

Orbital Motion Interactive

Purpose:

The purpose of this activity is to investigate the nature of an elliptical orbit of a planet or other satellite about the Sun or some central body.

Procedure and Questions:

1. Navigate to the Orbital Motion Interactive (Physics Classroom >> Physics Interactives >> Circular Motion and Gravitation >> Orbital Motion) and experiment with the on-screen buttons in order to gain familiarity with the Interactive. The eccentricity of the elliptical orbit can be varied. A trace of the object's motion is displayed. The vector nature of velocity and force can be shown on the screen. The animation can be started, paused, continued or *reset*.

After gaining familiarity with the program, use it to answer the following questions:

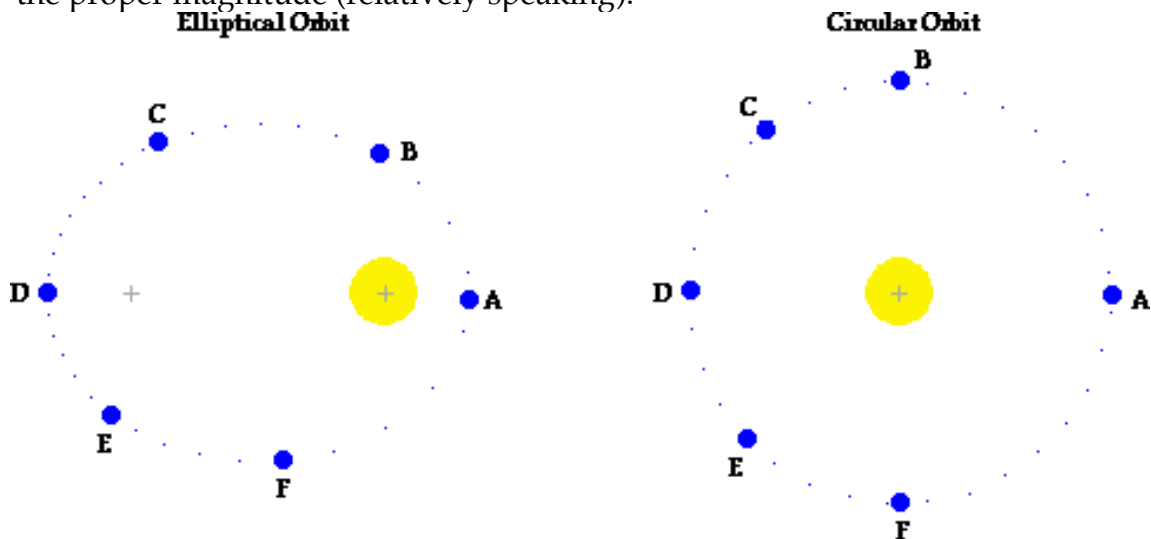
2. Velocity is a vector quantity which has both magnitude and direction. Using complete sentences, describe the object's velocity during the course of the elliptical orbit. Comment on both the magnitude and the direction.

3. Net force is also a vector quantity which has both magnitude and direction. Using complete sentences, describe the net force acting upon the object during the course of the elliptical orbit. Comment on both the magnitude and the direction.

4. Describe how an alteration in eccentricity of the orbit effects the elliptical and circular nature of it.

5. What eccentricity value results in a circular orbit? _____

6. A circular orbit and a highly elliptical orbit are shown in the diagram below. Draw and label the net force (F) and velocity (v) vectors for each of the six marked positions for a *clockwise* orbit. Draw the vectors in the appropriate direction and of the proper magnitude (relatively speaking).



7. Complete the following sentences by filling in the blanks:

For **elliptical orbits**: the direction of the velocity of the satellite is _____ (always, seldom, never) perpendicular to the net force acting upon the satellite.

For **circular orbits**: the direction of the velocity of the satellite is _____ (always, seldom, never) perpendicular to the net force acting upon the satellite.

8. Fill in the blanks in the following paragraph:

If a satellite is orbiting the Earth in elliptical motion, then it will move _____ (slowest, fastest) when its closest to the Earth. While moving towards the Earth (along the path from D to A) there is a component of force in the _____ (same, opposite) direction as the motion; this causes the satellite to _____ (slow down, speed up). While moving away from the Earth (along the path from A to D) there is a component of force in the _____ (same, opposite) direction as the motion; this causes the satellite to _____ (slow down, speed up).

Conclusion:

Summarize your findings by describing the features of a satellite's elliptical orbit. Describe such quantities as velocity, acceleration and force. Elaborate on your statements and include detail.