

СПБ-162

N 1.

$$E = 10^{55} \text{ Дж}$$

$$E_0 = M c^2$$

$$E = \frac{1}{2} E_0$$

$$\frac{1}{2} M c^2 = 10^{55} \text{ Дж}$$

$$M = \frac{2 \cdot 10^{55} \text{ Дж}}{c^2}$$

$$M = \frac{2 \cdot 10^{39}}{3 \cdot 3 \cdot 10^{16}} = 0,2 \cdot 10^{39} \text{ кг}$$

$$u = \frac{M}{M_0} \quad u \approx 0,3 \cdot 10^9$$

$$\text{Ответ: } 0,3 \cdot 10^9.$$

N 2.

$$\varphi_1 = 60^\circ$$

$$\varphi_2 = 72^\circ$$

$$\delta = -3^\circ$$

$$\Delta h_1 = 60^\circ$$

$$\Delta h_2 = 37^\circ$$

$$t = 12$$

$$\text{Ответ: } \text{нельзя.}$$

$$h_{BK} = 90^\circ - |\varphi - \delta|$$

$$h_{BK1} = 90^\circ - 63^\circ = 27^\circ$$

$$h_{BK2} = 90^\circ - 75^\circ = 15^\circ$$

$$h_{H.K.} = |\varphi + \delta| - 90^\circ$$

$$h_{H.K.1} = 57^\circ - 90^\circ = -33^\circ$$

$$h_{H.K.2} = 69^\circ - 90^\circ = -21^\circ$$

N 4.

$$T = \frac{1}{60} T_{\text{н}}$$

$$R = 6400 \text{ км}$$

$$\rho = 9 \cdot 10^8 \frac{\text{кг}}{\text{м}^3}$$

$$T = \frac{1}{60} \cdot 0,62 = 0,011 = 1,1 \text{ с} = 3200000 \text{ с}$$

$$v_2 = \frac{2\pi r}{T}$$

$$v_2 = \sqrt{6 \frac{M_3}{r}}$$

$$\frac{2\pi r}{T} = \sqrt{6 \frac{M_3}{r}}$$

$$\frac{4\pi^2 v^2}{T^2} = \frac{GM_3}{r} \quad M_3 = \frac{4}{3}\pi R^3 \rho$$

$$\frac{4\pi^2 v^2}{T^2} = \frac{G \frac{4}{3}\pi R^3 \rho}{r} \quad 4\pi^2 v^3 = G \frac{4}{3}\pi R^3 \rho T^2$$

$$\pi v^3 = \frac{GR^3 \rho T^2}{3} \quad v^3 = \frac{GR^3 \rho T^2}{3\pi}$$

$$v^3 = \frac{6,67 \cdot 10^{-11} \cdot 6400000^3 \cdot 9 \cdot 10^8 \cdot 3200000}{3\pi} = 160,32 \cdot 10^{24} = 512 \cdot 10^{24}$$

$$v = 2^3 \cdot 10^8 = 8 \cdot 10^8 \text{ (m/s)} \quad v = 8 \cdot 10^5 \text{ km/s}$$

$$v_1' = \sqrt{G \frac{2M_3}{r}}$$

$$v_1' = \sqrt{\frac{6,67 \cdot 10^{-11} \cdot 2 \cdot \frac{4}{3}\pi R^3 \rho}{8 \cdot 10^8}}$$

$$v_1' = \sqrt{127 \cdot 10^{13}} \approx 11 \cdot 10^6 \frac{\text{m}}{\text{s}} = 11 \cdot 10^3 \frac{\text{km}}{\text{s}}$$

Answer: не могу.

~5.

$$m_1 = 4M_\odot \quad v_1 = \sqrt{G \frac{m_2}{R_1}} \quad v_1 = \sqrt{G \frac{2,4 \cdot 10^{31}}{1,5 \cdot 10^8}} \approx \sqrt{2 \cdot 10^{12}}$$

$$m_2 = 1 \cdot 10^{24} \text{ kg} \quad v_2 = \sqrt{G \frac{m_1}{R_2}} \quad v_2 = \sqrt{G \frac{3 \cdot 10^{24}}{8 \cdot 10^5}} = \sqrt{\frac{3}{8} \cdot 10^8}$$

$$R_1 = 4 \text{ a.e.} \quad v_1 \approx 10^6 \frac{\text{m}}{\text{s}}$$

$$R_2 = 800 \text{ km} \quad v_2 \approx 0,5 \cdot 10^4 \frac{\text{m}}{\text{s}}$$

$$T_1 = \frac{S_1}{v_1} \quad T_1 \approx 10^3 \text{ c}$$

$$T_2 = \frac{S_2}{v_2} \quad T_2 \approx 10^3 \text{ c} \quad S = 2\pi R$$

$$S = \frac{T_1 \cdot T_2}{|T_1 - T_2|} \quad S \approx \frac{10^6 \text{ c}}{1} = 10^6 \text{ c} \approx 332.$$

Answer: 332.

~3.

$$v = \omega R \quad \omega = \frac{v}{R} \quad T = \frac{1}{f}$$

$$\omega_1 = \omega_2 = \frac{360^\circ}{T}$$

$$g_1 R_1 = g_2 R_2 \leftarrow v_1 = \sqrt{gR}$$

$$\frac{g_1}{g_2} = \frac{R_2}{R_1} \quad \frac{g_1}{g_2} = \frac{1}{7} \rightarrow \frac{v_1}{v_2} = \frac{1}{7} \quad \text{Answer: } \frac{1}{7}.$$