**Harold’s Physics Units of Measure**

**Cheat Sheet**

4 May 2024

**The 7 Base Units of Measure**

|  |  |  |  |
| --- | --- | --- | --- |
| **Quantity Name** | **Symbol** | **Metric Units (SI)** | **Imperial Units (English)** |
| **1. Length / Distance** | l, x, y, z | meter (m) | foot (ft) |
| **2. Mass** | m, M | kilogram (kg) | slug (or lb) |
| **3. Time** | t | second (s) | |
| **4. Temperature** | T | Kelvin (K)  Celsius (⁰C) | Fahrenheit (⁰F) |
| **5. Electrical Current** | i | Ampere (A) | |
| **6. Amount of Substance** | M, χ | mole (mol) | 1 mol ≈ 6.02214076 × 1023 |
| **7. Luminous Intensity** | lv | Candela (cd) | |
| **Note**: The 7 base units are mutually independent from each other. All other units of measurement can be derived from them. | | | |

**Derived Units of Measure – Mechanics**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Quantity Name** | **Symbol** | **Metric Units**  **(SI)** | | **Imperial Units**  **(English)** | |
| **Length / Displacement** | s, d, h | meter (m) | m | foot (ft) | ft |
| **Area** | A, S |  | m2 |  | ft2 |
| **Volume** | V | liter (l) | m3 | fluid ounce (fl) | ft3 |
| **Velocity / Speed** | v, s |  | m/s |  | ft/s |
| **Acceleration** | a, g | **g** = -9.81 m/s2 | m/s2 | **g** = -32.2 ft/s2 | ft/s2 |
| **Jerk / Jolt** | J |  | m/s3 |  | ft/s3 |
| **Impulse** | I |  | N∙s  kg∙m/s |  | lb∙ft/s |
| **Linear Momentum** | p |  | kg∙m/s |  | lb∙ft/s |
| **Force** | F | Newton (N) | kg∙m/s2 | pound (lb) | slug∙ft/s2 |
| **Energy / Work / Heat** | E, W, KE or K, Ug, Us, UE, Q | Joule (J) | N∙m  C∙V  W∙s  kg∙m2/s2 | calorie (cal) | ft∙lb |
| **Power** | P | Watt (W) | J/s  V∙A  kg∙m2 /s3 | horsepower (hp) | ft∙lb/s |
| **Surface Tension** | T |  | N/m  kg/s2 |  | lb/ft |
| **Pressure / Stress** | P | Pascal (Pa)  bar | N/m2  kg/m∙s2 | atmosphere (atm) | lb∙ft/s2 |
| **Density** | ρ |  | kg/m3 |  | slug/m3 |

**Derived Units of Measure – Kinematics**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Quantity Name** | **Symbol** | **Unit Name** | **SI Units** | **SI Base Units** |
| **Wavelength** | λ |  | m |  |
| **Frequency** | F, v | Hertz (Hz) | cycles/s | 1/s |
| **Time Period** | T |  | s |  |
| **Angular Displacement / Plane Angle** | θ | radian (rad) | m/m | 1 |
| **Solid Angle** | Ω, sr | Steradian (sr) | m2/m2 | 1 |
| **Angular Velocity / Frequency** | ω |  | rad/s |  |
| **Angular Acceleration** | α |  | rad/s2 |  |
| **Moment of Inertia** | I |  | kg∙m2 |  |
| **Angular Momentum** | J, L |  | kg∙m2∙rad/s | kg∙m2/s |
| **Torque**  **(Moment of Force)** | τ |  | N∙m |  |
| **Angular Impulse** | J |  | N∙m∙s |  |

