ACT® International Subject Tests

Physics Reference Sheet

Constants

Acceleration due to gravity on Earth	g	$9.80\ \text{m/s}^2$
Proton mass	m_p	$1.67 \times 10^{-27}\ \text{kg}$
Neutron mass	m_n	$1.67 \times 10^{-27}\ \text{kg}$
Electron mass	m_e	$9.11 \times 10^{-31}\ \text{kg}$
Elementary charge	e	$1.60 \times 10^{-19}\ \text{C}$
Coulomb's law constant	k	$8.99 \times 10^{9}\ \dfrac{\text{N}\cdot\text{m}^2}{\text{C}^2}$
Gravitational constant	G	$6.67 \times 10^{-11}\ \dfrac{\text{N}\cdot\text{m}^2}{\text{kg}^2}$
Speed of light in vacuum	c	$3.00 \times 10^{8}\ \text{m/s}$
Planck's constant	h	$6.63 \times 10^{-34}\ \text{J}\cdot\text{s} = 4.14 \times 10^{-15}\ \text{eV}\cdot\text{s}$

Mechanics

$\overline{v} = \frac{\Delta x}{\Delta t}$

$x = x_0 + vt$

$x = x_0 + v_0 t + \frac{1}{2}at^2$

$\overline{a} = \frac{\Delta v}{\Delta t}$

$v^2 = v_0^2 + 2a\Delta x$

$F = ma$

$F_g = mg$

$F = \frac{Gm_1 m_2}{d^2}$

$F\Delta t = \Delta p = m\Delta v$

$a_c = \frac{v^2}{r}$

$F_c = \frac{mv^2}{r}$

v = velocity
x = position
t = time
a = acceleration
F = force
m = mass
F_g = weight
g = acceleration due to gravity
d = distance between centers of mass
p = momentum
a_c = centripetal acceleration
F_c = centripetal force
r = radius

Energy

$W = F\Delta x$

$P = \frac{W}{\Delta t} = F\overline{v}$

$\text{PE}_\text{g} = mgh$

$\text{KE} = \frac{1}{2}mv^2$

$F = -kx$

$\text{PE}_\text{k} = \frac{1}{2}kx^2$

W = work
F = force
x = position
P = power
t = time
v = velocity
PE_g = gravitational potential energy
m = mass
h = height
KE = kinetic energy
k = spring constant
PE_k = spring potential energy

continued

Electricity

$E = \frac{kq}{d^2}$	E = electric field
$V = Ed$	k = Coulomb's law constant
$F = q_1E = \frac{kq_1q_2}{d^2}$	d = distance between two points
$W_{a\to b} = q(V_b - V_a)$	q = charge
$V = IR$	V = electrical potential difference
$P = VI = I^2R = \frac{V^2}{R}$	$W_{a\to b}$ = work done by field on charge q moving from V_a to V_b
$R = \frac{\rho L}{A}$	I = current
	P = power
	R = resistance
	ρ = resistivity
	L = length
	A = area

Circuitry

Series Circuits	$I_T = I_1 = I_2 = I_3 = \ldots$ $V_T = V_1 + V_2 + V_3 + \ldots$ $R_{\text{equiv}} = R_1 + R_2 + R_3 + \ldots$	I = current V = voltage R = resistance
Parallel Circuits	$I_T = I_1 + I_2 + I_3 + \ldots$ $V_T = V_1 = V_2 = V_3 = \ldots$ $\frac{1}{R_{\text{equiv}}} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + \ldots$	

Waves

$$T = \frac{1}{f}$$

$$v = f\lambda$$

$$n = \frac{c}{v}$$

$$n_1 \sin \theta_1 = n_2 \sin \theta_2$$

$$\sin \theta_c = \frac{n_2}{n_1}$$

$$n_1 v_1 = n_2 v_2$$

T = period
f = frequency
λ = wavelength
n = index of refraction
c = speed of light in a vacuum
v = speed
θ_c = critical angle of incidence

Simple Harmonic Motion

$$f = \frac{1}{2\pi}\sqrt{\frac{k}{m}}$$

$$x = A \cos\left[\left(\sqrt{\frac{k}{m}}\right)t + \phi\right]$$

f = frequency
k = spring constant
m = mass
x = displacement
A = amplitude
ϕ = phase angle

Thin Lenses & Spherical Mirrors

$$\frac{1}{f} = \frac{1}{d_o} + \frac{1}{d_i}$$

$$m = \frac{h_i}{h_o} = -\left(\frac{d_i}{d_o}\right)$$

f = focal length
d_o = object distance
d_i = image distance
m = magnification
h_o = object height
h_i = image height

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