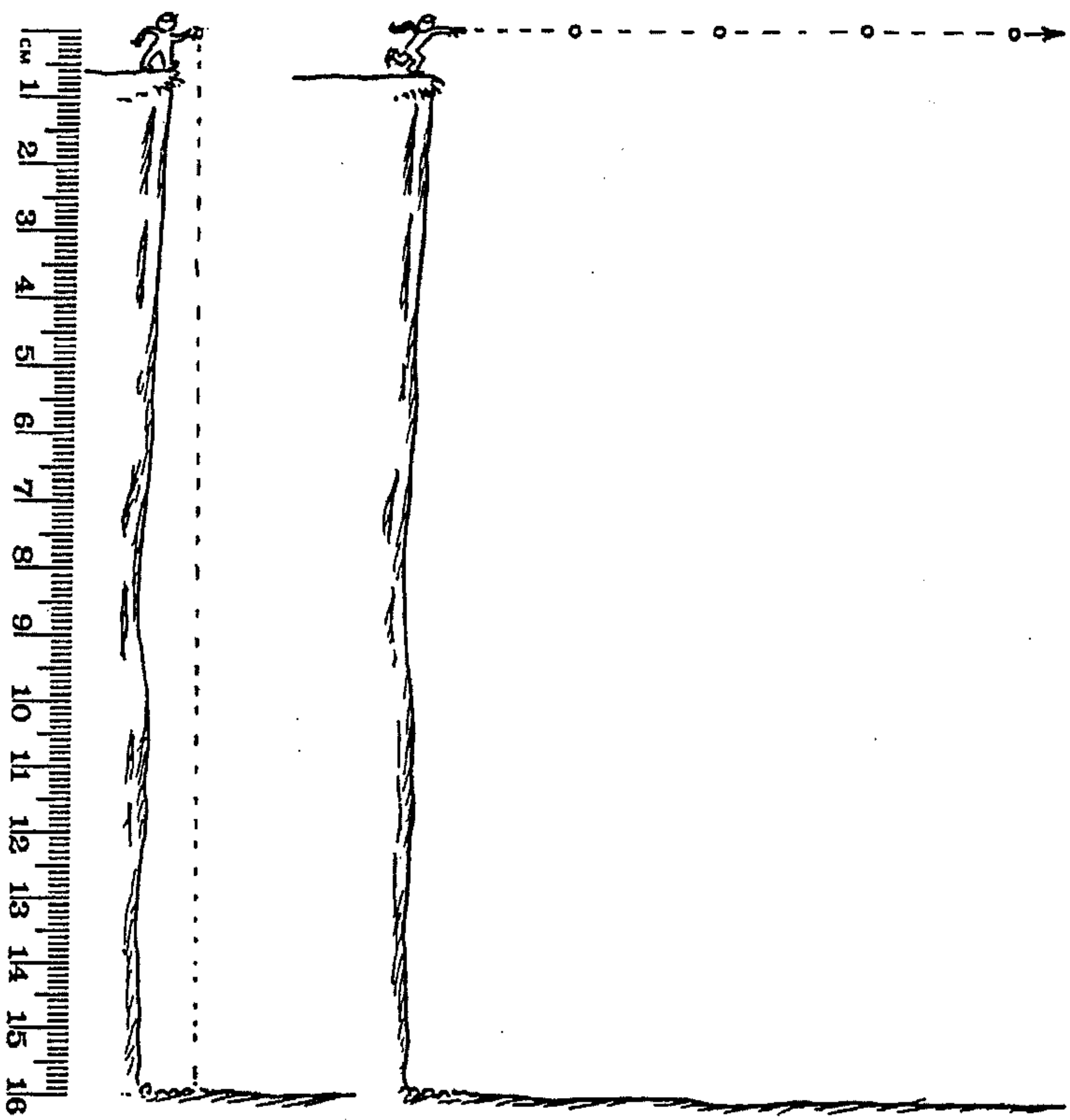
Name ____________________ Date ________

CONCEPTUAL **Physics** PRACTICE PAGE

Chapter 10 Projectile and Satellite Motion

Independence of Horizontal and Vertical Components of Motion



1. Above left: Use the scale 1 cm: 5 m and draw the positions of the dropped ball at 1-second intervals. Neglect air resistance and assume g = 10 m/s^2.
   Estimate the number of seconds the ball is in the air. _______ seconds

2. Above right: The four positions of the thrown ball with *no gravity* are at 1-second intervals. At 1 cm: 5 m, carefully draw the positions of the ball *with* gravity. Neglect air resistance and assume g = 10 m/s^2. Connect your positions with a smooth curve to show the path of the ball. How is the motion in the vertical direction affected by motion in the horizontal direction?

