Learning Intentions

- To learn how the physics of uniform circular motion and gravitational attraction combine to describe the orbit of planets and satellites

Notes

1. Astronomical unit:

2. When a body (object floating in space) is orbiting another body, the primary force can be described using Newton's Law of _____.

3. When one body has a circular orbit around another body, the orbital velocity can be calculated as follows:

4. When a satellite has a circular orbit around the Earth, the orbital velocity can be calculated as follows:

5. _____'s Three Laws of Planetary Motion

   a. The Law of _____:

   b. The Law of _____ Areas:

   c. The Law of _____:

6. The Three _____ Problem:

    a. Animation of the problem

7. Urbain Le Verrier was a French mathematician who used the laws of planetary motion to predict the existence of _____.

See over →

Questions

1. A geostationary satellite has a period of 1.000 Earth days, such that it appears to "hover" permanently above the Earth. If the Earth has a radius of 6,371 km and a mass of 5.972×10^{24} kg, what is the orbital height of a geostationary satellite?
2. The International Space Station (ISS) has an orbital speed of 7.66 km/s. How high above the Earth's surface does it rotate?
3. The moon has an orbital velocity of 1.02 km/s. How far from the Earth’s centre does the moon orbit?
4. If Mercury has a period of 0.241 Earth years, what is its average distance from the Sun?
5. If Pluto (no longer a planet) has a period of 248 Earth years, what is its average distance from the Sun?
6. If Jupiter has an average distance of 5.20 au from the Sun, what is its period?
7. If Uranus has an average distance of 19.18 au from the Sun, what is its period?

Answers

1. 35,900 km above the Earth
2. 418 km above the Earth
3. 383,000,000 km
4. 0.387 au
5. 39.4 au
6. 11.8 Earth years
7. 84.00 Earth years