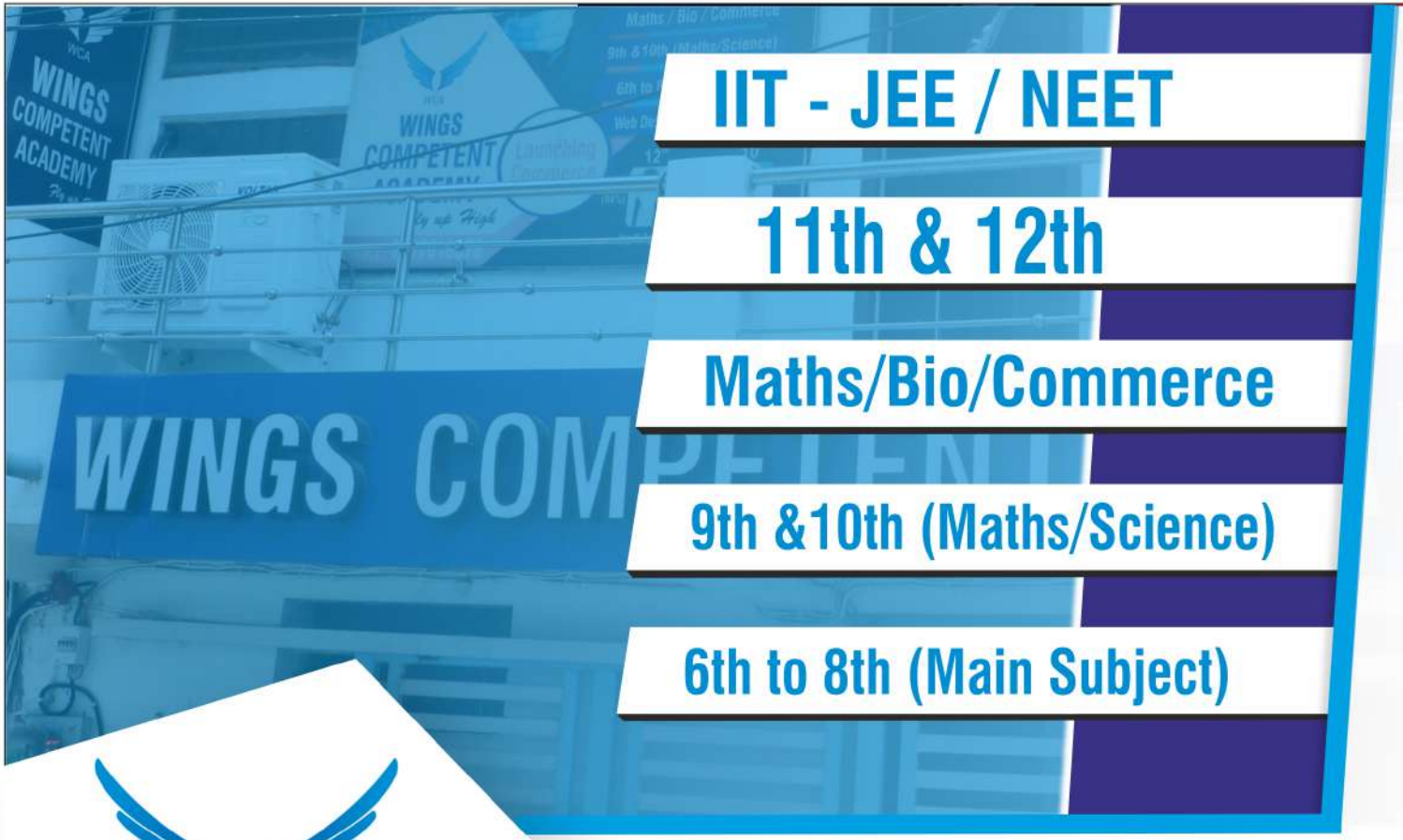

IIT - JEE / NEET

11th & 12th

Maths/Bio/Commerce

9th &10th (Maths/Science)

6th to 8th (Main Subject)

