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Homework:

Classification of Earth's artificial satellites orbits; the launching and the escaping velocity (present the calculus with g_0 = gravitational at the Earth surface) for at least one real satellite on each type of orbits)

1) Low Earth Orbit (LEO)

- IRS-1E $h_1 = 817\,km = 817000\,m$

$$v_1 = \sqrt{g_0 \cdot \frac{R_0}{1+\frac{h}{R_0}}} \qquad g_0 = 9{,}8\ \frac{m}{s^2}$$

$$R_0 = 6{,}36744 \cdot 10^6\ m$$

$$v_1 = \sqrt{9{,}8\ \frac{6{,}36744 \cdot 10^6}{1+\frac{817 \cdot 10^3}{6{,}36744 \cdot 10^6}}}$$

$$v_1 = \sqrt{9{,}8\ \frac{6{,}36744 \cdot 10^6}{\frac{6{,}36744 \cdot 10^3 + 817}{6{,}36744 \cdot 10^3}}}$$

$$v_1 = \sqrt{\frac{9{,}8 \cdot 6367440}{\frac{6367{,}44+817}{6367{,}44}}} = \sqrt{55304806{,}4} = 7436{,}72\ m/s$$

$$= \sqrt{7436} = 7{,}43\ km/s$$

$$v_e = \sqrt{2} \cdot v_1 = \sqrt{2} \cdot 7{,}43 = 10{,}5\ km/s$$

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2) Medium Earth Orbit (MEO)

• Galileo $h_2 = 23.222\ km = 23222 \cdot 10^3\ m$

$$v_2 = \sqrt{9,8 \cdot \frac{6,36744 \cdot 10^6}{1 + \frac{23222 \cdot 10^3}{6,36744 \cdot 10^6}}} =$$

$$v_2 = \sqrt{13428238,7} = 3664,45\ m/s = 3,66\ km/s$$

$$v_e = \sqrt{2} \cdot v_2 = 5,17\ km/s$$

3) High Earth Orbit (HEO)

• IBEX $h_3 = 61941\ km = 61941 \cdot 10^3\ m$

$$v_3 = \sqrt{9,8 \frac{6,3674 \cdot 10^6}{1 + \frac{61941 \cdot 10^3}{6,36744 \cdot 10^6}}}$$

$$v_3 = \sqrt{5815763,83} = 2411,74\ m/s = 2,41\ km/s$$

$$v_e = 2,41 \cdot \sqrt{2} = 3,41\ km/s$$

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4) Geostationary orbit (GEO)

- CHINASAT 2E $h_4 = 35789\ km = 35789 \cdot 10^3\ m$

$$v_4 = \sqrt{9{,}8 \cdot \frac{6{,}36744 \cdot 10^6}{1 + \frac{35789 \cdot 10^3}{6{,}36744 \cdot 10^6}}}$$

$$v_4 = \sqrt{9425228{,}11} = 3070{,}05\ m/s$$

$$= 3{,}07\ km/s$$

$$v_e = \sqrt{2} \cdot 3{,}07 = 4{,}34\ km/s$$