Name [redacted] Per Date

CONCEPTUAL Physics PRACTICE PAGE

Chapter 9 *Satellite Motion*

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

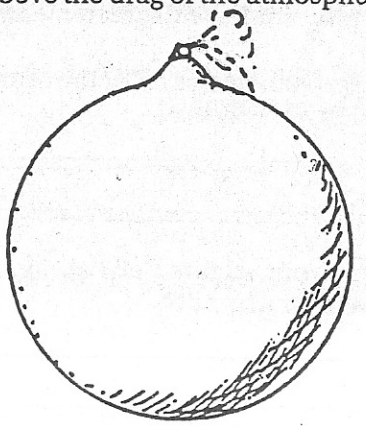

Figure A

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

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

   c. Then draw the orbital path it would take if its speed were 8 km/s.

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

   _____

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

   _____

2. Figure B shows a satellite in circular orbit.

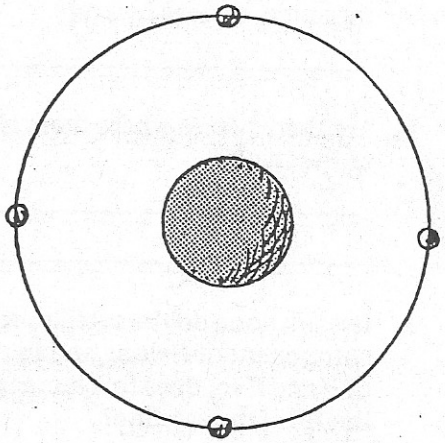

Figure B

   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 label it *V*.

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

   _____

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

   _____

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

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

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

   _____

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

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

   _____

Hewitt Drew it!

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 vectors *F* all the same magnitude? Why or why not?

   _____

   _____

   c. Are your vectors *V* all the same magnitude? Why or why not?

   _____

   _____

   _____

   _____

   d. Is the angle between vectors *F* and *V* everywhere the same, or does it vary?

   _____

   e. Are there places where there is a component of *F* along *V*?

   _____

   _____

   f. Is work done on the satellite when there is a component of *F* along and in the same direction of *V* and if so, does this increase or decrease the KE of the satellite?

   _____

   g. 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?

   _____

   _____

   _____

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

   _____

   _____

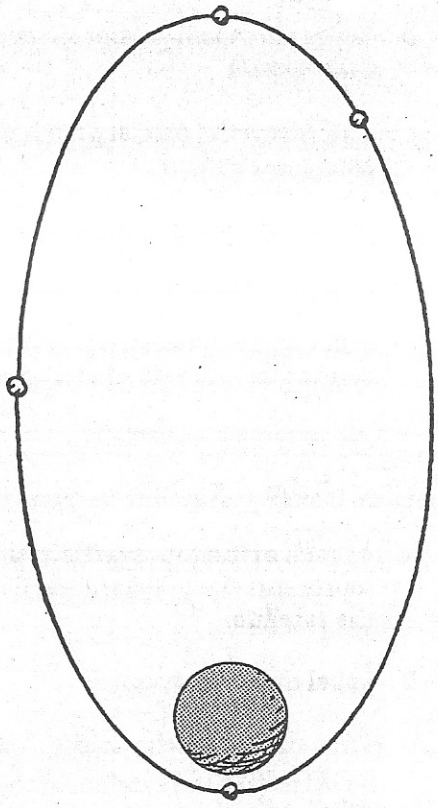

Figure C

Be very very careful when placing both velocity and force vectors on the same diagram. Not a good practice, for one may construct the resultant of the vectors -- ouch!

Hewitt Drew it!