Astronomy preparation
Celestial mechanics – Basic problems 1

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Problem 1

Using data from the table below, calculate the gravitational acceleration g on the surface of the following celestial bodies: Moon, Venus, Jupiter, Sun

Celestial Body	**Mass (kg)**	**Radius (m)**
Moon	7.35×10^{22}	1.74×10^{6}
Venus	4.87×10^{24}	6.05×10^{6}
Jupiter	1.90×10^{27}	6.99×10^{7}
Sun	1.99×10^{30}	6.96×10^{8}

Table 1: Masses and radii of selected celestial bodies

Problem 2

Geostationary satellites have the same orbital period as Earth's rotation period, so because their orbits lie in the Earth's equatorial plane, they are always over a particular point on Earth. How far above the Earth's surface do they orbit?

Problem 3

Determine the semi-major axis of Saturn's orbit, knowing that its orbital period is 29.46 years.

Problem 4

The semi-major axis of the comet Hale–Bopp is $a = 186$ AU and its eccentricity is $e = 0.995$. The last time it was closest to the Sun was in 1997. When will it next be in perihelion and how far from the Sun will it be then?

Problem 5

How long does it take a rock dropped from a height of 1 meter on the Moon to fall? What about a feather under similar circumstances?