Problems of Gravitational field. Orbits of satellites and planets

1) The satellite Europa has an orbital period of 3.5512 days and a mean distance of 6.709×10^5 km from the center of Jupiter. Find the orbital radius of Ganymede (another satellite of Jupiter) if its orbital period is 7.1546 days.
Answer: 1.070×10^9 m.

2) The orbital period of the Earth is 365.26 days and its mean distance from the center of the Sun is 1.496×10^{11} m. Calculate the orbital period of Uranus if its orbital radius is 2.877×10^{12} m.
Answer: 2.661×10^9 s.

3) The Moon has an orbital period of 27.3 days and a mean distance of 384 400 km from the center of the Earth. An artificial satellite orbiting the Earth has an orbital period of 177 minutes. What is the mean orbital radius of the satellite?
Answer: 10480 km.

4) The satellite Deimos has an orbital period of 1.263 days and a mean distance of 23460 km from the center of Mars. Find the orbital period of Phobos (another satellite of Mars) if its orbital radius is 9376 km.
Answer: 27570 s.

5) Uranus has an orbital period of 30799 days and a mean distance of 2.877×10^{12} m from the center of the Sun. Find the orbital radius of Jupiter if its orbital period is 4332.6 days.
Answer: 7.781×10^{11} m.

6) The period of the Moon is 27.3 days and its mean distance from the center of the Earth is 384 400 km. An artificial satellite orbiting the Earth has an orbital radius of 7.246×10^6 m. What is the orbital period of the satellite?
Answer: 6104 s.

7) A satellite has an orbital period of 453.8 minutes and a mean distance of 2537 km from the center of Pluto. Find the mass of Pluto and the speed of the satellite.
$G = 6.674\times10^{-11}$ N·m^2/kg^2.
Answer: **a)** 1.303×10^{22} kg, **b)** 585.5 m/s.

8) Calculate the altitude and the speed of a geostationary satellite around the Earth. A geostationary satellite has an orbital period of 24 hours.
Mass of Earth = 5.98×10^{24} kg, radius of Earth = 6378 km, $G = 6.674\times10^{-11}$ N·m^2/kg^2.
Answer: **a)** 35880 km, **b)** 3070 m/s.

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9) The Moon has an orbital period of 27.3 days and a mean distance of 384 400 km from the center of the Earth. Calculate the mass of the Earth and the velocity of the Moon.
$G = 6.674\times10^{-11}$ N·m^2/kg^2.
Answer: **a)** 6.039×10^{24} kg, **b)** 1024 m/s.

10) A satellite of the Moon orbits 1600 km above its surface. Find the speed of the satellite and its period.
Radius of the Moon = 1737 km, mass of the Moon = 7.342×10^{22} kg, $G = 6.674\times10^{-11}$ N·m^2/kg^2.
Answer: 1212 m/s, 17300 s.

11) A satellite of Jupiter has an orbital period of 212.4 minutes. Find the mean orbital radius of the satellite and its speed.
Mass of Jupiter = 1.899×10^{27} kg, $G = 6.674\times10^{-11}$ N·m^2/kg^2.
Answer: **a)** 80490 km, **b)** 39680 m/s.