

0 K	= -273.15°C	= -459.67°F
Standard "g"	= 9.806 65 m/s ²	
Density of earth	= 5522 g/L or kg/m ³	
D.of Hg at 0°C	= 13596 g/L or kg/m ³	
D(max) of H ₂ O	= 999.973 kg/m ³	
D.of air at STP	= 1.2929 g/L or kg/m ³	
H.fusion H ₂ O	= 3.3373 E+5 J/kg	
H.vapor. H ₂ O	= 2.25899 E+6 J/kg	
Sp. Heat H ₂ O	= 4.186 E+3 J/kg°C	
SP. Heat Metal	≈ 2.5 E+4/ GFW J/kg°C	
Speed of sound 0°C	= 331.36 m/s +(,59m/s/°C)	
Electron Mass (e)	= 9.109 E-31 kg	
Atomic Mass Unit (p,n)	= 1.661 E-27 kg	
Electron Volt	= 1.603 E-19 J	

R = Rydberg	= 1.097 E+7 1/m
c = velocity of light	= 2.998 E+8 m/s
k = Boltzmann	= 1.381 E-23 J/K
h = Planck	= 6.626 E-34 J's
G = Univ. grav.	= 6.673 E-11 N·m ² /kg ²
K = Coulomb = 1/(4πϵ ₀)	= 8.988 E+9 N·m ² /C ²
σ = Stefan Boltzmann	= 5.670 E-8 W/m ² ·K ⁴
μ _o = Permeability	= 4π E-7 T·m/A
ε ₀ = Permittivity = 1/(μ ₀ c ²)	= 8.854 E-12 C ² /N·m ²
N _A = Avogadro's Number	= 6.023 E+23 particles/mole
e = elem. charge (p ⁺ ,e ⁻)	= 1.60 E-19 C

$$ax^2 + bx + c = 0 \quad \text{quadratic eq.:} \quad x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

VECTORS

$$\vec{r} = a_x \hat{x} + a_y \hat{y} + a_z \hat{z}$$

$$\text{dot} \quad \vec{a} \cdot \vec{b} = (a_x b_x + a_y b_y + a_z b_z) = (ab) \cos \theta$$

$$\text{cross} \quad \vec{a} \times \vec{b} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ a_x & a_y & a_z \\ b_x & b_y & b_z \end{vmatrix} = ab \sin \theta$$

GEOMETRY circle	C = πD = 2πr	A = πr ²
sphere	A = 4πr ²	V = (4/3) πr ³
cone	A = πr (r ² +h ²) ^{1/2}	V = (1/3) a·h
1 radian	= 57.295 779 5°	= 360/(2π)
π = 3.141 592 653 590	e = 2.718 281 828	

PHYSICS NERD CARD

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LOGS

$$a^y = x \quad y = \log_a x$$
$$\log_a(xy) = \log_a x + \log_a y \quad \log_a (x^y) = y \log_a x \quad \log_a x - \log_a y = \log_a (x/y)$$
$$\log_a x^n = n \log_a x$$
$$\ln x = (\ln 10)(\log x) = 2.3026 \log x$$
$$\text{db} = 10 \log (P_1/P_2) = 20 \log (V_1/V_2)$$
$$\text{Doubling time} = 69.315 / (\% \text{ growth per time})$$

TRIG

$$\tan A = \sin A / \cos A \quad \sin^2 A + \cos^2 A = 1$$
$$\sec A = 1 / \cos A \quad \csc A = 1 / \sin A$$

SOHCAHTOA

$$\sin(A \pm B) = \sin A \cos B \pm \cos A \sin B$$
$$\sin = O/H \quad \cos(A \pm B) = \cos A \cos B \mp \sin A \sin B$$
$$\cos = A/H \quad \sin(A/2) = \pm ((1 - \cos A)/2)^{1/2}$$
$$\tan = O/A \quad \cos(A/2) = \pm ((1 + \cos A)/2)^{1/2}$$
$$\sin A \pm \sin B = 2 \sin \frac{1}{2}(A \pm B) \cos \frac{1}{2}(A \mp B)$$
$$\cos A + \cos B = 2 \cos \frac{1}{2}(A+B) \cos \frac{1}{2}(A-B)$$
$$\text{law of sines :} \quad \frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$
$$\text{law of cosines :} \quad c^2 = a^2 + b^2 - 2ab \cos C$$

