Name\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Period \_\_\_\_\_\_\_\_\_\_\_\_\_ Date \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_



**Lesson 4: Advanced Ball Drop**

Any object that has mass exerts a gravitational force; the larger the mass, the greater the force of attraction. Objects placed near a large mass undergo acceleration, which is called gravitational acceleration (*g*). Can you pull off an experiment to determine the value of “*g*” on various astronomical objects?

**Doing the Science**

1. Start the Space Gravity Simulation by clicking on the “Sim” tab.

2. Note and record in Table 1 the ten-letter Location code.

3. Click on the Drop Button located below the blue ball in the right-hand part of the screen.

4. Note and record in Table 1 the length of time the ball took to drop and the distance the ball fell.

5. Calculate the *g* value for this location. Record your calculated *g* value in Table 1.

6. Choose a Rocket Fuel and Launch your rocket. When you arrive at a new location, repeat steps 2 - 5 for the new location. Make sure to enter your data into Table 1. Repeat this step until you have data for 5 different space locations.

**Table 1.**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Trial** | **Location ID** | **Time (s)** | **Distance (m)** | ***g* value (m/s2)** |
| 1 |  |  |  |  |
| 2 |  |  |  |  |
| 3 |  |  |  |  |
| 4 |  |  |  |  |
| 5 |  |  |  |  |

**Do You Understand?**

1. Which space location of the five you investigated had the largest *g* value (Trial 1 – 5)?

2. If a new space location had a *g* value larger than your answer to *question #1*, would the ball take a longer or a shorter time to fall 5 meters when dropped? Please explain your response.

3. Which space location of the five you investigated had the smallest *g* value (Trial 1 – 5)?

You must show your calculations (including unit cancellation) for the following questions. Assume free fall conditions for all motion.

4a. For the space location you specified in *question #3*, what would be the instantaneous speed of an object that was dropped and fell for 14.6 seconds?

4bi. For the space location you specified in *question #3*, if an object was dropped and fell a distance of 164 meters, how long (in seconds) did the object take to fall this distance?

4bii. What was the instantaneous speed of the object after it fell the 164 meters?

5. For the space location you specified in *question #1*, what would be the average speed of an object that was dropped from a height between the time interval of 8 seconds to 9 seconds after the object was dropped?