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# Reference Tables for Physical Science: Physics

## 2025 Edition

### List of Physical Constants

| Name | Symbol | Magnitude |
|---|---|---|
| Acceleration due to gravity near Earth's surface | $g$ | 9.8 m/s$^2$ |
| Gravitational field strength near Earth's surface | $g$ | 9.8 N/kg |
| Universal gravitational constant | $G$ | $6.67 \times 10^{-11}$ N•m$^2$/kg$^2$ |
| Speed of light in a vacuum | $c$ | $3.00 \times 10^8$ m/s |
| Speed of sound in air at STP | | $3.31 \times 10^2$ m/s |
| 1 electronvolt (eV) | | $1.60 \times 10^{-19}$ J |
| Electrostatic constant | $k$ | $9.0 \times 10^9$ N•m$^2$/C$^2$ |
| 1 elementary charge | $e$ | $1.60 \times 10^{-19}$ C |
| Planck's constant | $h$ | $6.63 \times 10^{-34}$ J•s |

| Prefixes for Powers of 10 | | |
|---|---|---|
| **Prefix** | **Symbol** | **Notation** |
| tera | T | $10^{12}$ |
| giga | G | $10^9$ |
| mega | M | $10^6$ |
| kilo | k | $10^3$ |
| deci | d | $10^{-1}$ |
| centi | c | $10^{-2}$ |
| milli | m | $10^{-3}$ |
| micro | μ | $10^{-6}$ |
| nano | n | $10^{-9}$ |
| pico | p | $10^{-12}$ |

