Name: _____ Period:_____ Date:_____

Unit VIII Worksheet 1A

From our whiteboarding session we found a few relationships that explain how the centripetal force is effected by radius, mass, and velocity. We found:

$F \alpha m$ $F \alpha v^2$ and $F \alpha 1/r$

We even brought these three individual relationships together to form the basic model that we will use for this unit:

$$F = \frac{mv^2}{r}$$

For this worksheet you will need to these relationships to answer the following questions qualitatively and quantitatively.

1. The figure below shows a satellite in circular orbit.
    a. At each of the four positions draw an arrow that represents the gravitational force exerted on the satellite.
    b. Label the force as F
    c. Then draw, at each of the four positions, an arrow to represent the velocity of the satellite at that position, and label it V.
    d. Are all four Force arrows the same length? Why or why not

    e. Are all four Velocity arrows the same length?
        i. or why not?

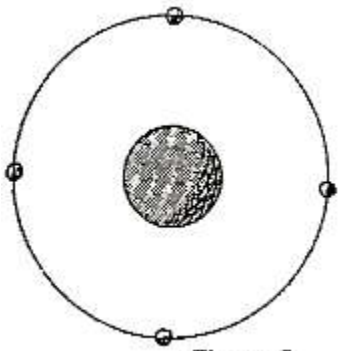
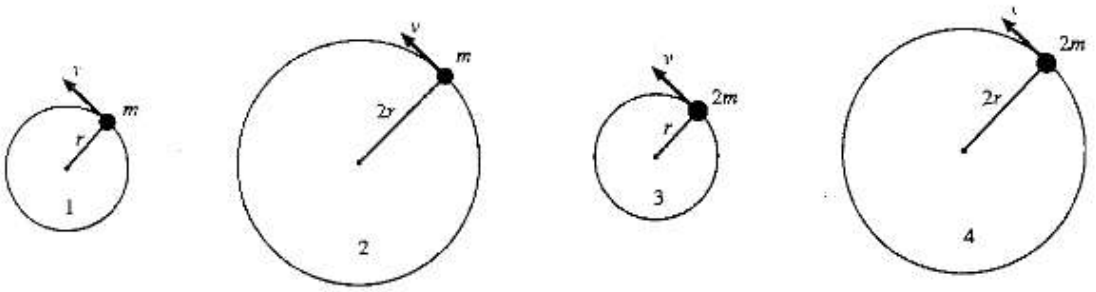


Figure B

    f. Usually objects in space follow elliptical orbits (elliptical orbits look similar to ovals), how do you think the velocity and Force arrows might change with a satellite moving in an elliptical orbit?

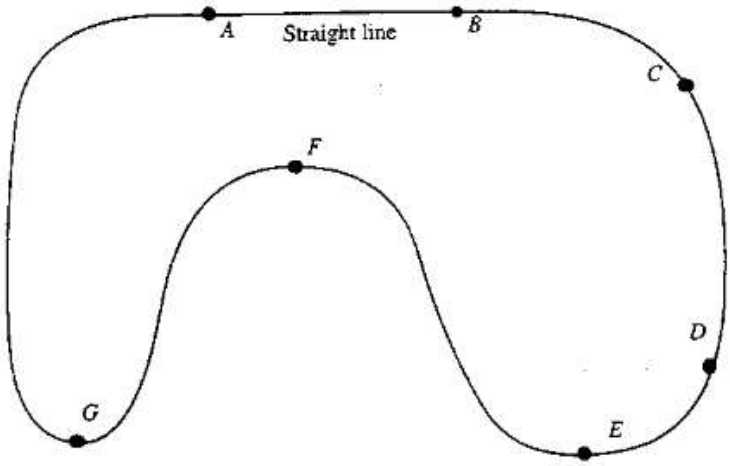
2. The figures are a birds eye view of particles moving in horizontal circles on a table top. All are moving at the same speed. Rank in order from largest to smallest the $F_{string \rightarrow ball}$



Ranking: largest ____ _____ _____ _____ smallest

Explanation:

3. A car travels clockwise once around the track shown below. Starting from rest at point A, the car speeds up at a constant rate until it reaches point B. After point B it is travelling at a constant speed and continues at this constant speed along the entire track. On the diagram below, draw velocity arrows for each of the points A-G. Be sure that the directions of the arrows are consistent with how the car is moving



4. On the same diagram, draw force arrows for each of the points A-G. If the acceleration is zero at any point(s) indicate that explicitly. (Remember, the radius of the track changes for most of the points)

5. A 615kg racing car completes one lap in 14.3 seconds around a circular track with a radius of 50.0 m. The car moves at a constant speed.
    a. What is the circumference of the track? (314m)

    b. What is the car's speed? (22.0m/s)

    c. What is the magnitude of the acceleration of the car?($9.68 m/s^2$)

    d. What is the force that the road exerts on the tires towards the center of the tack? (5953N)

6. How much force does the sun exert on the Earth to keep it moving in its orbit? (Hint: first find the circumference, then the speed, then the force using our relationship) (3.9×10^{22}N)
   Mass of the Earth: 6.0×10^{24} kg
   Distance from the earth to the sun (approximate radius): 1.5×10^{11} m
   Time to make one complete revolution: 1 year or 3.0×10^{7} s

7. A ball swings in a **vertical** circle on a string. During one revolution, a very sharp knife is used to cut the string at the instant when the ball is at its lowest point. Sketch the subsequent trajectory of the ball until it hits the ground.