



Physics 30

Learner Assessment

Data Sheets of

Constants

Equations

Periodic Table of the Elements

PHYSICS DATA SHEET

Constants

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

Physics Principles

Uniform motion (balanced forces)
 Uniformly accelerated motion (unbalanced forces)
 Circular motion (unbalanced forces)
 Work-energy theorem
 Conservation of momentum
 Conservation of energy
 Conservation of mass-energy
 Conservation of charge
 Conservation of nucleons
 Wave-particle duality

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}

Particles

	Charge	Mass
Alpha Particle.....	$+2e$	$6.65 \times 10^{-27} \text{ kg}$
Electron	$-1e$	$9.11 \times 10^{-31} \text{ kg}$
Proton	$+1e$	$1.67 \times 10^{-27} \text{ kg}$
Neutron.....	0	$1.67 \times 10^{-27} \text{ kg}$

First-Generation Fermions

	Charge	Mass
Electron	$-1e$	$0.511 \text{ MeV}/c^2$
Positron	$+1e$	$0.511 \text{ MeV}/c^2$
Electron neutrino, ν	0	$< 50 \text{ eV}/c^2$
Electron antineutrino, $\bar{\nu}$	0	$< 50 \text{ eV}/c^2$
Up quark, u.....	$+\frac{2}{3}e$	$\sim 5 \text{ MeV}/c^2*$
Anti-up antiquark, $\bar{u}$	$-\frac{2}{3}e$	$\sim 5 \text{ MeV}/c^2*$
Down quark, d.....	$-\frac{1}{3}e$	$\sim 10 \text{ MeV}/c^2*$
Anti-down antiquark, $\bar{d}$	$+\frac{1}{3}e$	$\sim 10 \text{ MeV}/c^2*$

*Current models seem to suggest a significantly lower mass of these quarks than those in this table.

EQUATIONS

Kinematics

$$\begin{aligned}\vec{v}_{\text{ave}} &= \frac{\Delta \vec{d}}{\Delta t} & \vec{d} &= \vec{v}_f t - \frac{1}{2} \vec{a} t^2 \\ \vec{a}_{\text{ave}} &= \frac{\Delta \vec{v}}{\Delta t} & \vec{d} &= \left(\frac{\vec{v}_f + \vec{v}_i}{2} \right) t \\ \vec{d} &= \vec{v}_i t + \frac{1}{2} \vec{a} t^2 & v_f^2 &= v_i^2 + 2ad \\ |\vec{v}_c| &= \frac{2\pi r}{T} & |\vec{a}_c| &= \frac{v^2}{r} = \frac{4\pi^2 r}{T^2}\end{aligned}$$

Dynamics

$$\begin{aligned}\vec{a} &= \frac{\vec{F}_{\text{net}}}{m} & |\vec{F}_g| &= \frac{Gm_1 m_2}{r^2} \\ |\vec{F}_f| &= \mu |\vec{F}_N| & |\vec{g}| &= \frac{Gm}{r^2} \\ \vec{F}_s &= -k\vec{x} & \vec{g} &= \frac{\vec{F}_g}{m}\end{aligned}$$

Momentum and Energy

$$\begin{aligned}\vec{p} &= m\vec{v} & E_k &= \frac{1}{2}mv^2 \\ \vec{F}\Delta t &= m\Delta\vec{v} & E_p &= mgh \\ W &= |\vec{F}| |\vec{d}| \cos\theta & E_p &= \frac{1}{2}kx^2 \\ W &= \Delta E \\ P &= \frac{W}{t}\end{aligned}$$

Waves

$$\begin{aligned}T &= 2\pi\sqrt{\frac{m}{k}} & m &= \frac{h_i}{h_o} = \frac{-d_i}{d_o} \\ T &= 2\pi\sqrt{\frac{l}{g}} & \frac{1}{f} &= \frac{1}{d_o} + \frac{1}{d_i} \\ T &= \frac{1}{f} & \frac{\sin\theta_1}{\sin\theta_2} &= \frac{n_2}{n_1} = \frac{v_1}{v_2} = \frac{\lambda_1}{\lambda_2} \\ v &= f\lambda & \lambda &= \frac{d \sin\theta}{n}\end{aligned}$$

$$f = \left(\frac{v}{v \pm v_s} \right) f_s \quad \lambda = \frac{xd}{nl}$$

Electricity and Magnetism

$$\begin{aligned}|\vec{F}_e| &= \frac{kq_1 q_2}{r^2} & \Delta V &= \frac{\Delta E}{q} \\ |\vec{E}| &= \frac{kq}{r^2} & I &= \frac{q}{t} \\ \vec{E} &= \frac{\vec{F}_e}{q} & |\vec{F}_m| &= \mu_{\perp} |\vec{B}| \\ |\vec{E}| &= \frac{\Delta V}{\Delta d} & |\vec{F}_m| &= qv_{\perp} |\vec{B}|\end{aligned}$$

Atomic Physics

$$\begin{aligned}W &= hf_0 & E &= hf = \frac{hc}{\lambda} \\ E_{k_{\text{max}}} &= q_e V_{\text{stop}} & N &= N_0 \left(\frac{1}{2} \right)^n\end{aligned}$$

