Chapter 12: Satellite Motion

12-1

1. Figure A is of "Newton's Mountain," high enough so its top is above the drag of the atmosphere. The cannonball is fired and hits the ground as shown.

   a. Draw the path the cannonball might take if it were fired a little bit faster.

   b. Repeat for a speed that is greater still, but still less than 8 km/s.

   c. Then draw the orbital path of the cannonball if its speed were 8 km/s.

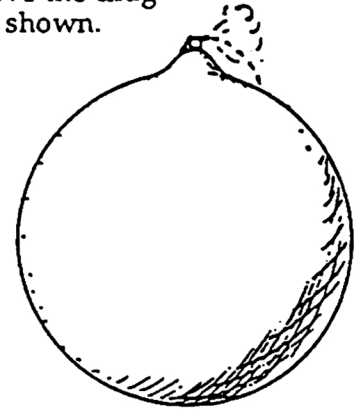   d. What is the shape of the curve for a speed of 8 km/s?

   _____

   e. What would be the shape of the orbital path if the cannonball were fired at a speed of about 9 km/s?

   _____

Figure A

2. Figure B shows a satellite in circular orbit.

   a. At each of the four positions draw a vector that represents the gravitational *force* exerted on the satellite.

   b. Label the force vectors *F*.

   c. Then draw at each position a vector to represent the *velocity* of the satellite at that position, and lable it *V*.

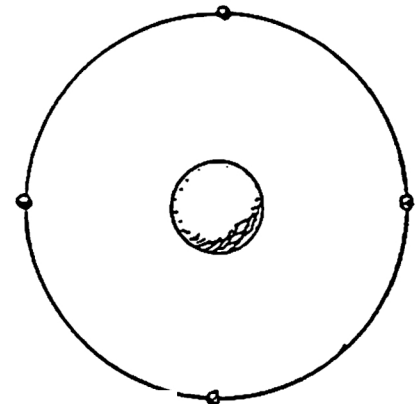   d. Are all four *F* vectors the same length? Why or why not?

   _____

Figure B

   e. What is the angle between your *F* and *V* vectors?_____

   f. Is there any component of *F* along *V* ? _____

   g. What does this tell you about the work the force of gravity does on the satellite?

   _____

   h. Are all four *V* vectors the same length? Why or why not?

   _____

i. Does the KE of the satellite in Figure B remain constant, or does it vary?

_____

k. Does the PE of the satellite remain constant, or does it vary?

_____

3. Figure C shows a satellite in elliptical orbit.

a. Repeat the procedure you used for the circular orbit, drawing vectors _F_ and _V_ for each position, including proper labeling. Show equal magnitudes with equal lengths, and greater magnitudes with greater lengths, but don't bother making the scale accurate.

b. Are your _F_ vectors all the same length? Why or why not?

_____

_____

c. Is the angle between your _F_ and _V_ vectors the same everywhere, or does it vary?

_____

d. Are there places where there is a component of _F_ along _V_?

_____

e. Is work done on the satellite when there is a component of _F_ along and in the same direction as _V_? If so, does this increase or decrease the KE of the satellite?

_____

f. When there is a component of _F_ along and opposite to the direction of _V_, does this increase or decrease the KE of the satellite?

_____

g. Are your _V_ vectors all the same length? Why or why not?

_____

_____

_____

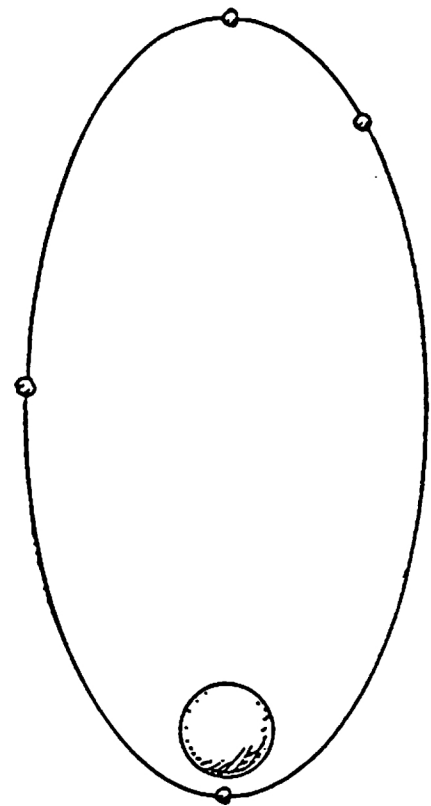h. What can you say about the sum KE + PE along the orbit?

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Figure C