1 yr = 365.242 days	1 yr = 31 556 925 s
1 m = 3.281 ft	1 m = 39.37 in
1 cm = 0.3937 in	1 in = 2.54 cm
1 km = 0.6214 mi	1 mi = 1.61 km
1 m ² = 10.76 ft ²	1 m ² = 1550 in ²
1 acre = 43 560 ft ²	1 acre = 4046.9 m ²
1 hectare = (hm) ² = 10 000 m ²	= 2.471 acre
1 mL = 0.203 tsp	1 mL = 0.061 02 in ³
1 L = 1.057 qt	1 L = 61.02 in ³
1 m ³ = 35.31 ft ³ = 1057 qt	= 264.2 gal
1 g = 0.035 27 oz	1 oz = 28.35 g
1 kg = 2.205 lb	1 lb = 453.6 g
1 m/s = 3.6 km/h	1 m/s = 2.237 mph
1 cm/s = 0.0328 ft/s	1 km/h = 0.6214 mph
1 N = 0.2248 lbf	1 lbf = 4.448 N
1 dyn = 1 E-5 N	1 dyn = 2.25 E-6 lbf
1 Pa = 1 N/m ²	1 psi = 6894.76 Pa
1 erg = 1 E-7 J	1 cal = 4.186 J
1 BTU = 1055 J	1 eV = 1.602 E-19 J
1 W = 0.001 34 hp	1 hp = 745.7 W
1 C = 6.2415 E+18 e	1 e = 1.602 E-19 C
C° = (F°+40)(5/9)-40	F° = (C°+40)(9/5)-40

21

11

10

6

8

7

6

5

4

3

2

1

0

alpha A α

beta B β

gamma Γ γ

delta Δ δ

epsilon E ε

zeta Z ζ

eta H η

theta Θ θ

iota I ι

kappa K κ

lambda Λ λ

mu M μ

nu N ν

xi Ξ ξ

omicron O o

pi Π π

rho P ρ

sigma Σ σ

tau T τ

upsilon Y υ

phi Φ φ

chi X χ

psi Ψ ψ

omega Ω ω

E+24 yotta Y

E+21 zetta Z

E+18 exa E

E+15 peta P

E+12 tera T

E+ 9 giga G

E+ 6 mega M

E+ 3 kilo k

E+ 2 hecto h

E+ 1 deka da

unit

E -1 deci d

E -2 centi c

E -3 milli m

E -6 micro μ

E -9 nano n

E -12 pico p

E -15 femto f

E -18 atto a

E -21 zepto z

E -24 yocto y

kinematics s = s₀ + v₀t + 1/2 at² v² = v₀² + 2as

SHM x(t) = x_mcos(ωt+φ) ω = (k/m)^{1/2} = (F_i)^{1/2}

E&M V = u/q = IR E = F/q F = qv x B or Il x B

Radius (m)	Mass (kg)	Orbit Radius (m)	Period (s)
Mercury 2.42 E+6	3.58 E+23	5.79 E+10	7.61 E+6
Venus 6.16 E+6	4.90 E+24	1.08 E+11	1.94 E+7
Earth 6.37 E+6	5.98 E+24	1.496E+11	3.16 E+7
Moon 1.74 E+6	7.34 E+22	3.84 E+8	2.36 E+6
Mars 3.33 E+6	6.58 E+23	2.38 E+11	5.93 E+7
Jupiter 6.99 E+7	1.90 E+27	7.78 E+11	3.74 E+8
Saturn 5.75 E+7	4.40 E+27	1.43 E+12	9.30 E+8
Uranus 2.57 E+7	3.83 E+26	2.87 E+12	2.65 E+9
Neptune 2.49 E+7	3.59 E+26	4.50 E+12	5.20 E+9
Pluto 1.14 E+6	1.27 E+22	5.91 E+12	7.84 E+9
Sun Radius = 6.96 E+8 m	Mass = 1.987 E+30 kg		
Light year = 9.47 E+15 m			
Parsec = 3.262 light yr. = 3.09 E+16m			

PHYSICS NERD CARD

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Force = ma : newtons (N)

Pressure = F/A : pascals(Pa)