FACILITIES

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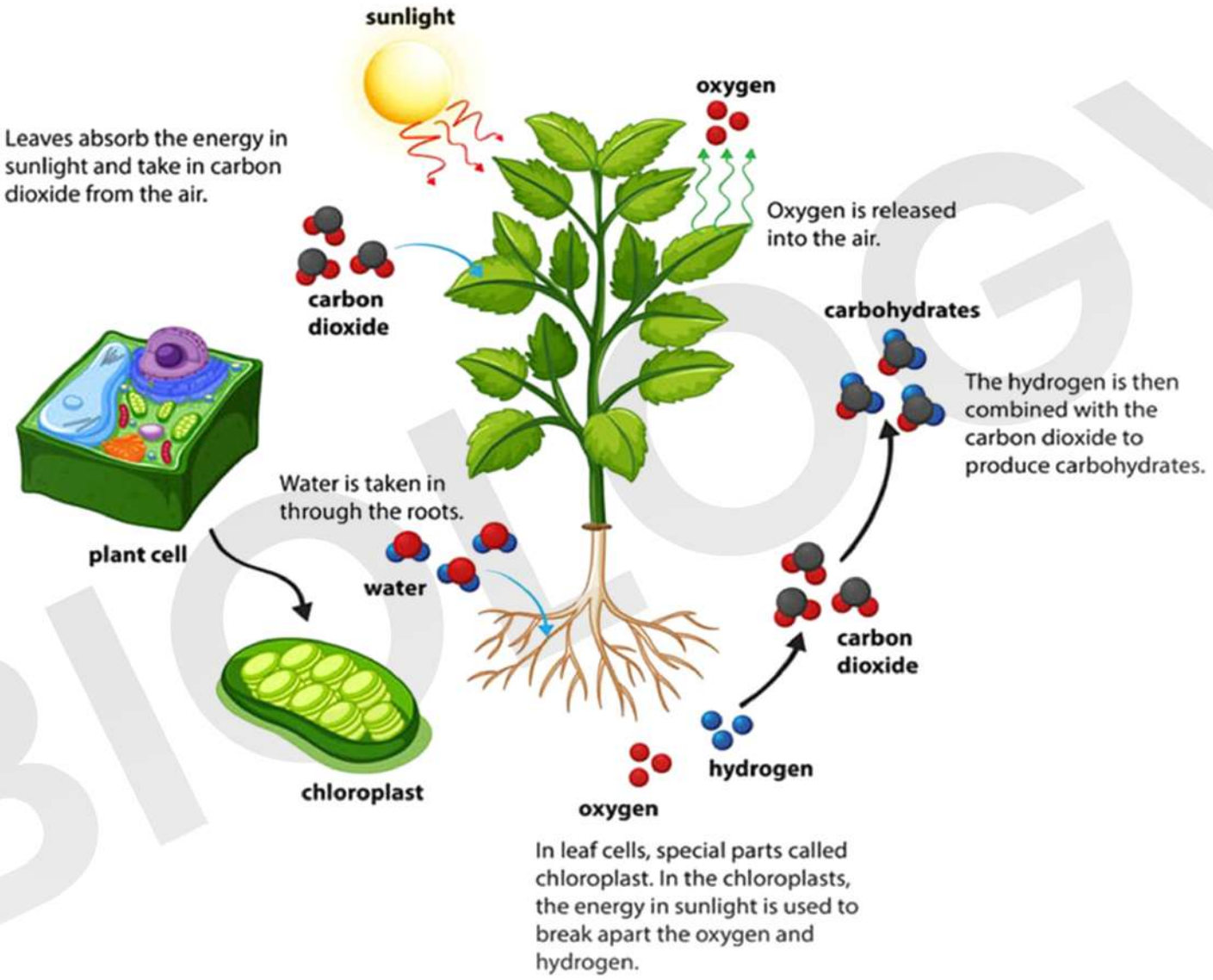
Process of Photosynthesis