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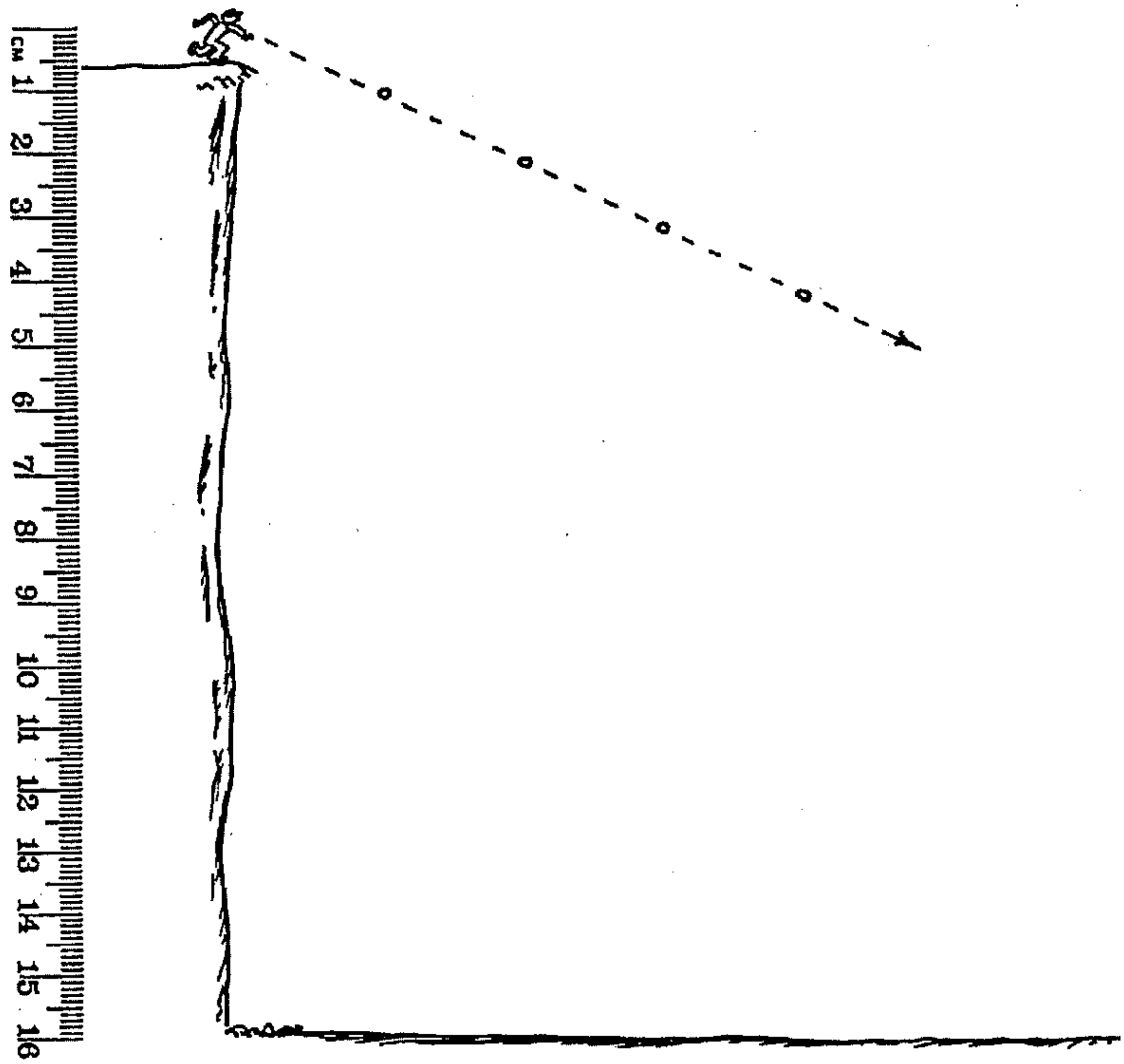
Hewitt Drew it!

