AP 2001 – A III

1.1. $F_{Grav} = F_Z \Rightarrow G\frac{Mm}{r^2} = m\frac{v^2}{r}$; $v = \frac{2\pi r}{T}$

$\Rightarrow G\cdot\frac{Mm}{r^2} = m\cdot\frac{4\pi^2 r^2}{r\cdot T^2} \Leftrightarrow \frac{T^2}{r^3} = \frac{4\pi^2}{M\cdot G} = C$

Nur abh. v. Masse Zentralgestirn

1.2.0 Geg: m_M ; d_M

1.2.1 $C_M = \frac{4\pi^2}{M\cdot G} = \frac{4\pi^2}{6{,}40\cdot 10^{23}\,kg\cdot 6{,}673\,m^3\cdot kg^{-1}\cdot s^{-2}} = \underline{9{,}24\cdot 10^{-13}\,\frac{s^2}{m^3}}$

1.2.2. $g = \frac{F_{Grav}}{m}$; m: Masse e. Probekörpers

$g_M = \frac{G\frac{M_M}{r^2}}{m} = \frac{G\cdot m_M}{r_M^2} = \frac{6{,}673\cdot 10^{-11}\,\frac{m^3}{kg\,s^2}\cdot 6{,}40\cdot 10^{23}\,kg}{(1/2\cdot 6{,}79\cdot 10^6\,m)^2}$

$\underline{g_M = 3{,}70\,\frac{m}{s^2}}$

1.3.0 Geg: $T_K = 119\,min = 119\cdot 60\,s$

1.3.1 $\frac{T_K^2}{r_K^3} = C_M \Leftrightarrow r_K = \sqrt[3]{T_K^2/C_M} = \left[\frac{(119\cdot 60\,s)^2}{9{,}24\cdot 10^{-13}\,s^2 m^{-3}}\right]^{1/3}$

$r_K = 3{,}81\cdot 10^6\,m$; $h = r_K - r_M = r_K - \frac{1}{2}d_M = \underline{412\,km}$

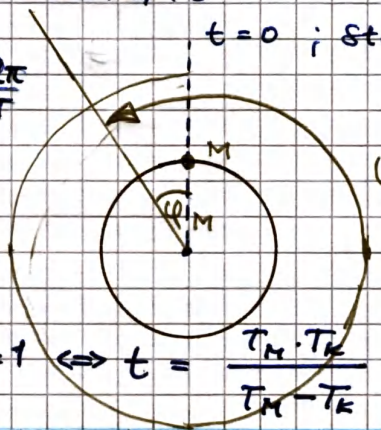
$v = \frac{2\pi r_K}{T_K} = \frac{2\pi\cdot 3{,}81\cdot 10^6\,m}{119\cdot 60\,s} = \underline{3{,}35\,\frac{km}{s}}$

1.3.2 $|F_S| = F_G = m_L\cdot g_M = 2{,}40\cdot 10^3\,kg\cdot 3{,}70\,\frac{N}{kg} = \underline{8{,}88\,kN}$

1.3.3

$T_K = 119\cdot 60\,s = 7140\,s$; $T_M = 1{,}026\,d = 1{,}026\cdot 24\cdot 3600\,s = 88646{,}4\,s$

Weil $T_K < T_M$



$\varphi_M = 2\pi + \varphi_K$; $\varphi = \omega t$; $\omega = \frac{2\pi}{T}$

$\frac{2\pi}{T_M}\cdot t = 2\pi + \frac{2\pi}{T_K}\cdot t \quad |:2\pi$

$\Leftrightarrow \frac{1}{T_M}\cdot t - \frac{1}{T_K}\cdot t = 1$

$t\left(\frac{1}{T_M} - \frac{1}{T_K}\right) = 1 \Leftrightarrow t\left(\frac{T_K - T_M}{T_K T_M}\right) = 1 \Leftrightarrow t = \frac{T_M\cdot T_K}{T_M - T_K}$

$\underline{t = 129\,min}$

1.3.4 ALTER LEHRPLAN !