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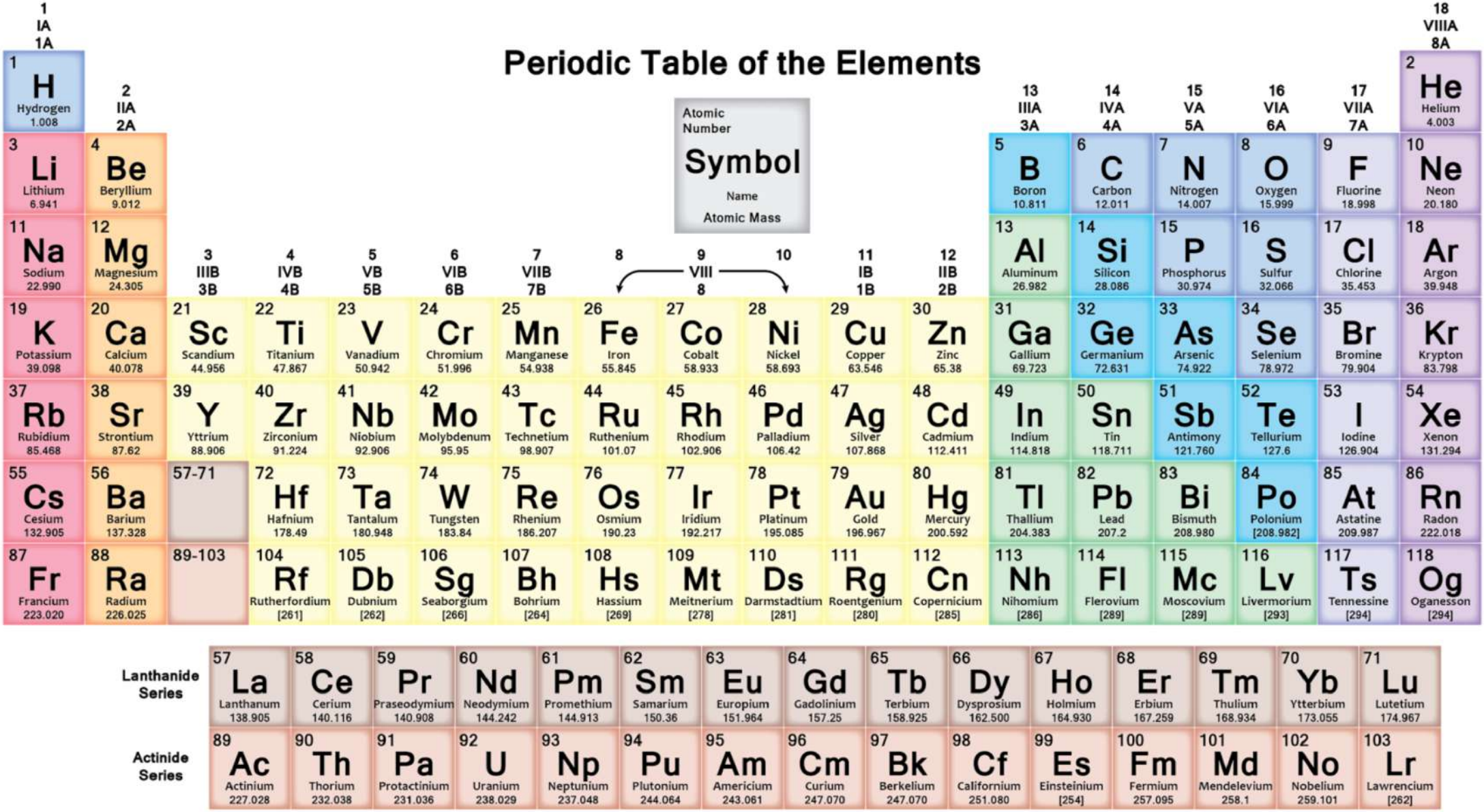
Periodic Table of the Elements



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Formulae of Mathematics

1. $(a+b)^2 = a^2 + 2ab + b^2;\ a^2 + b^2 = (a+b)^2 - 2ab$
2. $(a-b)^2 = a^2 - 2ab + b^2;\ a^2 + b^2 = (a-b)^2 + 2ab$
3. $(a+b+c)^2 = a^2 + b^2 + c^2 + 2(ab + bc + ca)$
4. $(a+b)^3 = a^3 + b^3 + 3ab(a+b);\ a^3 + b^3 = (a+b)^3 - 3ab(a+b)$
5. $(a-b)^3 = a^3 - b^3 - 3ab(a-b);\ a^3 - b^3 = (a-b)^3 + 3ab(a-b)$
6. $a^2 - b^2 = (a+b)(a-b)$
7. $a^3 - b^3 = (a-b)(a^2 + ab + b^2)$
8. $a^3 + b^3 = (a+b)(a^2 - ab + b^2)$
9. $a^n - b^n = (a-b)(a^{n-1} + a^{n-2}b + a^{n-3}b^2 + \cdots + b^{n-1})$
10. $a^n = a.a.a \ldots n$ times
11. $a^m.a^n = a^{m+n}$
12. $\frac{a^m}{a^n} = a^{m-n}$ if $m > n$
    $= 1$ if $m = n$
    $= \frac{1}{a^{n-m}}$ if $m < n; a \in R, a \neq 0$
13. $(a^m)^n = a^{mn} = (a^n)^m$
14. $(ab)^n = a^n.b^n$
15. $\left(\frac{a}{b}\right)^n = \frac{a^n}{b^n}$
16. $a^0 = 1$ where $a \in R, a \neq 0$
17. $a^{-n} = \frac{1}{a^n}, a^n = \frac{1}{a^{-n}}$
18. $a^{p/q} = \sqrt[q]{a^p}$
19. If $a^m = a^n$ and $a \neq \pm 1, a \neq 0$ then $m = n$
20. If $a^n = b^n$ where $n \neq 0$, then $a = \pm b$
21. If $\sqrt{x}, \sqrt{y}$ are quadratic surds and if $a + \sqrt{x} = \sqrt{y}$, then $a = 0$ and $x = y$
22. If $\sqrt{x}, \sqrt{y}$ are quadratic surds and if $a + \sqrt{x} = b + \sqrt{y}$ then $a = b$ and $x = y$
23. If a, m, n are positive real numbers and $a \neq 1$, then $\log_a mn = \log_a m + \log_a n$
24. If a, m, n are positive real numbers, $a \neq 1$, then $\log_a \left(\frac{m}{n}\right) = \log_a m - \log_a n$
25. If a and m are positive real numbers, $a \neq 1$ then $\log_a m^n = n \log_a m$
26. If a, b and k are positive real numbers, $b \neq 1, k \neq 1$, then $\log_b a = \frac{\log_k a}{\log_k b}$
27. $\log_b a = \frac{1}{\log_a b}$ where a, b are positive real numbers, $a \neq 1, b \neq 1$
28. if a, m, n are positive real numbers, $a \neq 1$ and if $\log_a m = \log_a n$, then $m = n$
29. if $a + ib = 0$ where $i = \sqrt{-1}$, then $a = b = 0$
30. if $a + ib = x + iy$, where $i = \sqrt{-1}$, then $a = x$ and $b = y$
31. The roots of the quadratic equation $ax^2 + bx + c = 0;\ a \neq 0$ are $\frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

