

Physics 30

Provincial Assessment Sector

Data Sheets of
Constants
Equations
Periodic Table of the Elements
Updated September 2017

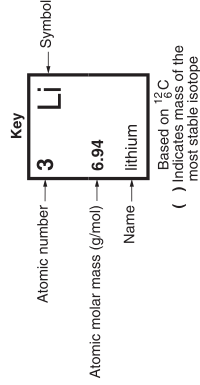


Alberta

Education

Periodic Table of the Elements

1 1.01 hydrogen	2 4.00 helium																																																																																						
3 6.94 lithium	4 9.01 beryllium	5 10.81 boron	6 12.01 carbon	7 14.01 nitrogen	8 16.00 oxygen	9 19.00 fluorine	10 20.18 neon	11 22.99 sodium	12 24.31 magnesium	13 26.98 aluminium	14 28.09 silicon	15 30.97 phosphorus	16 32.07 sulfur	17 35.45 chlorine	18 39.95 argon	19 39.10 potassium	20 40.08 calcium	21 44.96 scandium	22 47.87 titanium	23 50.94 vanadium	24 52.00 chromium	25 54.94 manganese	26 55.85 iron	27 58.93 cobalt	28 58.69 nickel	29 63.55 copper	30 65.39 zinc	31 69.72 gallium	32 72.64 germanium	33 74.92 arsenic	34 78.96 selenium	35 79.90 bromine	36 83.80 krypton	37 85.47 rubidium	38 87.62 strontium	39 88.91 yttrium	40 91.22 zirconium	41 92.91 niobium	42 95.94 molybdenum	43 (98) technetium	44 101.07 ruthenium	45 102.91 rhodium	46 106.42 palladium	47 107.87 silver	48 112.41 cadmium	49 114.82 indium	50 118.71 tin	51 121.75 antimony	52 127.60 tellurium	53 126.90 iodine	54 131.29 xenon	55 132.91 cesium	56 137.33 barium	57-71	72 178.49 hafnium	73 180.95 tantalum	74 183.84 tungsten	75 186.21 rhenium	76 190.23 osmium	77 192.22 iridium	78 195.08 platinum	79 196.97 gold	80 200.59 mercury	81 204.38 thallium	82 207.21 lead	83 208.98 bismuth	84 (209) polonium	85 (210) astatine	86 (222) radon	87 (223) francium	88 (226) radium	89-103	104 (261) rutherfordium	105 (262) dubnium	106 (266) seaborgium	107 (264) bohrium	108 (277) hassium	109 (268) meitnerium	110 (271) darmstadtium	111 (272) roentgenium	112 (285) copernicium	113 (286) nihonium	114 (289) flerovium	115 (289) moscovium	116 (292) livermorium	117 (294) tennessine	118 (294) oganesson
57 138.91 lanthanum	58 140.12 cerium	59 140.91 praseodymium	60 144.24 neodymium	61 (145) promethium	62 150.36 samarium	63 151.96 europium	64 157.25 gadolinium	65 162.50 dysprosium	66 164.93 holmium	67 167.26 erbium	68 173.04 thulium	69 174.97 ytterbium	70 177.04 lutetium	71 178.49 ytterbium	72 180.95 thorium	73 232.04 protactinium	74 231.04 thorium	75 238.03 uranium	76 (237) neptunium	77 (244) plutonium	78 (243) americium	79 (247) curium	80 (247) berkelium	81 (251) californium	82 (252) einsteinium	83 (257) fermium	84 (258) mendelevium	85 (259) nobelium	86 (262) lawrencium																																																										



PHYSICS DATA SHEET

Particles

	Charge	Mass
Alpha Particle.....	$+2e$	6.65×10^{-27} kg
Electron	$-1e$	9.11×10^{-31} kg
Proton	$+1e$	1.67×10^{-27} kg
Neutron.....	0	1.67×10^{-27} kg
First-Generation Fermions		
	Charge	Mass
Electron	$-1e$	~ 0.511 MeV/c ²
Positron	$+1e$	~ 0.511 MeV/c ²
Electron neutrino, ν	0	< 2.2 eV/c ²
Electron antineutrino, $\bar{\nu}$	0	< 2.2 eV/c ²
Up quark, u	$+\frac{2}{3}e$	~ 2.4 MeV/c ²
Anti-up antiquark, \bar{u}	$-\frac{2}{3}e$	~ 2.4 MeV/c ²
Down quark, d	$-\frac{1}{3}e$	~ 4.8 MeV/c ²
Anti-down antiquark, \bar{d}	$+\frac{1}{3}e$	~ 4.8 MeV/c ²

Prefixes Used with SI Units

Prefix	Symbol	Exponential Value
atto	a	10^{-18}
femto	f	10^{-15}
pico	p	10^{-12}
nano.....	n	10^{-9}
micro	μ	10^{-6}
milli.....	m	10^{-3}
centi.....	c	10^{-2}
deci.....	d	10^{-1}
deka	da	10^1
hecto	h	10^2
kilo	k	10^3
mega	M	10^6
giga.....	G	10^9
tera.....	T	10^{12}

