AP 2007 III

1.1 (4)

$F_Z \overset{①}{=} F_G \Leftrightarrow G\frac{m_Z m}{R^2} \overset{①}{=} m\frac{v^2}{r}$; $v \overset{④}{=} \frac{2\pi R}{T}$

$G\frac{m_Z}{R^2} = \frac{4\pi^2 R^2}{R T^2} \Leftrightarrow T^2 \overset{½}{=} \frac{4\pi^2}{G m_Z}\cdot R^3$; $C = \frac{4\pi^2}{G m_Z}$ ½ nur abh v. m_Z

1.2.0 $m_V = 4{,}87\cdot 10^{24}\,kg$; $r_V = 6{,}05\cdot 10^6\,m$

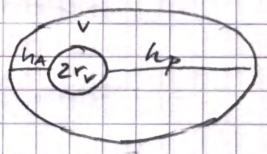
1.2.1 (2) $C_V = \frac{4\pi^2}{6{,}673\cdot 10^{-11}\frac{m^3}{kg\,s^2}\cdot 4{,}87\cdot 10^{24}\,kg} = \underline{1{,}21\cdot 10^{-13}\frac{s^2}{m^3}}$ (1,2148) ②

1.2.2 (3) $m g_V = G\frac{m_V\cdot m}{r_V^2} = 6{,}673\cdot 10^{-11}\frac{m^3}{kg\,s^2}\cdot\frac{4{,}87\cdot 10^{24}\,kg}{(6{,}05\cdot 10^6\,m)^2} = \underline{8{,}88\frac{m}{s^2}}$

1.3.0 $h_A = 250\,km$; $v_A = 8{,}48\frac{km}{s}$

1.3.1 (5) $T = 3{,}16\,h = 11\,376\,s$

① $T^2 = C_V\cdot a^3 \Leftrightarrow a = \sqrt[3]{\frac{T^2}{C_V}}$

② 

$2a = h_A + 2r_V + h_P$

① $a = \left(\frac{(11\,376\,s)^2}{1{,}21\cdot 10^{-13}\frac{s^2}{m^3}}\right)^{1/3} = (1{,}0695\cdot 10^{21}\,m^3)^{1/3} = \underline{1{,}023\cdot 10^7\,m}$

$h_P = 2a - h_A - 2r_V = 2{,}046\cdot 10^7\,m - 2{,}50\cdot 10^5\,m - 2\cdot 6{,}05\cdot 10^6\,m$

① $\underline{h_P = 8{,}10_{32}\cdot 10^6\,m}$

1.3.2 (5) $r_A = h_A + r_V$; $r_P = h_P + r_V$; $P = B$

$A_P = A_V \Leftrightarrow \frac{1}{2} b_A r_A \overset{①}{=} \frac{1}{2} b_P r_P$; $b \overset{①}{=} v\cdot\Delta t$

(3,5) $v_A\cdot\Delta t\cdot r_A = v_P\cdot\Delta t\cdot r_P \;|:\Delta t$ (klein)

(0,5) $(r_V + h_A)\cdot v_A = (r_V + h_P)\cdot v_B$

(1,5) (0,5) $v_B = \frac{r_V + h_A}{r_V + h_P}\cdot v_A = \frac{6{,}05\cdot 10^6\,m + 0{,}250\cdot 10^6\,m}{6{,}05\cdot 10^6\,m + 8{,}10\cdot 10^6\,m}\cdot v_A = 0{,}445\,v_A = \underline{3{,}78\frac{km}{s}}$ (3,7755) ①

1.3.3. (5) 4+1

$F_Z \overset{①}{=} F_G \Leftrightarrow m\frac{v_K^2}{r_K} \overset{①}{=} G\frac{m_E m}{r_K^2} \Leftrightarrow v_K = \sqrt{\frac{G m_V}{r_K}}$; $r_K \overset{①}{=} r_V + h_A$

$v_K = \left(\frac{6{,}673\cdot 10^{-11}\frac{m^3}{kg\,s^2}\cdot 4{,}87\cdot 10^{24}\,kg}{250\,km + 6{,}05\cdot 10^6\,m}\right)^{1/2} = 7182\frac{m}{s} \overset{①}{=} 7{,}18\frac{km}{s}$

1.4 (4) Bahn B ; $F_G \neq F_Z$ zum Mittelpkt

$\underline{\Delta v = -1{,}30\frac{km}{h}}$ ①