Work = Fd : joules (J) = N·m = (kg · m²)/s²

Power = w/t : watts (W) = J/s = (kg · m²)/s³

Current = q/t : amperes (A) = C/s

E. pot. = w/q : volts (V) = J/C

E. field = F/q : N/C = (kg · m)/(s² · C)

B. field : tesla(T) = N / (A · M)

1

H

1.01

3

Li

6.94

4

Be

9.01

11

Na

22.99

12

Mg

24.31

19

K

39.10

20

Ca

40.08

37

Rb

85.47

38

Sr

87.62

55

Cs

132.91

56

Ba

137.33

87

Fr

223

88

Ra

226

21

Sc

44.96

22

Ti

47.88

23

V

50.94

24

Cr

51.99

25

Mn

54.94

26

Fe

55.85

27

Co

58.93

28

Ni

58.69

29

Cu

63.55

30

Zn

65.38

31

Ga

69.72

32

Ge

72.64

33

As

74.92

34

Se

78.96

35

Br

79.90

36

Kr

83.80

39

Y

88.91

40

Zr

91.22

41

Nb

92.91

42

Mo

95.94

43

Tc

98

44

Ru

101.07

45

Rh

102.91

46

Pd

106.42

47

Ag

107.87

48

Cd

112.41

49

In

114.82

50

Sn

118.71

51

Sb

121.76

52

Te

127.60

53

I

126.91

54

Xe

131.29

71

Hf

178.49

72

Ta

180.95

73

W

183.85

74

Re

186.21

75

Os

190.23

76

Ir

192.22

77

Pt

195.08

78

Au

196.97

79

Hg

200.59

80

Tl

204.38

81

Pb

207.2

82

Bi

208.98

83

Po

209

84

At

210

85

Rn

222

103

Lu

174.96

104

Hf

178.49

105

Ta

180.95

106

W

183.85

107

Re

186.21

108

Os

190.23

109

Ir

192.22

110

Pt

195.08

111

Au

196.97

112

Hg

200.59

113

Tl

204.38

114

Pb

207.2

115

Bi

208.98

116

Po

209

117

At

210

118

Rn

222

121

La

138.91

122

Ce

140.12

123

Pr

140.91

124

Nd

144.24

125

Pm

145

126

Sm

150.36

127

Eu

151.96

128

Gd

157.25

129

Tb

158.93

130

Dy

162.50

131

Ho

164.93

132

Er

167.26

133

Tm

168.93

134

Yb

173.05

135

Lu

174.96

136

Hf

178.49

137

Ta

180.95

138

W

183.85

139

Re

186.21

140

Os

190.23

141

Ir

192.22

142

Pt

195.08

143

Au

196.97

144

Hg

200.59

145

Tl

204.38

146

Pb

207.2

147

Bi

208.98

148

Po

209

149

At

210

150

Rn

222

151

Ac

227

152

Th

232.04

153

Pa

231.04

154

U

238.03

155

Np

237.05

156

Pu

244.06

157

Am

243.06

158

Cm

247.07

159

Bk

247

160

Cf

251

161

Es

252

162

Fm

257

163

Md

258

164

No

259

1

H

1.01

2

He

4.00

3

Li

6.94

4

Be

9.01

5

B

10.81

6

C

12.01

7

N

14.01

8

O

16.00

9

F

18.99

10

Ne

20.18

11

Na

22.99

12

Mg

24.31

13

Al

26.98

14

Si

28.09

15

P

30.97

16

S

32.07

17

Cl

35.45

18

Ar

39.95

19

K

39.10

20

Ca

40.08

21

Sc

44.96

22

Ti

47.88

23

V

50.94

24

Cr

51.99

25

Mn

54.94

26

Fe

55.85

27

Co

58.93

28

Ni

58.69

29

Cu

63.55

30

Zn

65.38

31

Ga

69.72

32

Ge

72.64

33

As

74.92

34

Se

78.96

35

Br

79.90

36

Kr

83.80

37

Rb

85.47

38

Sr

87.62

39

Y

88.91

40

Zr

91.22

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Nb

92.91

42

Mo

95.94

43

Tc

98

44

Ru

101.07

45

Rh

102.91

46

Pd

106.42

47

Ag

107.87

48

Cd

112.41

49

In

114.82

50

Sn

118.71

51

Sb

121.76

52

Te

127.60

53

I

126.91

54

Xe

131.29

55

Cs

132.91

56

Ba

137.33

57

La

138.91

58

Ce

140.12

59

Pr

140.91

60

Nd

144.24

61

Pm

145

62

Sm

150.36

63

Eu

151.96

64

Gd

157.25

65

Tb

158.93

66

Dy

162.50

67

Ho

164.93

68

Er

167.26

69

Tm

168.93

70

Yb

173.05

71

Hf

178.49

72

Ta

180.95

73

W

183.85

74

Re

186.21

75

Os

190.23

76

Ir

192.22

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Pt

195.08

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Au

196.97

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Hg

200.59

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Tl

204.38

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Pb

207.2

82

Bi

208.98

83

Po

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84

At

210

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Rn

222

86

Ra

226

87

Ac

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Th

232.04

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Pa

231.04

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U

238.03

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Np

237.05

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Pu

244.06

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Am

243.06

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Cm

247.07

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Bk

247

96

Cf

251

97

Es

252

98

Fm

257

99

Md

258

100

No

259

1

H

1.01

2

He

4.00

3

Li

6.94

4

Be

9.01

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B

10.81

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C

12.01

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F

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Na

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