Formula Sheet:

Physics Grade 11 Placement test to enter PHYS Physics 182

Note: use 9.81 m/s^2 for the acceleration due to gravity and 6.67 x 10^{-11} N·m^2/kg^2 for the universal gravitation constant

$$v = \frac{d}{t} \qquad \vec{a} = \frac{\vec{v}_f - \vec{v}_i}{t} \qquad v_{ave} = \frac{\Delta d}{\Delta t}$$

$$\overrightarrow{\Delta d} = \vec{v}_i \Delta t + \frac{1}{2}\vec{a}t^2 \qquad \overrightarrow{\Delta d} = \left(\frac{\vec{v}_i + \vec{v}_f}{2}\right)t \qquad \Delta d = \vec{v}_f \Delta t - \frac{1}{2}\vec{a}t^2$$

$$a_{ave} = \frac{\Delta v}{\Delta t} \qquad \overrightarrow{v_f^2} = \vec{v}_i^{\,2} + 2a\overrightarrow{\Delta d} \qquad |v_c| = \frac{2\pi r}{T}$$

$$|a_c| = \frac{v^2}{r} = \frac{4\pi^2 r}{T^2} \qquad \vec{F}_{net} = m\vec{a} \qquad F_c = \frac{mv^2}{r}$$

$$g = \frac{F_g}{m} \qquad |F_g| = \frac{Gm_1m_2}{r^2} \qquad |g| = \frac{Gm}{r^2}$$

$$|F_f| = \mu |F_N| \qquad F_s = -kx$$

$$E_k = \frac{1}{2}mv^2 \qquad E_p = mgh \qquad E_p = \frac{1}{2}kx^2$$

$$E_m = E_k + E_p = \frac{1}{2}mv^2 + mgh \qquad W = |F||d|\cos\theta \qquad W = \Delta E$$

$$T = 2\pi\sqrt{\frac{l}{g}} \qquad T = 2\pi\sqrt{\frac{m}{k}} \qquad T = \frac{1}{f}$$

$$f_d = f_{source}\left(\frac{v_{sound}}{v_{sound} \mp v_{source}}\right) \qquad K = \frac{T_A^{\,2}}{r_A^3} = \frac{T_B^{\,2}}{r_B^3} \qquad \%efficiency = \frac{W_{out}}{W_{in}} \times 100\%$$

$$T^2 = \left(\frac{4\pi^2}{GM_{Sun}}\right)r^3 \qquad v = f\lambda \qquad v = (331 + 0.6T_C)$$

Planet	Moons	Mass (kg)	Equatorial Radius (m)	Orbital Period (Earth days)	Mean Orbital Radius (m)
Earth	Moon	7.35×10^{22}	1.737×10^{6}	27.322	3.844×10^{8}
Mars	Phobos	1.063×10^{16}	1.340×10^{4}	0.3189	9.378×10^{6}
	Deimos	2.38×10^{15}	7.500×10^{3}	1.262	2.346×10^{7}
Jupiter (4 most massive)	Io	8.9316×10^{22}	1.830×10^{6}	1.769	4.220×10^{8}
	Europa	4.79982×10^{22}	1.565×10^{6}	3.551	6.710×10^{8}
	Ganymede	1.48186×10^{23}	2.634×10^{6}	7.154	1.070×10^{9}
	Callisto	1.07593×10^{23}	2.403×10^{6}	16.689	1.883×10^{9}
Saturn (7 most massive)	Mimas	3.75×10^{19}	2.090×10^{5}	0.942	1.855×10^{8}
	Enceladus	7×10^{19}	2.560×10^{5}	1.37	2.380×10^{8}
	Tethys	6.27×10^{20}	5.356×10^{5}	1.887	2.947×10^{8}
	Dione	1.10×10^{21}	5.600×10^{5}	2.74	3.774×10^{8}
	Rhea	2.31×10^{21}	7.640×10^{5}	4.52	5.270×10^{8}
	Titan	1.3455×10^{23}	2.575×10^{6}	15.945	1.222×10^{9}
	Iapetus	1.6×10^{21}	7.180×10^{5}	79.33	3.561×10^{9}
Uranus (5 most massive)	Miranda	6.6×10^{19}	2.400×10^{5}	1.41	1.299×10^{8}
	Ariel	1.35×10^{21}	5.811×10^{5}	2.52	1.909×10^{8}
	Umbriel	1.17×10^{21}	5.847×10^{5}	4.14	2.660×10^{8}
	Titania	3.53×10^{21}	7.889×10^{5}	8.71	4.363×10^{8}
	Oberon	3.01×10^{21}	7.614×10^{5}	13.46	5.835×10^{8}
Neptune (3 most massive)	Proteus	5.00×10^{19}	2.080×10^{5}	1.12	1.176×10^{8}
	Triton	2.14×10^{22}	1.352×10^{6}	5.8766	3.548×10^{8}
	Nereid	2.00×10^{19}	1.700×10^{5}	360.14	5.513×10^{9}

Table 1 – Planets and their large moons – Ackroyd et al, "Unit III Circular Motion, Work, and Energy" in Physics. 1st edition, Ontario, Canada, Pearson, 2009, Ch. 5, p274

Object	Mass (kg)	Radius of object (m)	Period of rotation on axis (s)	Mean radius of orbit (m)	Period of revolution orbit (s)
Sun	1.98×10^{30}	6.95×10^{8}	2.14×10^{6}	–	–
Mercury	3.28×10^{23}	2.57×10^{6}	5.05×10^{6}	5.79×10^{10}	7.60×10^{6}
Venus	4.83×10^{24}	6.31×10^{6}	2.10×10^{7}	1.08×10^{11}	1.94×10^{7}
Earth	5.98×10^{24}	6.38×10^{6}	8.61×10^{4}	1.49×10^{11}	3.16×10^{7}
Mars	6.37×10^{23}	3.43×10^{6}	8.85×10^{4}	2.28×10^{11}	5.91×10^{7}
Jupiter	1.90×10^{27}	7.18×10^{7}	3.54×10^{4}	7.78×10^{11}	1.74×10^{8}
Saturn	5.67×10^{26}	6.03×10^{7}	3.60×10^{4}	1.43×10^{12}	9.30×10^{8}
Uranus	8.80×10^{25}	2.67×10^{7}	3.88×10^{4}	2.87×10^{12}	2.66×10^{9}
Neptune	1.03×10^{26}	2.48×10^{7}	5.69×10^{6}	4.50×10^{12}	5.20×10^{9}
Pluto	6.00×10^{23}	3.00×10^{6}	5.51×10^{5}	5.90×10^{12}	7.82×10^{9}
Moon	7.34×10^{22}	1.74×10^{6}	2.36×10^{6}	3.80×10^{8}	2.36×10^{6}

Table 2 – Planets and their constants