PHYSICS 20 DATA SHEET

Salisbury Composite High School
(Revised June 2020)

Constants

Description	Value
Acceleration Due to Gravity (Earth's Surface)	$g = 9.81\ \text{m/s}^2$
Speed of Sound in Air (20.0° C, 1.00 atm)	$v = 343\ \text{m/s}$
Astronomical Unit	$\text{au} = 1.496 \times 10^{11}\ \text{m}$
Radius of Earth	$R_E = 6.37 \times 10^{6}\ \text{m}$
Earth-Moon Separation	$r = 3.84 \times 10^{8}\ \text{m}$
Universal Gravitational Constant	$G = 6.67 \times 10^{-11}\ \text{N·m}^2/\text{kg}^2$
Mass of Earth	$M_E = 5.97 \times 10^{24}\ \text{kg}$
Mass of Sun	$M_S = 1.99 \times 10^{30}\ \text{kg}$
Mass of Moon	$M_M = 7.35 \times 10^{22}\ \text{kg}$

SI Prefixes

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

Physics Principles

1	Conservation of Energy
2	Work-Energy Theorem
3	Uniform Motion ($\vec{\mathbf{F}}_{net} = 0$)
4	Uniformly Accelerated Motion (Constant $\vec{\mathbf{F}}_{net} \neq 0$)
5	Simple Harmonic Motion ($\vec{\mathbf{F}}_{net} = -k\vec{\mathbf{x}}$)
6	Uniform Circular Motion (Constant F_{net} in centripetal direction)

Physics & Mathematics Relations (Equations) on Reverse

Linear Relations

1	$k = \frac{y_2 - y_1}{x_2 - x_1}$	2	$y = kx + b$

Trigonometry

3	$\sin\theta = \frac{\text{Opp}}{\text{Hyp}}$	4	$\cos\theta = \frac{\text{Adj}}{\text{Hyp}}$
5	$\tan\theta = \frac{\text{Opp}}{\text{Adj}}$	6	$c^2 = a^2 + b^2$
7	$c^2 = a^2 + b^2 - 2ab\cos\theta_C$		
8	$\frac{a}{\sin\theta_A} = \frac{b}{\sin\theta_B} = \frac{c}{\sin\theta_C}$		

Energy & Work

9	$\Sigma E_i = \Sigma E_f$	10	$E_k = \frac{1}{2}mv^2$
11	$E_g = mgh$	12	$E_{elas} = \frac{1}{2}k(\Delta L)^2$
13	$W = \vec{\mathbf{F}} \cdot \Delta\vec{\mathbf{d}} = \lvert\vec{\mathbf{F}}\rvert \cdot \lvert\Delta\vec{\mathbf{d}}\rvert \cos\Delta\theta$		
14	$\Delta E_k = \Sigma W$	15	$P = \frac{\Delta E}{\Delta t}$
16	$\epsilon = \left\lvert\frac{\Delta E_{useful}}{\Delta E_{input}}\right\rvert$		

Kinematics

17	$\Delta\vec{\mathbf{d}} = \vec{\mathbf{d}}_f - \vec{\mathbf{d}}_i$	18	$\vec{\mathbf{v}}_{avg} = \frac{\Delta\vec{\mathbf{d}}}{\Delta t}$
19	$\vec{\mathbf{a}}_{avg} = \frac{\Delta\vec{\mathbf{v}}}{\Delta t}$		

Uniform Accelerated Motion / Projectile Motion

20	$\vec{\mathbf{a}} = \frac{\vec{\mathbf{v}}_f - \vec{\mathbf{v}}_i}{\Delta t}$	21	$\Delta\vec{\mathbf{d}} = \frac{\vec{\mathbf{v}}_i + \vec{\mathbf{v}}_f}{2}\Delta t$
22	$v_f^2 = v_i^2 + 2\vec{\mathbf{a}} \cdot \Delta\vec{\mathbf{d}}$	23	$\Delta\vec{\mathbf{d}} = \vec{\mathbf{v}}_i\Delta t + \frac{1}{2}\vec{\mathbf{a}}(\Delta t)^2$
24	$\Delta\vec{\mathbf{d}} = \vec{\mathbf{v}}_f\Delta t - \frac{1}{2}\vec{\mathbf{a}}(\Delta t)^2$		

Dynamics

25	$\vec{\mathbf{F}}_{net} = m\vec{\mathbf{a}}$	26	$\vec{\mathbf{F}}_{AB} = -\vec{\mathbf{F}}_{BA}$
27	$\vec{\mathbf{F}}_g = m\vec{\mathbf{g}}$	28	$\mu = \frac{F_f}{F_n}$

Uniform Circular Motion

29	$v = \frac{2\pi r}{T}$	30	$f = \frac{1}{T}$
31	$a_c = \frac{2\pi v}{T} = \frac{v^2}{r} = \frac{4\pi^2 r}{T^2}$		

Planetary Motion

32	$T^2 = kr^3$	33	$\left(\frac{T_2}{T_1}\right)^2 = \left(\frac{r_2}{r_1}\right)^3$

Universal Gravitation

34	$F_g = \frac{Gm_1m_2}{r^2}$	35	$g = \frac{GM}{r^2}$
27	$\vec{\mathbf{F}}_g = m\vec{\mathbf{g}}$	36	$E_g = -\frac{Gm_1m_2}{r}$

Simple Harmonic Motion

Equation 40 applies over a limited range of motion that depends on the specific elastic object.

37	$v_{max} = \frac{2\pi A}{T}$	30	$f = \frac{1}{T}$
38	$a_{max} = \frac{2\pi v_{max}}{T} = \frac{v_{max}^2}{A} = \frac{4\pi^2 A}{T^2}$		
39	$\vec{\mathbf{F}}_{net} = -k\vec{\mathbf{x}}$	40	$\vec{\mathbf{F}}_{elas} = -k\Delta L$
41	$T = 2\pi\sqrt{\frac{m}{k}}$	42	$T = 2\pi\sqrt{\frac{L}{g}}$
43	$E_p = \frac{1}{2}kx^2$		

Mechanical Waves

Equation 45 applies for colinear (1D), non-relativistic motion.

44	$v = \frac{\lambda}{T} = f\lambda$	45	$f_o = \frac{v - v_o}{v - v_s}f_s$
46	$f_n = \frac{nv}{2L}$	47	$f_n = \frac{nv}{4L}$
48	$f_{beat} = \lvert f_1 - f_2\rvert$		

2D Vectors

These equations apply to any 2D vector, not just velocity.

49	$\vec{\mathbf{v}}_x = \lvert\vec{\mathbf{v}}\rvert\cos\theta$	50	$\vec{\mathbf{v}}_y = \lvert\vec{\mathbf{v}}\rvert\sin\theta$
51	$\lvert\vec{\mathbf{v}}\rvert = \sqrt{v_x^2 + v_y^2}$	52	$\tan\theta = \frac{\vec{\mathbf{v}}_y}{\vec{\mathbf{v}}_x}$