Universal Gravitation

1. A satellite orbits around Earth at a distance of 1.28×10^7 m from the center of the Earth. The satellite weighs 6000 N on the surface of Earth. For the satellite in orbit calculate its
   (a) mass. (612 kg)
   (b) weight. (1.49×10^3 N)
   (c) speed. (5.58×10^3 $\frac{m}{s}$)
2. A satellite which weighs 1.0×10^4 N on the surface of Earth is put into circular orbit 7.05×10^8 m above the Earths surface. Calculate its
   (a) mass (1.0×10^3 kg)
   (b) weight (0.79 N)
   (c) velocity (7.5×10^2 $\frac{m}{s}$)
   (d) acceleration towards the Earth. (7.9×10^{-4} $\frac{m}{s^2}$)
3. A satellite orbits Neptune in 200 minutes. The radius of its orbit is 2.92×10^7. Calculate
   (a) the average speed of the satellite. (1.53×10^4 $\frac{m}{s}$)
   (b) its centripetal acceleration. (8.01 $\frac{m}{s^2}$)
4. What orbital speed must a satellite of mass 800 kg have in order to maintain an orbit 2.00×10^7 m above the surface of Jupiter where the gravitational field strength is 15 $\frac{m}{s^2}$? What would it weigh at this height? (3.7×10^4 $\frac{m}{s}$, 1.2×10^4 N)
5. Compute the gravitational force between a proton and an electron using the following data:
   mass of proton = 1.67×10^{-27} kg
   mass of electron = 9.11×10^{-31} kg
   radius of orbit of an electron = 5.29×10^{-9} cm. (3.63×10^{-47} N)
6. A space explorer is 1 billion km away from a certain star and she observes that the gravitational force between herself and the star is 1000 N. What will this force be when she is half a billion km from the star?
   (4000 N)
7. A satellite circles the Earth once every 95 minutes at an average altitude of 500 km. Calculate the mass of the Earth. (5.9×10^{24} kg)
8. A satellite put into circular orbit around Uranus weighs 2.0×10^4 N on Earth. The radius of the satellites orbit is 4.0×10^7 m (DO NOT use the mass of Uranus in your calculations). Calculate
   (a) the period of the satellite. (2.1×10^4s)
   (b) its orbital velocity. (1.2×10^4 $\frac{m}{s}$)
   (c) the force needed to maintain this orbit. (7.2×10^3N)
   (d) the centripetal acceleration (3.6 $\frac{m}{s^2}$)
   (e) the mass of Uranus. (8.6×10^{25}kg)
9. A satellite which weighs 7.0×10^3 N on Earth is put into orbit 200 km above the surface of Mars. For the satellite find the
   (a) mass. (7.1×10^2 kg)
   (b) weight in orbit. (2.3×10^3 N)
   (c) gravitational field strength acting on it. (3.2 $\frac{m}{s^2}$)
   (d) speed of the satellite. (3.4×10^3 $\frac{m}{s}$)
10. A satellite with a mass of 640 kg is in orbit above the surface of the Earth where the gravitational field strength is 8.6 $\frac{m}{s^2}$. What is the gravitational force on the satellite at this height? (5.5×10^3 N)
11. A 1000 kg satellite is put into a circular orbit above Earth so that it always remains over the same place on Earth. (This is called a synchronous or geostationary orbit.)
    (a) What is the radius of this orbit? (4.22×10^7m)
    (b) What would the satellite weigh in orbit? (224 N)
    (c) How fast does it go while orbiting? (3.07×10^3 $\frac{m}{s}$)