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## PHYS 1110 Worksheet: Gravity

### *Newton's gravity formula*

$F = G \frac{m_1 m_2}{r^2}$ , where  $G = 6.6742 \times 10^{-11} \text{ N} \cdot \text{m}^2/\text{kg}^2$ , the universal gravitational constant

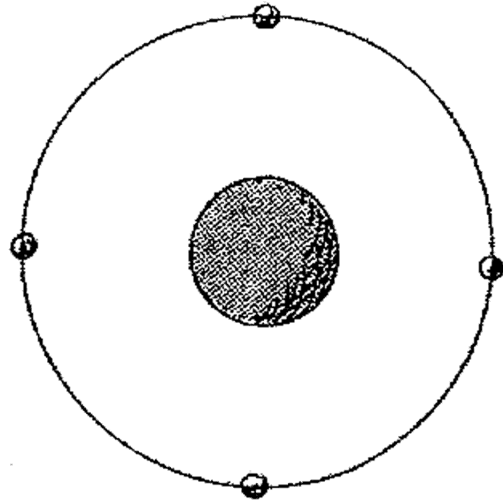
$U = -\frac{G m_1 m_2}{r}$ , meaning  $U = 0$  at  $r = \infty$

### Problems

1. A satellite revolves around its planet in a perfectly circular orbit at a constant speed.

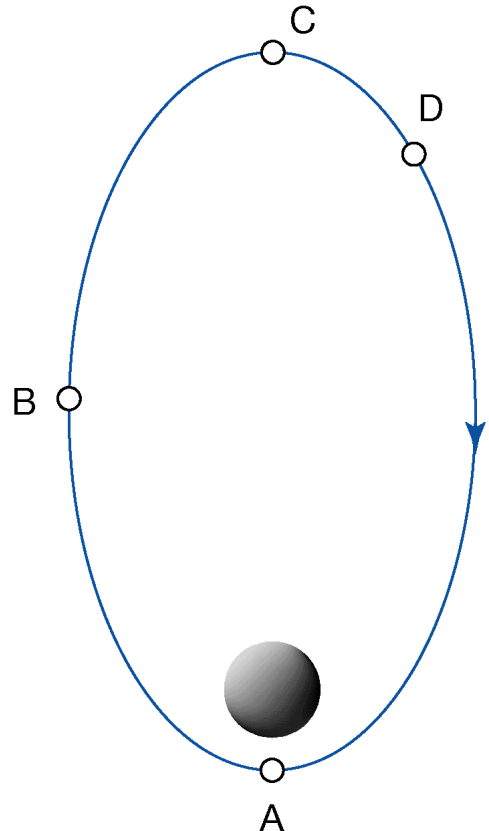
- Draw and label force vectors  $F$ .
- Draw and label velocity vectors  $v$ .
- What is the angle between the  $F$  and  $v$  vectors?

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- f. Is there any component of  $F$  parallel to  $v$ ? \_\_\_\_\_

2. The picture to the right shows the path of a satellite orbiting a planet.
- At which position(s) is the satellite slowing down?
  - At which position(s) is the satellite speeding up?
  - At which position(s) is the satellite's direction changing?



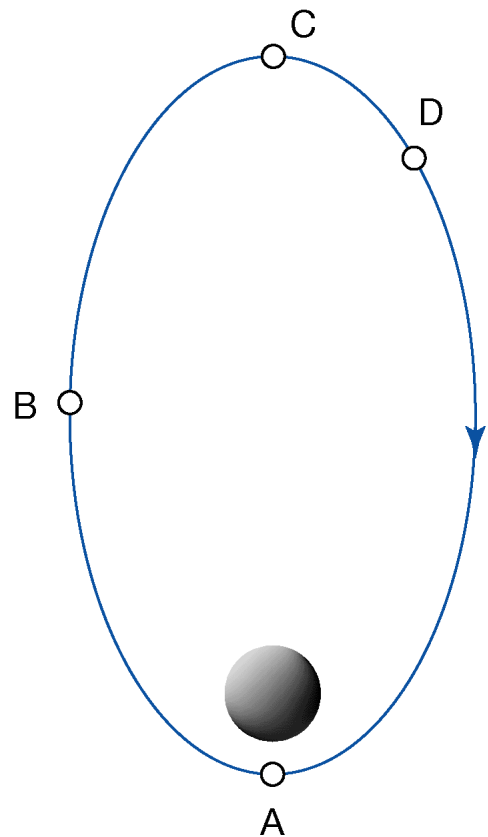
3. Rank the positions A, B, C, and D in descending order of the satellite's:

a. Gravitational force.

b. Acceleration.

c. Speed.

d. Angular momentum.



4. What distance from the Earth's center would a geosynchronous satellite, with an orbital period of 86,164 s, orbit? Earth's mass =  $5.976 \times 10^{24}$  kg.