Derived unit 导出量

Derived quantity (symbol)	Derived unit	Abbreviation
Area (A)	m^2	-
Volume (V)	m^3	-
Speed, velocity (v)	ms^{-1}	-
Acceleration (a)	ms^{-2}	-
Density (ρ)	kgm^{-3}	-
Current density (J)	Am^{-2}	-
Electric charge (Q)	As	Coulomb (c)
Frequency (f)	s^{-1}	Hertz (Hz)
Force (F)	$\mathrm{kg\ ms}^{-2}$	Newton (N)
Pressure, stress (p)	$\mathrm{Nm}^{-2}, \mathrm{kg\ m}^{-1}\mathrm{s}^{-2}$	Pascal (Pa)
Energy (E)	$\mathrm{Nm}, \mathrm{kg\ m}^2\mathrm{s}^{-2}$	Joule (J)
Power (P)	$\mathrm{Js}^{-1}, \mathrm{kg\ m}^2\mathrm{s}^{-3}$	Watt (W)
Electric potential difference (V)	$\mathrm{W\ A}^{-1}, \mathrm{kg\ m}^2\mathrm{s}^{-3}\mathrm{A}^{-1}$	Volt (V)
Capacitance (C)	$\mathrm{C\ V}^{-1}, \mathrm{A}^2\mathrm{s}^4\mathrm{kg}^{-1}\mathrm{m}^{-2}$	Farad (F)
Electric resistance (R)	$\mathrm{V\ A}^{-1}, \mathrm{kg\ m}^2\mathrm{s}^{-3}\mathrm{A}^{-2}$	Ohm (Ω)
Magnetic flux (Φ)	$\mathrm{V\ s}, \mathrm{kgm}^2\mathrm{s}^{-2}\mathrm{A}^{-1}$	Weber (Wb)
Magnetic flux density (B)	$\mathrm{Wb\ m}^{-2}, \mathrm{kg\ s}^{-2}\mathrm{A}^{-1}$	Tesla (T)
Inductance (L)	$\mathrm{Wb\ A}^{-1}, \mathrm{kg\ m}^2\mathrm{s}^{-2}\mathrm{A}^{-2}$	Henry (H)

Prefixes 前綴字

Factor	Name	Symbol
10^{24}	Yotta	Y
10^{21}	Zetta	Z
10^{18}	Exa	E
10^{15}	Peta	P
10^{12}	Tera	T
10^{9}	Giga	G
10^{6}	Mega	M
10^{3}	Kilo	k
10^{2}	Hector	h
10^{1}	deca	da

Factor	Name	Symbol
10^{-1}	Deci	d
10^{-2}	Centi	c
10^{-3}	Milli	m
10^{-6}	Micro	μ
10^{-9}	Nano	n
10^{-12}	Pico	p
10^{-15}	Femto	f
10^{-18}	Atto	a
10^{-21}	Zapto	z
10^{-24}	yocto	y

Dimensions of Base Quantities 基本单位的因次

Base quantity	Dimension
Mass	M
Length	L
Time	T
Electric current	I

temperature	θ
Amount of substance	N

Dimensions of Derived quantity 导出量的因次

Eg. $density = \frac{mass}{volume} = \frac{M}{L^3} = ML^{-3}$

Eg. $momentum = mass \times velocity = (M)(LT^{-1}) = MLT^{-1}$

Derived quantity	Relationship with other quantities	units	Dimensions
Force	$\text{mass} \times \text{acceleration}$	kg m s^{-2}	MLT^{-2}
Pressure	$\frac{\text{force}}{\text{area}}$	$\text{kg m}^{-1}\text{s}^{-2}$	$\text{ML}^{-1}\text{T}^{-2}$
Energy	$\text{force} \times \text{displacement}$	$\text{kg m}^2\text{s}^{-2}$	ML^2T^{-2}
Strain	$\frac{\text{change in length}}{\text{original length}}$	-	-
Power	$\frac{\text{workdone}}{\text{time taken}}$	$\text{kg m}^2\text{s}^{-3}$	ML^2T^{-3}
Electric potential difference	$\frac{\text{power}}{\text{electric current}}$	$\text{kg m}^2\text{s}^{-3}\text{A}^{-1}$	$\text{ML}^2\text{T}^{-3}\text{I}^{-1}$
Electric resistance	$\frac{\text{electric potential difference}}{\text{electric current}}$	$\text{kg m}^2\text{s}^{-3}\text{A}^{-2}$	$\text{ML}^2\text{T}^{-3}\text{I}^{-2}$

练习

1. 一金属的热传导速度可以公式$\frac{Q}{t} = kA\frac{(\theta_2-\theta_1)}{l}$来表达，而 k 是导热系数，A 是 横截面积和$\frac{(\theta_2-\theta_1)}{l}$是温差，求导热系数的单位
2. 求下列的导出量
   a) 重力势能
   b) 功率
3. 提高温度所需的热量为$\Delta\theta$， 物质质量为 m, 若热量为$Q = mc\Delta\theta$， 求 C 的导出量
4. 每单位辐射的热量为$\frac{E}{t}$，$\frac{E}{t} = \sigma AT^4$ A 为表面面积， T 是绝对值，求系数σ
5. 一竿的惯性矩的公式为$I = \frac{1}{3}ml^2$， 质量为 m, 长度为l，求
   a) I的单位
   b) I的因次
6. V=u+at , 求因次