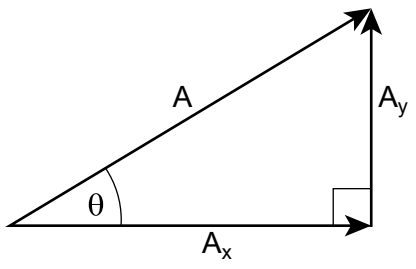
### Vectors

$$A^2 = A_x^2 + A_y^2$$

$$\cos\theta = \frac{A_x}{A}$$

$$\sin\theta = \frac{A_y}{A}$$

$$\tan\theta = \frac{A_y}{A_x}$$



## Motion and Forces

$$\overline{v} = \frac{d}{t} = \frac{v_f + v_i}{2}$$

$$a = \frac{\Delta v}{t} = \frac{v_f - v_i}{t}$$

$$v_f = v_i + at$$

$$d = v_i t + \frac{1}{2} at^2$$

$$v_f^2 = v_i^2 + 2ad$$

$$F_{net} = ma$$

$$F_g = mg$$

$$F_{net} t = m\Delta v$$

$$p = mv$$

$$F_g = \frac{Gm_1 m_2}{r^2}$$

$$a_c = \frac{v^2}{r}$$

$$C = 2\pi r$$

$a$ = acceleration

$a_c$ = radial acceleration during circular motion

$C$ = circumference

$d$ = displacement *or* distance

$F_g$ = weight *or* gravitational force

$F_{net}$ = net force

$g$ = acceleration due to gravity *or* gravitational field strength

$G$ = universal gravitational constant

$m$ = mass

$p$ = momentum

$r$ = radius *or* distance between centers

$t$ = time interval

$v$ = velocity *or* speed

$\overline{v}$ = average velocity *or* average speed

$v_i$ = initial velocity *or* initial speed

$v_f$ = final velocity *or* final speed

$\Delta$ = change

## Energy

$$KE = \frac{1}{2}mv^2$$

$$\Delta PE_g = mg\Delta h$$

$$PE_s = \frac{1}{2}kx^2$$

$$W = Fd$$

$$W_{net} = \Delta E_T$$

$$E_T = PE + KE + E_{other}$$

$$P = \frac{W}{t} = \frac{Fd}{t} = F\overline{v}$$

$$Q = mc\Delta T$$

$$\% \text{ efficiency} = \frac{\text{output}}{\text{input}} \times 100$$

$c$ = specific heat capacity

$d$ = displacement *or* distance

$E_{other}$ = non-mechanical energy

$E_T$ = total energy

$F$ = force

$g$ = acceleration due to gravity *or* gravitational field strength

$h$ = height

$k$ = spring constant

$KE$ = kinetic energy

$m$ = mass

$P$ = power

$PE$ = potential energy

$PE_g$ = gravitational potential energy

$PE_s$ = spring potential energy

$Q$ = change in thermal energy

$T$ = temperature

$t$ = time interval

$v$ = velocity *or* speed

$\overline{v}$ = average velocity *or* average speed

$W$ = work

$W_{net}$ = net work

$x$ = change in spring length from equilibrum position

$\Delta$ = change

## Waves and Electromagnetic Radiation

$$v = f\lambda$$

$$T = \frac{1}{f}$$

$$E_{photon} = hf$$

$$\theta_i = \theta_r$$

$$n = \frac{c}{v}$$

$$n_1 \sin\theta_1 = n_2 \sin\theta_2$$

$$\frac{n_2}{n_1} = \frac{v_1}{v_2} = \frac{\lambda_1}{\lambda_2}$$

$$\frac{1}{F} = \frac{1}{d_o} + \frac{1}{d_i}$$

$$\frac{h_i}{h_o} = -\frac{d_i}{d_o}$$

$c$ = speed of light in a vacuum

$d_i$ = distance to image

$d_o$ = distance to object

$E_{photon}$ = energy of photon

$F$ = focal length

$f$ = frequency

$h$ = Planck's constant

$h_i$ = image height

$h_o$ = object height

$n$ = absolute index of refraction

$T$ = period

$v$ = velocity *or* speed

$\lambda$ = wavelength

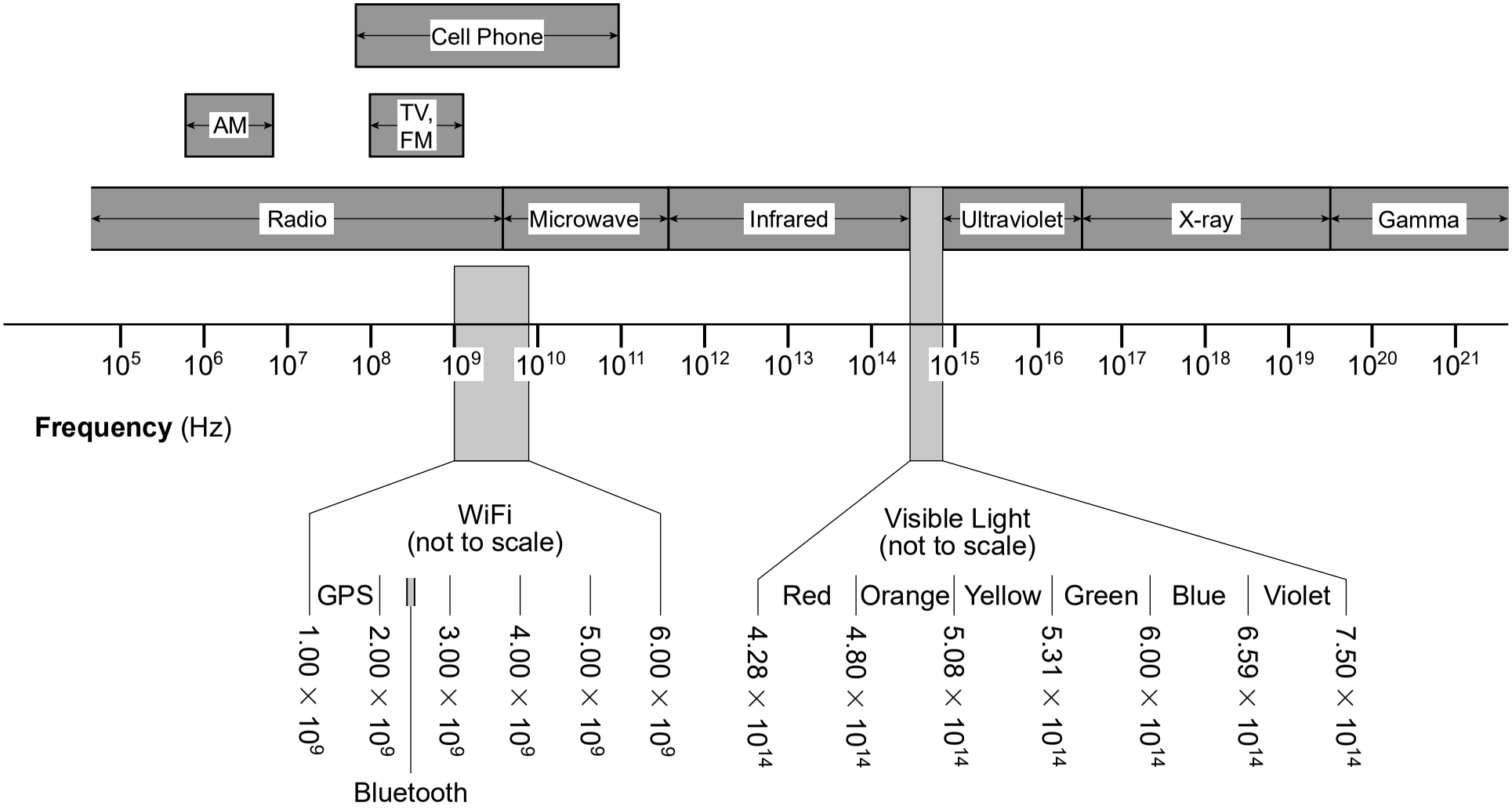
$\theta$ = angle

$\theta_i$ = angle of incidence

$\theta_r$ = angle of reflection

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

## The Electromagnetic Spectrum



## Electricity

$$F_e = \frac{kq_1q_2}{r^2}$$

$$F_e = qE$$

$$W = qV$$

$$P = VI = I^2R = \frac{V^2}{R}$$

$$W = Pt = VIt = I^2Rt = \frac{V^2t}{R}$$

$$V = IR$$

$$I = \frac{\Delta q}{t}$$

$E$ = electric field strength

$F_e$ = electrostatic force

$I$ = current

$k$ = electrostatic constant

$P$ = power

$q$ = charge

$r$ = distance between centers

$R$ = resistance

$R_{eq}$ = equivalent resistance

$t$ = time interval

$V$ = potential difference

$W$ = work *or* electrical energy

$\Delta$ = change

### Circuit Symbols


battery

power supply


switch

voltmeter

ammeter


resistor


variable resistor


light bulb

### Series Circuits

$$I = I_1 = I_2 = I_3 = \ldots$$

$$V = V_1 + V_2 + V_3 + \ldots$$

$$R_{eq} = R_1 + R_2 + R_3 + \ldots$$

### Parallel Circuits

$$I = I_1 + I_2 + I_3 + \ldots$$

$$V = V_1 = V_2 = V_3 = \ldots$$

$$\frac{1}{R_{eq}} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + \ldots$$