    The solution set of the equation is $\left\{\frac{-b + \sqrt{\Delta}}{2a}, \frac{-b - \sqrt{\Delta}}{2a}\right\}$
    where Δ = discriminant $= b^2 - 4ac$
32. The roots are real and distinct if $\Delta > 0$.
33. The roots are real and coincident if $\Delta = 0$.
34. The roots are non-real if $\Delta < 0$.
35. If α and β are the roots of the equation $ax^2 + bx + c = 0, a \neq 0$ then
    i) $\alpha + \beta = \frac{-b}{a} = -\frac{\text{coeff. of } x}{\text{coeff. of } x^2}$
    ii) $\alpha \cdot \beta = \frac{c}{a} = \frac{\text{constant term}}{\text{coeff. of } x^2}$
36. The quadratic equation whose roots are α and β is $(x - \alpha)(x - \beta) = 0$
    i.e. $x^2 - (\alpha + \beta)x + \alpha\beta = 0$
    i.e. $x^2 - Sx + P = 0$ where S =Sum of the roots and P =Product of the roots.
37. For an arithmetic progression (A.P.) whose first term is (a) and the common difference is (d).
    i) n^{th} term= $t_n = a + (n-1)d$
    ii) The sum of the first (n) terms $= S_n = \frac{n}{2}(a + l) = \frac{n}{2}\{2a + (n-1)d\}$
    where l =last term= $a + (n-1)d$.

Data & Formulae of Physics

Magnetic fields

force on a current	$F = BIl$
force on a moving charge	$F = BQv$
magnetic flux	$\Phi = BA$
magnetic flux linkage	$N\Phi = BAN\cos\theta$
magnitude of induced emf	$\varepsilon = N\frac{\Delta\Phi}{\Delta t}$
	$N\Phi = BAN\cos\theta$
emf induced in a rotating coil	$\varepsilon = BAN\omega\sin\omega t$
alternating current	$I_{rms} = \frac{I_0}{\sqrt{2}}$ $V_{rms} = \frac{V_0}{\sqrt{2}}$
transformer equations	$\frac{N_s}{N_p} = \frac{V_s}{V_p}$
	efficiency $= \frac{I_s V_s}{I_p V_p}$

Nuclear physics

inverse square law for γ radiation	$I = \frac{k}{x^2}$
radioactive decay	$\frac{\Delta N}{\Delta t} = -\lambda N$, $N = N_0 e^{-\lambda t}$
activity	$A = \lambda N$
half-life	$T_{½} = \frac{\ln 2}{\lambda}$
nuclear radius	$R = R_0 A^{1/3}$
energy-mass equation	$E = mc^2$

