NAME_____

11 Physics Assignment

Gravitation and Satellites

1. The space station Delta 3 is in high orbit around the gas giant planet Rogulus IV. Their masses are 9.26×10^{6} kg and 3.45×10^{28} kg respectively and the distance between their centres is 5.67×10^{10} m.
   (a) Calculate the gravitational force the planet exerts on Delta 3 /3
   (b) Calculate the acceleration of Delta 3 /3
   (c) Calculate the acceleration of Rogulus IV /3
   (d) Discuss whether or not you would say that Rogulus IV is in orbit around Delta 3. /2
   (e) Calculate the orbital speed of Delta 3. /2
   (f) Calculate how long it takes Delta 3 to perform each orbit of Rogulus IV. /2

2. Calculate the radius of orbit (from centre to centre) of a geostationary satellite around Earth, given that Earth's mass is 5.98×10^{24} kg. (Hint: a geostationary orbit will orbit Earth once every 24 hours).
   /2

3. Explain whether or not gravitational forces obey Newton's third law. /2

4.
   (a) Calculate the magnitude of the acceleration due to gravity on the Earth's surface, given that its radius is 6.37×10^{6} m and it has a mass of 5.98×10^{24} kg. /2
   (b) Explain why it is not necessary to know the mass of a falling object in order to calculate its acceleration, even though the force depends on its mass due to $F = G\frac{mM}{r^2}$ /2
   (c) It *is* important to know the distance of the object from the centre of the planet. State the effect of doubling the distance on the magnitude of acceleration. (You should be able to answer this without performing any calculations). /1

5. Draw some possible satellite orbits around a planet. Explain what makes them possible. /2

6. State one difference between a polar orbit and a geostationary orbit. /1