Quantum Mechanics and Nuclear Physics

$$\begin{aligned}\Delta E &= \Delta mc^2 & E &= pc \\ p &= \frac{h}{\lambda} & \Delta\lambda &= \frac{h}{mc}(1 - \cos\theta)\end{aligned}$$

Trigonometry and Geometry

$$\sin\theta = \frac{\text{opposite}}{\text{hypotenuse}} \quad \textbf{Line} \\ m = \frac{\Delta y}{\Delta x}$$

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

$$\tan\theta = \frac{\text{opposite}}{\text{adjacent}} \quad \textbf{Area}$$

$$c^2 = a^2 + b^2 \quad \text{Rectangle} = lw$$

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C} \quad \text{Triangle} = \frac{1}{2}ab$$

$$c^2 = a^2 + b^2 - 2ab \cos C \quad \text{Circle} = \pi r^2$$

Graphing Calculator Window Format

$$x: [x_{\text{min}}, x_{\text{max}}, x_{\text{scl}}]$$

$$y: [y_{\text{min}}, y_{\text{max}}, y_{\text{scl}}]$$

Periodic Table of the Elements

1 H																		2 He																	
1.01 hydrogen																		4.00 helium																	
3 Li		4 Be														5 B		6 C		7 N		8 O		9 F		10 Ne									
6.94 lithium		9.01 beryllium														10.81 boron		12.01 carbon		14.01 nitrogen		16.00 oxygen		19.00 fluorine		20.18 neon									
11 Na		12 Mg														13 Al		14 Si		15 P		16 S		17 Cl		18 Ar									
22.99 sodium		24.31 magnesium														26.98 aluminium		28.09 silicon		30.97 phosphorus		32.07 sulfur		35.45 chlorine		39.95 argon									
19 K		20 Ca		21 Sc		22 Ti		23 V		24 Cr		25 Mn		26 Fe		27 Co		28 Ni		29 Cu		30 Zn		31 Ga		32 Ge		33 As		34 Se		35 Br		36 Kr	
39.10 potassium		40.08 calcium		44.96 scandium		47.87 titanium		50.94 vanadium		52.00 chromium		54.94 manganese		55.85 iron		58.93 cobalt		58.69 nickel		63.55 copper		65.39 zinc		69.72 gallium		72.64 germanium		74.92 arsenic		78.96 selenium		79.90 bromine		83.80 krypton	
37 Rb		38 Sr		39 Y		40 Zr		41 Nb		42 Mo		43 Tc		44 Ru		45 Rh		46 Pd		47 Ag		48 Cd		49 In		50 Sn		51 Sb		52 Te		53 I		54 Xe	
85.47 rubidium		87.62 strontium		88.91 yttrium		91.22 zirconium		92.91 niobium		95.94 molybdenum		(98) technetium		101.07 ruthenium		102.91 rhodium		106.42 palladium		107.87 silver		112.41 cadmium		114.82 indium		118.71 tin		121.75 antimony		127.60 tellurium		126.90 iodine		131.29 xenon	
55 Cs		56 Ba		57-71		72 Hf		73 Ta		74 W		75 Re		76 Os		77 Ir		78 Pt		79 Au		80 Hg		81 Tl		82 Pb		83 Bi		84 Po		85 At		86 Rn	
132.91 cesium		137.33 barium				178.49 hafnium		180.95 tantalum		183.84 tungsten		186.21 rhenium		190.23 osmium		192.22 iridium		195.08 platinum		196.97 gold		200.59 mercury		204.38 thallium		207.21 lead		208.98 bismuth		(209) polonium		(210) astatine		(222) radon	
87 Fr		88 Ra		89-103		104 Rf		105 Db		106 Sg		107 Bh		108 Hs		109 Mt		110 Ds		111 Rg		112 Uub		113 Uut		114 Uuq		115 Uup		116 Uuh		117 Uus		118 Uuo	
(223) francium		(226) radium				(261) rutherfordium		(262) dubnium		(266) seaborgium		(264) bohrium		(277) hassium		(268) meitnerium		(271) darmstadtium		(272) roentgenium		(285) ununbium		(284) ununtrium		(289) ununquadium		(288) ununpentium		(292) ununhexium		(?) ununseptium		(294) ununoctium	
						57 La		58 Ce		59 Pr		60 Nd		61 Pm		62 Sm		63 Eu		64 Gd		65 Tb		66 Dy		67 Ho		68 Er		69 Tm		70 Yb		71 Lu	
						138.91 lanthanum		140.12 cerium		140.91 praseodymium		144.24 neodymium		(145) promethium		150.36 samarium		151.96 europium		157.25 gadolinium		158.93 terbium		162.50 dysprosium		164.93 holmium		167.26 erbium		168.93 thulium		173.04 ytterbium		174.97 lutetium	
						89 Ac		90 Th		91 Pa		92 U		93 Np		94 Pu		95 Am		96 Cm		97 Bk		98 Cf		99 Es		100 Fm		101 Md		102 No		103 Lr	
						(227) actinium		232.04 thorium		231.04 protactinium		238.03 uranium		(237) neptunium		(244) plutonium		(243) americium		(247) curium		(247) berkelium		(251) californium		(252) einsteinium		(257) fermium		(258) mendelevium		(259) nobelium		(262) lawrencium	

Key

Atomic number → 3

Atomic molar mass (g/mol) → 6.94

Name → lithium

Based on ¹²₆C
() Indicates mass of the most stable isotope

Symbol → Li