Constants

Acceleration Due to Gravity Near Earth.....	$ \vec{a}_g = 9.81$ m/s ²
Gravitational Constant	$G = 6.67 \times 10^{-11}$ N·m ² /kg ²
Radius of Earth	$r_e = 6.37 \times 10^6$ m
Mass of Earth	$M_e = 5.97 \times 10^{24}$ kg
Elementary Charge	$e = 1.60 \times 10^{-19}$ C
Coulomb's Law Constant ..	$k = 8.99 \times 10^9$ N·m ² /C ²
Electron Volt	1 eV = 1.60×10^{-19} J
Index of Refraction of Air.	$n = 1.00$
Speed of Light in Vacuum.	$c = 3.00 \times 10^8$ m/s
Planck's Constant	$h = 6.63 \times 10^{-34}$ J·s
	$h = 4.14 \times 10^{-15}$ eV·s
Atomic Mass Unit	$u = 1.66 \times 10^{-27}$ kg

Physics Principles

- 0 Uniform motion ($\vec{F}_{\text{net}} = 0$)
- 1 Accelerated motion ($\vec{F}_{\text{net}} \neq 0$)
- 2 Uniform circular motion (\vec{F}_{net} is radially inward)
- 3 Work-energy theorem
- 4 Conservation of momentum
- 5 Conservation of energy
- 6 Conservation of mass-energy
- 7 Conservation of charge
- 8 Conservation of nucleons
- 9 Wave-particle duality

EQUATIONS

Kinematics

$$\vec{v}_{\text{ave}} = \frac{\Delta \vec{d}}{\Delta t} \quad \vec{d} = \vec{v}_i t - \frac{1}{2} \vec{a} t^2$$

$$\vec{a}_{\text{ave}} = \frac{\Delta \vec{v}}{\Delta t} \quad \vec{d} = \left(\frac{\vec{v}_f + \vec{v}_i}{2} \right) t$$

$$\vec{d} = \vec{v}_i t + \frac{1}{2} \vec{a} t^2 \quad v_f^2 = v_i^2 + 2ad$$

$$|\vec{v}_c| = \frac{2\pi r}{T} \quad |\vec{a}_c| = \frac{v^2}{r} = \frac{4\pi^2 r}{T^2}$$

Dynamics

$$\vec{F}_{\text{net}} = \vec{a} = \frac{Gm_1 m_2}{r^2} \quad |\vec{F}_g| = \frac{Gm_1 m_2}{r^2}$$

$$|\vec{F}_f| = \mu |\vec{F}_N| \quad |\vec{g}| = \frac{Gm}{r^2} \quad \vec{F}_g = \frac{Gm}{m}$$

$$\vec{F}_s = -k\vec{x} \quad \vec{g} = \frac{Gm}{m}$$

Momentum and Energy

$$\vec{p} = m\vec{v} \quad E_k = \frac{1}{2} mv^2$$

$$\vec{F} \Delta t = m\Delta \vec{v} \quad E_p = mgh$$

$$W = |\vec{F}| |\vec{d}| \cos \theta \quad E_p = \frac{1}{2} kx^2$$

$$W = \Delta E$$

$$P = \frac{W}{t}$$

Waves

$$T = 2\pi \sqrt{\frac{m}{k}} \quad m = \frac{h_i}{h_o} = \frac{-d_i}{d_o}$$

$$T = 2\pi \sqrt{\frac{l}{g}} \quad \frac{1}{f} = \frac{1}{d_o} + \frac{1}{d_i}$$

$$T = \frac{1}{f} \quad \frac{n_2}{n_1} = \frac{\sin \theta_1}{\sin \theta_2}$$

$$v = f\lambda \quad \frac{n_2}{n_1} = \frac{v_1}{v_2} = \frac{\lambda_1}{\lambda_2}$$

$$f = \left(\frac{v}{v \pm v_s} \right) f_s \quad \lambda = \frac{d \sin \theta}{n}$$

$$\lambda = \frac{xd}{nl}$$

Electricity and Magnetism

$$|\vec{F}_e| = \frac{kq_1 q_2}{r^2} \quad \Delta V = \frac{\Delta E}{q}$$

$$|\vec{E}| = \frac{kq}{r^2} \quad I = \frac{q}{t}$$

$$\vec{E} = \frac{\vec{F}_e}{q} \quad |\vec{F}_m| = I l |\vec{B}|$$

$$|\vec{E}| = \frac{\Delta V}{\Delta d} \quad |\vec{F}_m| = qv_{\perp} |\vec{B}|$$

Atomic Physics

$$W = hf_0 \quad E = hf = \frac{hc}{\lambda}$$

$$E_{k_{\text{max}}} = q_e V_{\text{stop}} \quad N = N_0 \left(\frac{1}{2} \right)^n$$

Quantum Mechanics and Nuclear Physics

$$\Delta E = \Delta mc^2 \quad E = pc$$

$$p = \frac{h}{\lambda} \quad \Delta \lambda = \frac{h}{mc} (1 - \cos \theta)$$

Trigonometry and Geometry

$$\sin \theta = \frac{\text{opposite}}{\text{hypotenuse}}$$

Line
 $m = \frac{\Delta y}{\Delta x}$

$$\cos \theta = \frac{\text{adjacent}}{\text{hypotenuse}} \quad y = mx + b$$

$$\tan \theta = \frac{\text{opposite}}{\text{adjacent}}$$

Area

$$\text{Rectangle} = lw$$

$$\text{Triangle} = \frac{1}{2} ab$$

$$\text{Circle} = \pi r^2$$

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

Circumference

$$c^2 = a^2 + b^2 - 2ab \cos C$$

$$\text{Circle} = 2\pi r$$