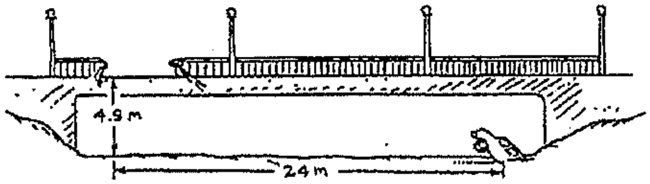
Chapter 10 Projectile and Satellite Motion

Independence of Horizontal and Vertical Components of Motion*—continued*



3. This time the ball is thrown below the horizontal. Use the same scale 1 cm: 5 m and carefully draw the positions of the ball as it falls beneath the dashed line. Connect your positions with a smooth curve. Estimate the number of seconds the ball remains in the air. _______ seconds

4. Suppose that you are an accident investigator on site to determine whether or not a car was speeding before it crashed through the rail of the bridge and into the mudbank as shown. The speed limit on the bridge is 55 mph = 24 m/s. What is your conclusion? ______________________



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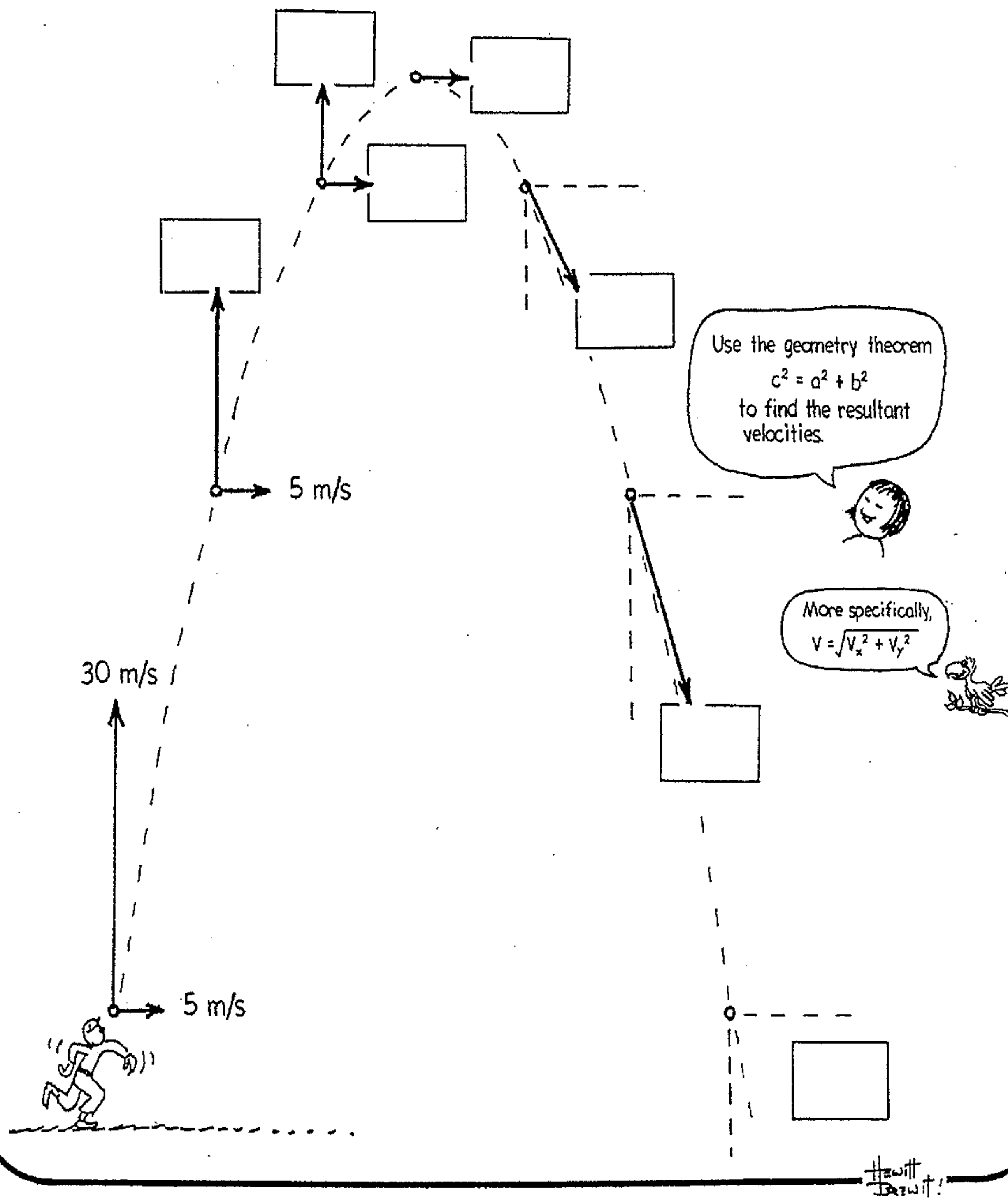
Name ______________________________ Date __________

