SOLAR SYSTEM PHYSICS : KEY EQUATIONS

What follows is a list of the equations we would expect you to remember for the A1X degree examination. Those marked with an * indicate that we would also expect you to know how to derive the equation. (We have not defined the terms in the equations below because we did that in the lecture notes.)

N.B. 1: Simply memorising an equation/derivation is rarely sufficient for an examination. Wherever possible, it is much better to *understand* the equation, rather than just memorise it.

N.B. 2: Remember that you will also need to know the facts of the course, in addition to the equations. If you have any specific questions concerning whether or not a particular section of your notes is examinable, don't hesitate to contact us.

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List of equations

$F = \frac{GM_1M_2}{r^2}$	$\lvert\vec{g}\rvert = \frac{GM}{R^2}$
$\upsilon_{\text{escape}} = \sqrt{\frac{2GM}{R}}$	$F_A - F_C = \frac{2Gm_P m\Delta}{r^3}$ (*)
$\rho = \frac{\text{mass}}{\text{volume}} = \frac{m}{\frac{4}{3}\pi r^3}$ for a spherical body	$P = \frac{\rho kT}{\mu m_H}$ (*)
$P = \frac{1}{3}\rho\upsilon^2$	$\frac{\mathrm{d}P}{\mathrm{d}r} = -\rho g$
$P(r) = P_0 \exp\left(-\frac{r}{H_P}\right)$ (*)	$P(h) = P_S \exp\left(-\frac{\mu m_H gh}{kT}\right)$ (*)
$r < 2^{1/3}\left(\frac{\bar{\rho}_P}{\bar{\rho}_S}\right)^{1/3} R_P$ (*)	$U = -\frac{GM_1M_2}{r}$
$T \sim \frac{2}{3}\frac{GM\bar{m}}{k_B R}$ (*)	$L = 4\pi R^2\sigma T^4$
$\lvert\tau_{cool}\rvert = \frac{1}{2}\frac{M}{m_a}\frac{k_B}{4\pi R^2\sigma}\left[\frac{1}{T_f^3} - \frac{1}{T_i^3}\right]$	$N(t) = N_0 e^{-\lambda t}$
$t_{1/2} = \frac{0.693}{\lambda}$ (*)	$e^{-\lambda(t_1 - t_0)} = \frac{N_P(t_1)}{N_P(t_1) + N_D(t_1)}$ (*)
$F(D) = \frac{L}{4\pi D^2} = \left(\frac{R_S}{D}\right)^2 F_S$	$\lambda_{\max} T = 2.9\times10^{-3}\,Km$
$P_{in} = (1-A)\pi a^2 F(D)$	$F = \sigma T^4$
$T_p = \left(\frac{\theta}{2}\right)^{\frac{1}{2}}(1-A)^{\frac{1}{4}} T_S$ (*)	$P_{out} = 4\pi a^2\sigma T_p^4$