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TX PACT: PHYSICS: GRADES 7–12 CONSTANTS

Description	Value
Acceleration of gravity on Earth (g)	$9.80\ m/s^2$
Speed of light in a vacuum (c)	$3.00 \times 10^8\ m/s$
Planck's constant (h)	$6.63 \times 10^{-34}\ J•s = 4.14 \times 10^{-15}\ eV•s$
Electron rest mass (m_e)	$9.11 \times 10^{-31}\ kg$
Proton rest mass (m_p)	$1.67 \times 10^{-27}\ kg$
Elementary charge (e)	$1.60 \times 10^{-19}\ C$
Coulomb's constant (k_e)	$8.99 \times 10^9\ N•m^2/C^2$
Boltzmann constant (k_b)	$1.38 \times 10^{-23}\ J/K$
Gas constant (R)	8.31 J/(mol•K)
Gravitational constant (G)	$6.67 \times 10^{-11}\ N•m^2/kg^2$
Permeability of free space (μ_0)	$4\pi \times 10^{-7}\ T•m/A$
Avogadro's number (N_A)	6.02×10^{23} particles/mole
Heat of fusion of water (L_f)	$3.33 \times 10^5\ J/kg$
Heat of vaporization of water (L_v)	$2.26 \times 10^6\ J/kg$
Specific heat of water (c_w)	$4.19 \times 10^3\ J/(kg•°C)$
Density of water (ρ_w)	$1.00 \times 10^3\ kg/m^3$

TX PACT: PHYSICS: GRADES 7–12 FORMULAS

Mathematics

$C = 2\pi r$

$A = \pi r^2$

$SA = 4\pi r^2$

$V = \frac{4}{3}\pi r^3$

(a, b) denotes a vector with an x-component of a and a y-component of b.

Force and Motion

$v_f = v_i + at$

$x_f = x_i + v_i t + \frac{1}{2}at^2$

$v_f^2 - v_i^2 = 2a(x_f - x_i)$

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

$\Sigma \mathbf{F} = m\mathbf{a}$

$F = -kx$

$F \leq \mu N$

$F = \frac{Gm_1m_2}{r^2}$

$\theta_f = \theta_i + \omega_i t + \frac{1}{2}\alpha^2$

$\omega_f = \omega_i + \alpha t$

$v = r\omega$

$a = r\alpha$

$\mathbf{r}_{cm} = \frac{\sum m\mathbf{r}}{\sum m}$

$I = \Sigma\, mr^2$

$\boldsymbol{\tau} = \mathbf{r} \times \mathbf{F}$

$\Sigma\boldsymbol{\tau} = I\boldsymbol{\alpha}$

$P = \rho gh$

$F = \rho Vg$

$A_1v_1 = A_2v_2$

$P + \frac{1}{2}\rho v^2 + \rho g y = \text{constant}$

TX PACT: PHYSICS: GRADES 7–12 FORMULAS (continued)

Energy, Momentum, and Heat Transfer

$W = Fd \cos \theta$

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

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

$PE = mgh$

$PE = \frac{1}{2}kx^2$

$\mathbf{p} = m\mathbf{v}$

$\Delta \mathbf{p} = \mathbf{F}\Delta t$

$\Delta \ell = \alpha \ell_0 \Delta T$

$Q = mc\Delta T$

$Q = mL$

$\frac{\Delta Q}{\Delta t} = \frac{kA\Delta T}{d}$

$PV = nRT$

$\frac{1}{2}m\overline{v^2} = \frac{3}{2}k_bT$

$\Delta E = Q - W$

$W = P\Delta V$

$e = \frac{T_h - T_c}{T_h}$

$KE = \frac{1}{2}I\omega^2$

$\mathbf{L} = \mathbf{r} \times \mathbf{p}$

$L = I\omega$

$T_k = 273 + T_c$

Electricity and Magnetism

$F = \frac{k_e q_1 q_2}{r^2}$

$\mathbf{E} = \frac{\mathbf{F}}{q_0}$

$PE = qV$

$V = -Ed$

$V = \frac{k_e q}{r}$

$R = \frac{\rho \ell}{A}$

$V = IR$

$R = \Sigma R_i$

$\frac{1}{R} = \sum \frac{1}{R_i}$

$P = IV$

$C = \frac{Q}{V}$

$C = \Sigma C_i$

$\frac{1}{C} = \sum \frac{1}{C_i}$

$\mathbf{F} = q\mathbf{v} \times \mathbf{B}$

$\mathbf{F} = I\boldsymbol{\ell} \times \mathbf{B}$

$B = \frac{\mu_0 I}{2\pi r}$

$B = \frac{\mu_0 NI}{\ell}$

$\varepsilon_{ave} = -\frac{\Delta \phi}{\Delta t}$

$\phi = B_\perp A$

In questions on electricity and magnetism, the term *current* refers to "conventional current" and the use of the right-hand rule is assumed.

TX PACT: PHYSICS: GRADES 7–12 FORMULAS (continued)

Waves, Sound, and Light	Modern Physics
$T = \frac{2\pi}{\omega}$	$E = hf$
$a = -\omega^2 x$	$E = \gamma mc^2$
$x = A \sin \omega t$	$\gamma = \frac{1}{\sqrt{1-\frac{v^2}{c^2}}}$
$T = 2\pi\sqrt{\frac{m}{k}}$	$hf = \phi + eV$
$T = 2\pi\sqrt{\frac{L}{g}}$	$\Delta x \Delta p \geq h$
$v = f\lambda$	$\Delta E \Delta t \geq h$
$v = \sqrt{\frac{T}{\mu}}$	$p = \frac{h}{\lambda}$
$v = \sqrt{\frac{\gamma RT}{M}}$	
$2L = n\lambda$, n is an integer	
$4L = n\lambda$, n is odd	
$n_1 \sin \theta_1 = n_2 \sin \theta_2$	
$n = \frac{c}{v}$	
$\frac{1}{f} = \frac{1}{s_i} + \frac{1}{s_0}$	
$M = \frac{h_i}{h_0} = -\frac{s_i}{s_0}$	
$d \sin \theta = m\lambda$	
$I = I_0 \cos^2 \theta$	

NOTES FOR PHYSICS EXAM

Not all constants and formulas necessary are listed, nor are all constants and formulas listed used on this exam.

In questions on electricity and magnetism, the term *current* refers to "conventional current" and the use of the right-hand rule is assumed.