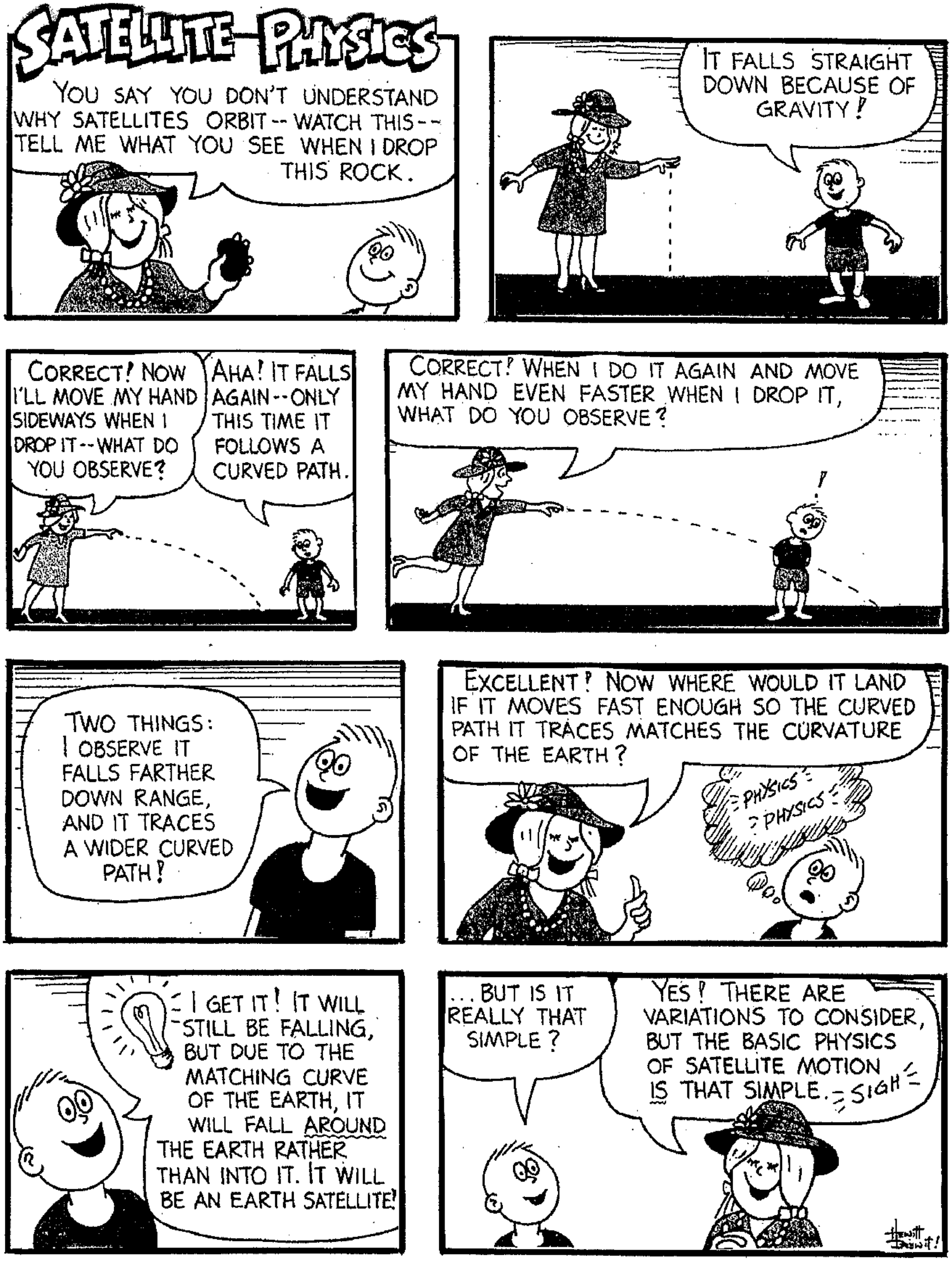
CONCEPTUAL **Physics** PRACTICE PAGE

Chapter 10 Projectile and Satellite Motion
Tossed Ball

A ball tossed upward has initial velocity components 30 m/s vertical and 5 m/s horizontal. The position of the ball is shown at 1-second intervals. Air resistance is negligible and $g = 10\ m/s^2$. Write the values in the boxes for ascending velocity *components* and your calculated *resultant* descending velocities.



CONCEPTUAL **Physics** PRACTICE PAGE



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Name ______________________________ Date __________

CONCEPTUAL Physics PRACTICE PAGE

Chapter 10 Projectile and Satellite Motion
Satellite in Circular Orbit

