

PHYSICS 30 FORMULA SHEET

CONSTANTS

$$k = 8.99 \times 10^9 \text{ N}\cdot\text{m}^2/\text{C}^2$$

$$1 \text{ C} = 6.24 \times 10^{18} \text{ e}$$

$$\epsilon_0 = 8.85 \times 10^{-12} \text{ F/m}$$

$$1 \text{ e} = 1.602189 \times 10^{-19} \text{ C}$$

$$\mu_0 = 4\pi \times 10^{-7} \text{ T}\cdot\text{m/A}$$

$$c = 3.00 \times 10^8 \text{ m/s}$$

$$g = 9.81 \text{ m/s}^2$$

$$1 \text{ H.P.} = 745.6 \text{ W}$$

$$h = 6.63 \times 10^{-34} \text{ J}\cdot\text{s}$$

$$= 4.14 \times 10^{-15} \text{ eV}\cdot\text{s}$$

$$m_e = 9.11 \times 10^{-31} \text{ kg}$$

$$m_p = 1.67 \times 10^{-27} \text{ kg}$$

$$m_n = 1.67 \times 10^{-27} \text{ kg}$$

$$1 \text{ eV} = 1.6 \times 10^{-19} \text{ J}$$

Alpha particle:

$$\text{Mass} = 6.65 \times 10^{-27} \text{ kg}$$

$$\text{Charge} = 3.204 \times 10^{-19} \text{ C}$$

SI PREFIXES

Y	Yotta	10^{24}
Z	Zetta	10^{21}
E	Exa	10^{18}
P	Peta	10^{15}
T	Tera	10^{12}
G	Giga	10^9
M	Mega	10^6
k	kilo	10^3
h	hecto	10^2
da	deka	10^1
d	deci	10^{-1}
c	centi	10^{-2}
m	milli	10^{-3}
μ	micro	10^{-6}
n	nano	10^{-9}
p	pico	10^{-12}
f	femto	10^{-15}
a	atto	10^{-18}
z	zepto	10^{-21}
y	yocto	10^{-24}

ELECTRICITY

$$I = \frac{q}{t} \quad V = IR$$

$$P = \frac{W}{t} = VI = I^2 R = \frac{V^2}{R}$$

$$R_{\text{series}} = R_1 + R_2 + \dots$$

$$R_{\text{parallel}} = \left(\frac{1}{R_1} + \frac{1}{R_2} + \dots \right)^{-1}$$

$$R = \rho \frac{L}{A} \quad A = \pi r^2 = \pi \frac{d^2}{4}$$

$$\rho = \rho_0 [1 + \alpha (T - T_0)]$$

$$R = R_0 [1 + \alpha (T - T_0)]$$

TRIGONOMETRY

$$F_x = F \cos \theta \quad F_y = F \sin \theta$$

$$F = \sqrt{F_x^2 + F_y^2}$$

$$\phi = \tan^{-1} (F_y / F_x)$$

WORK AND ENERGY

$$W = F d \cos \theta \quad P = \frac{W}{t} = F v$$

$$KE = \frac{1}{2} m v^2 \quad PE = mgh$$

ELECTROSTATICS

$$F = \left| \frac{K Q_1 Q_2}{r^2} \right|$$

$$F = qE$$

$$E = \left| \frac{KQ}{r^2} \right|$$

MOMENTUM

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

$$p = mv$$

collisions:

$$\Sigma p_{\text{before}} = \Sigma p_{\text{after}}$$

$$m_1 v_1 + m_2 v_2 = m_1 v_1' + m_2 v_2'$$

ELECTRIC POTENTIAL

$$V = \frac{W}{q} = \frac{\Delta PE}{q}$$

$$W = \Delta PE = |qEd| = |qV|$$

$$V = Ed$$

RESISTIVITY AND THERMAL COEFFICIENTS

$$\rho_{\text{Cu}} = 1.72 \times 10^{-8} \Omega \cdot \text{m}$$

$$\rho_{\text{Al}} = 2.82 \times 10^{-8} \Omega \cdot \text{m}$$

$$\rho_{\text{C}} = 3500 \times 10^{-8} \Omega \cdot \text{m}$$

$$\rho_{\text{Si}} = 2300 \Omega \cdot \text{m}$$

$$\alpha_{\text{Cu}} = 0.0039/^\circ\text{C}$$

$$\alpha_{\text{Al}} = 0.0039/^\circ\text{C}$$

$$\alpha_{\text{C}} = -0.0005/^\circ\text{C}$$

$$\alpha_{\text{Si}} = -0.07/^\circ\text{C}$$

MAGNETISM

$$\mu_r = \frac{\mu}{\mu_0}$$

$$B = \frac{\mu I}{2\pi r} \quad (\text{long wire})$$

$$B = \frac{\mu NI}{2R} \quad (\text{loop of N turns})$$

$$B = \frac{\mu NI}{L} \quad (\text{solenoid})$$

$$\phi = AB$$

Force on a charge

$$F = qvB \sin \theta \quad (\theta \text{ from } v \text{ to } B)$$

Force on a wire

$$F = IBL \sin \theta \quad (\theta \text{ from } I \text{ to } B)$$

INDUCED EMF

$$\text{EMF} = vBL \sin \theta \quad (\theta \text{ from } B \text{ to } v)$$

TRANSFORMERS

$$\frac{V_s}{V_p} = \frac{N_s}{N_p}$$

$$\text{eff} = \frac{V_s I_s}{V_p I_p}$$

COMPTON EFFECT

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

PHOTON MOMENTUM

$$p = \frac{h}{\lambda} = \frac{E_p}{c} = \frac{hf}{c}$$

ATOMIC PHYSICS

$$E_n = \frac{-13.6eV}{n^2}$$

$$E_p = 13.6eV(n_f^{-2} - n_i^{-2})$$

$$\lambda = (1.097 \times 10^7 m^{-1}(n_f^{-2} - n_i^{-2}))^{-1}$$

OPTICS

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

$$m = \frac{h_i}{h_o} = \frac{-d_i}{d_o}$$

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

$$\frac{\sin \theta_1}{\sin \theta_2} = \frac{n_2}{n_1} = \frac{v_1}{v_2} = \frac{\lambda_1}{\lambda_2}$$

$$\lambda = \frac{d \sin \theta}{n}$$

$$\theta_c = \sin^{-1} \left(\frac{n_2}{n_1} \right)$$

ELECTROMAGNETIC RADIATION

$$c = f \lambda$$

$$E = nhf$$

$$E = hf = \frac{hc}{\lambda}$$

Photoelectric effect

$$E = W + (E_k)_{\max}$$

WORK FUNCTION (eV)

Sodium	Na	2.28
Cobalt	Co	3.90
Aluminum	Al	4.08
Lead	Pb	4.14
Cesium	Ce	1.90
Zinc	Zn	4.31
Copper	Cu	4.70
Silver	Ag	4.73