\text{H}$ or ${}^1_1\text{p}$

Selected Ions Forming Aqueous Solutions	
Name	Formula
Group 1 metals	$\text{Li}^+, \text{Na}^+, \text{etc.}$
ammonium	NH_4^+
acetate	$\text{C}_2\text{H}_3\text{O}_2^-$
chlorate	ClO_3^-
hydrogen carbonate	HCO_3^-
nitrate	NO_3^-

Mathematical and Computational Models	
Equations	Variables
$\frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2}$	P = pressure V = volume T = temperature
$q = mc\Delta T$ $q = mH_f$ $q = mH_v$	q = heat m = mass c = specific heat capacity ΔT = change in temperature H_f = heat of fusion H_v = heat of vaporization
$\text{ppm} = \frac{\text{mass of solute}}{\text{mass of solution}} \times 1\,000\,000$	ppm = parts per million
$n = MV$	n = moles M = molarity V = volume
$F \propto \frac{q_1 q_2}{d^2}$ *qualitative analysis	F = coulombic force q = charge d = distance of separation

Mathematical Relationships	
Temperature	$K = ^\circ\text{C} + 273.15$
Pressure	$1 \text{ atm} = 101.3 \text{ kPa}$
1 mole	= molar mass (g)
	= 6.02×10^{23} particles
	= 22.4 L (ideal gas at STP)

Note: Standard Temperature and Pressure (STP) conditions are 273.15 K and 1 atm.

Selected Units	
Symbol	Name
atm	atmosphere
$^\circ\text{C}$	degrees Celsius
g	gram
Hz	hertz
J	joule
K	kelvin
L	liter
m	meter
mol	mole
Pa	pascal
s	second

Selected Metric Prefixes		
Name	Symbol	Factor
kilo–	k	10^3
milli–	m	10^{-3}
micro–	μ	10^{-6}
nano–	n	10^{-9}