**Gravity Well Simulation: Distance Learning**

**Phenomena/Observations to be Explained:** How the speed of objects change as they move closer together. Why ellipses are the common shape of satellites. Why the speed at the perihelion and aphelion are different.

**Essential Questions/Focus Questions**

How do objects move as they travel in an orbit? What is flawed about the simulator? What is correct?

**Part A.**

In a perfect world, you and 7 other students would be standing in front of our gravity well and placing the masses and rolling balls for yourself. I must admit, it is amazingly satisfying. Alas, we can not. Watch [the video](https://www.youtube.com/watch?v=MTY1Kje0yLg) and look for the specific instances that are described below. Fill in your answers and your observations on a copy of this document. This will go on Page #28 of the VIANB. Place both a link and the screen shots of the document.

1. Place a large 1 kg mass in the center of the simulator.
2. Attempt to roll a ball into “orbit” around the well, this should take a few tries. Try changing the eccentricity of the orbit, observe the different speeds in the orbit.
3. Roll lots of balls at once in opposite directions, observe the outcomes. Does this explain why all the planets go around the sun the same way? (Counter-clockwise from above the north pole)

<Yes, this does explain why all the planets go one way around the sun because the distance form have a slight preference of one way over the other and the ones going the wrong way were eliminated.>

1. Place a second 1 kg mass in the well, see if the two masses will attract each other. Will they orbit each other?

<No they will not because they are the same mass with the same amount of force.>

1. Replace the two masses farther apart, can you make one ball travel around both masses? In terms of space and gravity, what does the raised area in between the masses represent?

<Yes you can make a ball orbit both and the raised are represents a area of space with no pull. >

1. Why do the balls eventually all spiral into the central mass? What causes this to happen? Why does this not happen to our planets?

<This happens because they lose energy but in space with the planets that doesn't happen.>

**Student observations/Findings:**

| <type your answer here> or make observations on a separate piece of paper and put of picture of those observations in the box…. I’m not particular, but make it happen!  **Matter bends space and warps space time so when there are 2 objects of madder they are attracted to each other**  **Space time and objects are not feeling a force of gravity they are just following the natural curvature**  **Bigger the object the more the space time continue warps**  **As the balls move towards each other the closer they are the faster they travel and vice versa when they are further apart.**  **Objects are always attracted the the other mass even if it's only a small amount and this includes the bigger mass it also moves (every action has an equal and opposite reaction) -this brought this to mind**  **The orbit is not a straight circle but is more like an oval and it speeds up as it gets closer to the bigger mass.**  **They will all end up going the same way**  **Free return trajectory shows how we sent objects (satellites) around the mood and were able to get it back. It makes a figure eight type shape**    **Questions:**  **Why does a smaller ball end up orbiting the other small mass instead of the overall larger mass.**  **How small must a small mass be to orbit another small mass istead**  **Why does a mass continue to travel when its at its closest to the large mass instead of going straight towards it and being destroyed**  **If there are two big masses that a really similar in size but not exactly will they eventually collide with each other**  **In space what happens to the object that are going in the opposite direction and what happens when they collide** |
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**Analysis/Conclusions**

1. How does the speed of the ball change as it moves closer to the large mass? What is causing this **change in speed?**

<The closer the ball is to the larger mass the more or stronger the area that the space is being warped around it is so it has a stronger pull and it more attracted to it which makes it go faster in comparison when its at a further distance the force is much weaker so it doesn't feel as much of an attraction/pull>

1. How does the change in the shape of the sheet represent the change in gravity as you move nearer to the well?

<The change is the steepness of the mass represents how the the closer you are to a large mass the more the fabric of space time is being pulled and affected. >

1. How could this simulation help when considering how low-earth orbit satellites move?

<This could help when we want to know when the satellites are the closest to the earth and the earth's atmosphere ( to keep it for getting damaged) and to tell when it is closest to the moon and how fast it moves while taking pictures or doing any other functions such as allowing communication, ex. It also helps us track it so we don't loose it in space.>

1. How do you think the orbits change if the central mass used was much larger?

<If the central mass used was much larger the orbits would overal get wider but the smaller masses would also get much closer to the mass and if the other masses did not gain enough momentum they would be attracted to the central mass too greatly and be destroyed/ brought into the center. The overall parabola shape would be much more pronounced and the U would be steeper. >