

# SciPy Constants

- In **SciPy**, there is a module called `scipy.constants` which contains a collection of physical constants, mathematical constants, and conversion factors.
- These constants are useful in scientific computations, especially in fields such as physics, chemistry, and engineering.

```
import scipy.constants as sc
```

OR

```
from scipy import constants
```

## Commonly Used Constants

### (A) Mathematical Constants

Constant	Description	Value
<code>constants.pi</code>	Pi ( $\pi$ )	3.141593
<code>constants.e</code>	Euler's number (e)	2.718282
<code>constants.tau</code>	Tau ( $\tau = 2\pi$ )	6.283185
<code>constants.golden</code>	Golden ratio ( $\phi$ )	1.618034

```
print(sc.pi)  # Output: 3.141592653589793
print(sc.e)    # Output: 2.718281828459045
```

### (B) Physical Constants

Constant	Description	Value & Unit
<code>constants.g</code>	Acceleration due to gravity	9.80665 m/s <sup>2</sup>
<code>constants.G</code>	Gravitational Constant (G)	$6.67430 \times 10^{-11} \text{ N}\cdot\text{m}^2/\text{kg}^2$
<code>constants.c</code>	Speed of light in vacuum	299792458 m/s
<code>constants.h</code>	Planck's constant	$6.62607015 \times 10^{-34} \text{ J}\cdot\text{s}$
<code>constants.k</code>	Boltzmann constant	$1.380649 \times 10^{-23} \text{ J/K}$
<code>constants.R</code>	Gas constant	8.314 J/(mol·K)

```
print(sc.g) # Output: 9.80665
print(sc.c) # Output: 299792458
```

## (C) Unit Conversions

Conversion	Function
<code>constants.minute</code>	60 (seconds)
<code>constants.hour</code>	3600 (seconds)
<code>constants.day</code>	86400 (seconds)
<code>constants.inch</code>	0.0254 (meters)
<code>constants.kilo</code>	1000 (grams)
<code>constants.lb</code>	0.453592(grams)
<code>sc.mile</code>	1609.3439 (meter)
<code>sc.inch</code>	0.0254 (meter)
<code>sc.zero_Celsius</code>	273.15 (K)

```
inches = 5
meters = inches * sc.inch
print(meters) # Output: 0.127 (meters)
```

```
sc.year
```

```
Output: 31536000.0
```

- There are 31536000.0 sec in a year

## Listing All Constants

```
dir(sc)
```

OR

```
dir(constants)
```

## List of Common Constants

Constant	Value
$\pi$ (Pi)	sc.pi = 3.141592653589793
Euler's number (e)	sc.e = 2.718281828459045
Gravitational constant (G)	sc.G = $6.67430 \times 10^{-11} \text{ N}\cdot\text{m}^2/\text{kg}^2$
Speed of light (c)	sc.c = 299792458.0 m/s
Boltzmann constant (k)	sc.k = $1.380649 \times 10^{-23} \text{ J/K}$
Planck's constant (h)	sc.h = $6.62607015 \times 10^{-34} \text{ J}\cdot\text{s}$
Avogadro's number (N_A)	sc.N_A = $6.02214076 \times 10^{23} \text{ 1/mol}$
Gas constant (R)	sc.R = $8.314462618 \text{ J/(mol}\cdot\text{K)}$
Electron charge (e)	sc.electron_volt = $1.602176634 \times 10^{-19} \text{ C}$
Electron mass (m_e)	sc.m_e = $9.10938356 \times 10^{-31} \text{ kg}$
Zero Celsius (K)	sc.zero_Celsius = 273.15 K
Absolute zero (K)	sc.zero_K = 0 K

# SciPy Constants: Categories and Their Units

Category	Unit Used
Mathematical Constants	Dimensionless
Length Constants	Meters (m)
Time Constants	Seconds (s)
Mass Constants	Kilograms (kg)
Speed Constants	Meters per second (m/s)
Force Constants	Newtons (N) = $\text{kg}\cdot\text{m}/\text{s}^2$
Energy Constants	Joules (J) = $\text{kg}\cdot\text{m}^2/\text{s}^2$
Power Constants	Watts (W) = J/s
Temperature Constants	Kelvin (K)
Charge Constants	Coulombs (C)
Magnetic Constants	Tesla (T), Henry (H)
Pressure Constants	Pascals (Pa) = $\text{N}/\text{m}^2$