Honors Physics — Unit 7 Practice Test

Mr. McQuiston — Name:_____

A 800kg robotic spacecraft is used to study a comet with a mass of 4.72×10^{14}kg.

1. What is the gravitational force of the comet acting on the spacecraft when they are separated by a distance of 5000m?

$$F_G = \frac{6.67\times10^{-11} \cdot 4.72\times10^{14} \cdot 800}{5000^2}$$

2. What is the gravitational force of the spacecraft acting on the comet when they are separated by a distance of 5000m?

1 N

3. If the distance is reduced to one fifth the distance in question 1, does the gravitational force increase, decrease or stay the same? If it changes, by what factor does it change?

$r \rightarrow r/5$

Double r: $\frac{1}{2^2} = \frac{1}{4}$ | Halve: $\frac{1}{(\frac{1}{2})^2} = 4$

$$F_G = 1N = \frac{Gm_1m_2}{r^2} \qquad \frac{Gm_1m_2}{(r/5)^2} = \frac{Gm_1m_2}{r^2/25} = 25\frac{Gm_1m_2}{r^2}$$

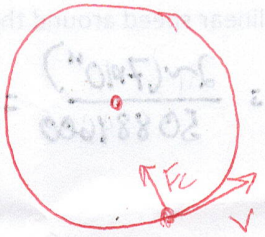
4. The spacecraft enters a circular orbit around the comet with a radius of 2200m and an orbital period of 3650s. What is the linear speed of the spacecraft?

$$v = \frac{2\pi r}{T} = \frac{2\pi\, 2200}{3650} = 3.785\ m/s$$

5. What is the centripetal acceleration of the spacecraft?

$$a_c = \frac{v^2}{r} = 0.0065\ m/s^2$$

6. Draw the orbit of the spacecraft around the comet, labeling the linear velocity and centripetal acceleration.



7. What is the centripetal force acting on the spacecraft?

$$F_c = ma_c = 5.2\ N$$