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.

   a. Draw a likely path that 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. 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 9 km/s?

   ____

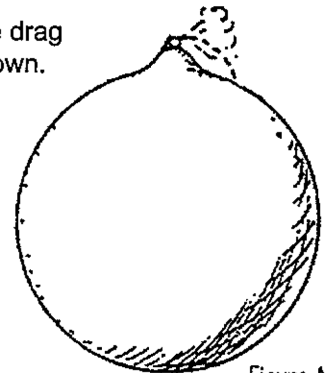

Figure A

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. 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? ______________

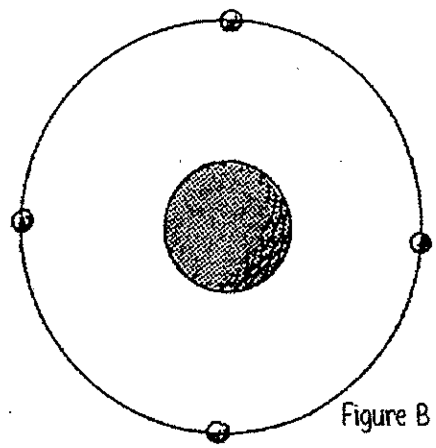

Figure B

Hewitt Drew it!

Chapter 10 Projectile and Satellite Motion
Satellite in Elliptical Orbit

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 greater 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 of KE + PE along the orbit?

   ____

   ____

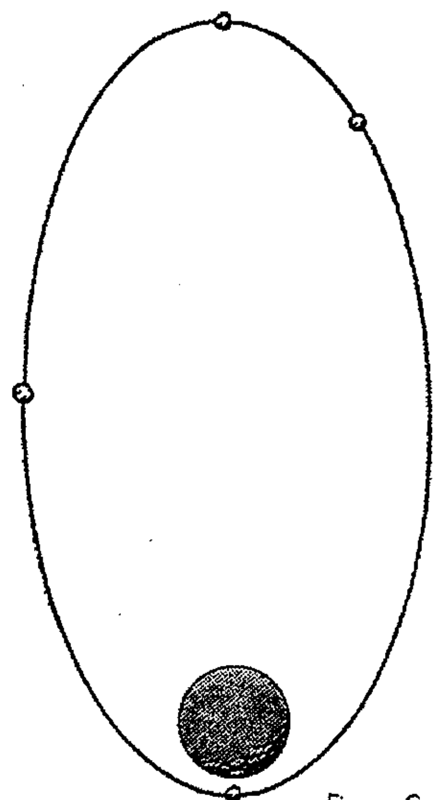

Figure C