OPTIONS

Astrophysics

1 astronomical unit = 1.50×10^{11} m

1 light year = 9.46×10^{15} m

1 parsec = 2.06×10^5 AU = 3.08×10^{16} m = 3.26 ly

Hubble constant, $H = 65$ km s^{-1} Mpc^{-1}

$$M = \frac{\text{angle subtended by image at eye}}{\text{angle subtended by object at unaided eye}}$$

telescope in normal adjustment	$M = \frac{f_0}{f_e}$
Rayleigh criterion	$\theta \approx \frac{\lambda}{D}$
magnitude equation	$m - M = 5\log\frac{d}{10}$
Wien's law	$\lambda_{max} T = 2.9 \times 10^{-3}$ m K
Stefan's law	$P = \sigma A T^4$
Schwarzschild radius	$R_s \approx \frac{2GM}{c^2}$
Doppler shift for $v << c$	$\frac{\Delta f}{f} = -\frac{\Delta\lambda}{\lambda} = \frac{v}{c}$
red shift	$z = -\frac{v}{c}$
Hubble's law	$v = Hd$

Medical physics

lens equations	$P = \frac{1}{f}$
	$m = \frac{v}{u}$
	$\frac{1}{f} = \frac{1}{u} + \frac{1}{v}$
threshold of hearing	$I_0 = 1.0 \times 10^{-12}$ W m^{-2}
intensity level	*intensity level* $= 10\log\frac{I}{I_0}$
absorption	$I = I_0 e^{-\mu x}$
	$\mu_m = \frac{\mu}{\rho}$
ultrasound imaging	$Z = p\,c$
	$\frac{I_r}{I_i} = \left(\frac{Z_2 - Z_1}{Z_2 + Z_1}\right)^2$
half-lives	$\frac{1}{T_E} = \frac{1}{T_B} + \frac{1}{T_P}$

Electricity

current and pd	$I = \frac{\Delta Q}{\Delta t}$ $V = \frac{W}{Q}$ $R = \frac{V}{I}$
resistivity	$\rho = \frac{RA}{L}$
resistors in series	$R_T = R_1 + R_2 + R_3 + \ldots$
resistors in parallel	$\frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + \cdots$
power	$P = VI = I^2R = \frac{V^2}{R}$
emf	$\varepsilon = \frac{E}{Q}$ $\varepsilon = I(R + r)$

Circular motion

magnitude of angular speed	$\omega = \frac{v}{r}$
	$\omega = 2\pi f$
centripetal acceleration	$a = \frac{v^2}{r} = \omega^2 r$
centripetal force	$F = \frac{mv^2}{r} = m\omega^2 r$

Simple harmonic motion

acceleration	$a = -\omega^2 x$
displacement	$x = A\cos(\omega t)$
speed	$v = \pm\omega\sqrt{(A^2 - x^2)}$
maximum speed	$v_{max} = \omega A$
maximum acceleration	$a_{max} = \omega^2 A$
for a mass-spring system	$T = 2\pi\sqrt{\frac{m}{k}}$
for a simple pendulum	$T = 2\pi\sqrt{\frac{l}{g}}$

Thermal physics

energy to change temperature	$Q = mc\Delta\theta$
energy to change state	$Q = ml$
gas law	$pV = nRT$
	$pV = NkT$
kinetic theory model	$pV = \frac{1}{3}Nm(c_{rms})^2$
kinetic energy of gas molecule	$\frac{1}{2}m(c_{rms})^2 = \frac{3}{2}kT = \frac{3RT}{2N_A}$

Gravitational fields

force between two masses	$F = \frac{Gm_1m_2}{r^2}$
gravitational field strength	$g = \frac{F}{m}$
magnitude of gravitational field strength in a radial field	$g = \frac{GM}{r^2}$
work done	$\Delta W = m\Delta V$
gravitational potential	$V = -\frac{GM}{r}$
	$g = -\frac{\Delta V}{\Delta r}$

Electric fields and capacitors

force between two point charges	$F = \frac{1}{4\pi\varepsilon_0}\frac{Q_1Q_2}{r^2}$
force on a charge	$F = EQ$
field strength for a uniform field	$E = \frac{V}{d}$
work done	$\Delta W = Q\Delta V$
field strength for a radial field	$E = \frac{1}{4\pi\varepsilon_0}\frac{Q}{r^2}$
electric potential	$V = \frac{1}{4\pi\varepsilon_0}\frac{Q}{r}$
field strength	$E = \frac{\Delta V}{\Delta r}$
capacitance	$C = \frac{Q}{V}$
	$C = \frac{A\varepsilon_0\varepsilon_r}{d}$
capacitor energy stored	$E = \frac{1}{2}QV = \frac{1}{2}CV^2 = \frac{1}{2}\frac{Q^2}{C}$
capacitor charging	$Q = Q_0(1 - e^{-\frac{t}{RC}})$
decay of charge	$Q = Q_0 e^{-\frac{t}{RC}}$
time constant	RC