**Lunar Lander**

**I. Introduction**

 The Solar System is full many objects that are bound by the universal force of gravity. The balance that exists with gravity is based on object masses and distances between objects. If an objects mass increases, the gravitational pull of the object increases. If the distance between two objects increases, then the gravitational pull is weakened. Any change in the gravitational balance of the Solar System can produce drastic, devastating effects.

 In this activity, you will explore the effects of gravity on spacecraft & planets.

**II. Procedure**

 1. Go to the following website :

 <https://phet.colorado.edu/en/simulation/legacy/lunar-lander> .

 2. Choose the application labeled **Lunar Lander**.

 3. Click on “Run Now!”. Then open the JNLP file.

 4. Review the controls and click on Start.

 5. Using the controls, try to land the spacecraft with a soft landing.

**III. Data**

 1. What happened the first five times you tried to land the spacecraft, and explain why.

 Trial 1 : \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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 Trial 2 : \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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 Trial 3 : \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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 Trial 4 : \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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 Trial 5 : \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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 7. How many times did it take for you to successfully land the spacecraft?

 \_\_\_\_\_\_\_\_\_\_\_\_\_\_ times

**IV. Analysis & Conclusions**

 **1. Describe what you had to do to get the Lunar Lander to land softly.**

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 **2. What happens if you give the Lander too much thrust?**

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 **3. What happens if you give it too little thrust?**

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 **4. Describe the sequence of maneuvers that you must execute to get the Lander to move**

 **sideways and then carry out a soft landing that is nice and vertical.**

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 **5. What color is the thrust vector and what color is the velocity vector? How can you tell?**

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 **6. When landing, is it better to let the Lander fall most of the way and then turn on the**

 **thrusters to maximum to get it to slow down? Or is it better to have the thrusters on low**

 **the whole time to keep the velocity from building up to much? Explain.**

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