**Derived Units of Measure – Electromagnetics**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Quantity Name** | **Symbol** | **Unit Name** | **SI Units** | **SI Base Units** |
| **Electric Charge** | Q, q, e | Coulomb (C) | s∙A  F∙V |  |
| **Current Density** | J |  | A/m2 |  |
| **Electric Potential / Electromotive Force (EMF) / Voltage** | V, E | Volt (V) | W/A  J/C | kg∙m2/s3∙A |
| **Electric Field** | E |  | V/m |  |
| **Electric Flux** | Ie |  | V∙m |  |
| **Electric Resistance** | R | Ohm (Ω) | V/A  1/S | kg·m2/s3·A2 |
| **Electric Capacitance** | C | Farad (F) | C/V  s/Ω | s4∙A2/kg∙m2 |
| **Electric Field Strength** | E |  | V/m | N/C |
| **Electric Conductance** | S | Siemens | 1/Ω  A/V | s3·A2/kg·m2 |
| **Magnetic Flux** | φB | Weber (Wb) | V∙s  J/A  T∙m2 | kg·m2/s2∙A |
| **Magnetic Field / Flux Density** | B | Tesla (T) | Wb/m2  V∙s/m2  N/A∙m | kg/s2·A |
| **Magnetic Induction** | Im | Henry (H) | Wb/A  V∙s/A  Ω∙s | kg·m2/s2·A2 |

**Derived Units of Measure – Photometry**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Quantity Name** | **Symbol** | **Unit Name** | **SI Units** | **SI Base Units** |
| **Illuminance / Illumination** | lx | Lux (lx) | lm/m2 | cd/m2 |
| **Luminous Flux** | Φ | Lumen (lm) | J/s  cd∙sr | Candela (cd) |

**SI Unit Prefixes**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Prefix** | **Symbol** | **Decimal** | **Base 10** | **English** |
| **googolplex-** |  | (too long) | 101000 | googolplex |
| **googol-** |  | (too long) | 10100 | googol |
| **Quetta-** | Q | 1 000 000 000 000 000 000 000 000 000 000 | 1030 | nonillion |
| **Ronna-** | R | 1 000 000 000 000 000 000 000 000 000 | 1027 | octillion |
| **Yotta-** | Y | 1 000 000 000 000 000 000 000 000 | 1024 | septillion |
| **Zetta-** | Z | 1 000 000 000 000 000 000 000 | 1021 | sextillion |
| **Exa-** | E | 1 000 000 000 000 000 000 | 1018 | quintillion |
| **Peta-** | P | 1 000 000 000 000 000 | 1015 | quadrillion |
| **Tera-** | T | 1 000 000 000 000 | 1012 | trillion |
| **Giga-** | G | 1 000 000 000 | 109 | billion |
| **Mega-** | M | 1 000 000 | 106 | million |
| **kilo-** | k | 1 000 | 103 | thousand |
| **hecto-** | h | 100 | 102 | hundred |
| **deca-** | da | 10 | 101 | ten |
|  |  | 1 | 100 | one |
| **deci-** | d | 0.1 | 10−1 | tenth |
| **centi-** | c | 0.01 | 10−2 | hundredth |
| **milli-** | m | 0.001 | 10−3 | thousandth |
| **micro-** | μ | 0.000 001 | 10−6 | millionth |
| **nano-** | n | 0.000 000 001 | 10−9 | billionth |
| **pico-** | p | 0.000 000 000 001 | 10−12 | trillionth |
| **femto-** | f | 0.000 000 000 000 001 | 10−15 | quadrillionth |
| **atto-** | a | 0.000 000 000 000 000 001 | 10−18 | quintillionth |
| **zepto-** | z | 0.000 000 000 000 000 000 001 | 10−21 | sextillionth |
| **yocto-** | y | 0.000 000 000 000 000 000 000 001 | 10−24 | septillionth |
| **ronto-** | r | 0.000 000 000 000 000 000 000 000 001 | 10−27 | octillionth |
| **quecto-** | q | 0.000 000 000 000 000 000 000 000 000 001 | 10−30 | nonillionth |
| **Googolth-** |  | (too long) | 10−100 | googolth |
| **Googolplexth-** |  | (too long) | 10−1000 | googolplexth |