

Simulated Gravitational Interaction Lab

The English scientist Isaac Newton realized that gravity acts everywhere in the universe, not just on Earth. The gravitational acceleration on the surface of each of the planets varies, depending on the mass and radius of the planet. Astronauts on the moon bounded across the surface, due to the weaker gravity, but the strength of gravity on other planets would be so strong that an astronaut couldn't even walk at all. In this activity, you will calculate and compare the gravitational acceleration on several different planets.

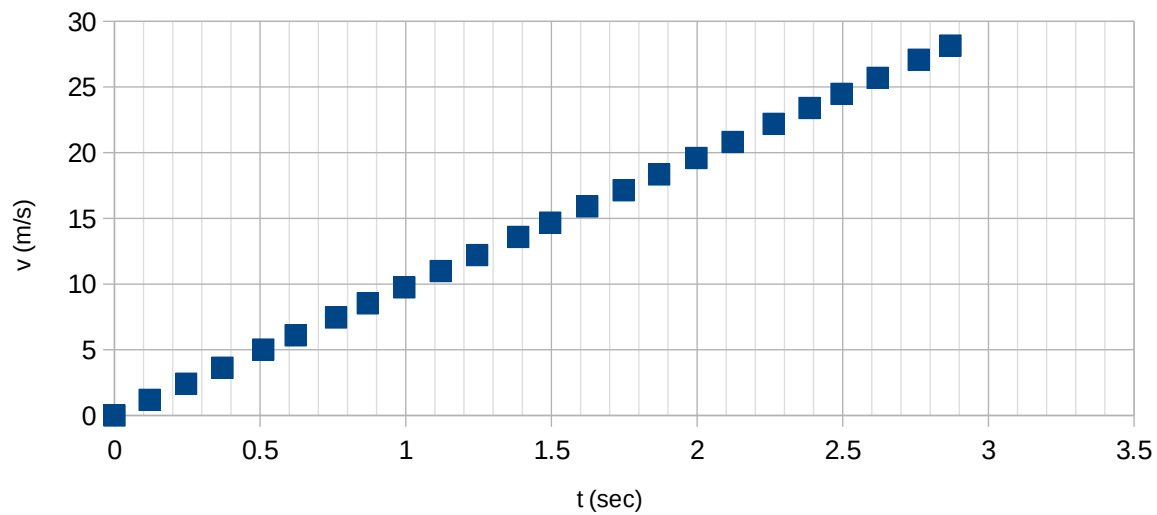
Procedure

1. Start Virtual Physics and select Gravitational Interactions from the list of assignments. The lab will open in the Mechanics laboratory.
2. The laboratory will be set up with a ball at the top of the experiment window, 40 m above the surface. This is about as high as a twelve-story building. Gravity, which is set the same as on Earth, will pull the ball downward. You will observe how long it takes the ball to fall to the ground. The mass of the ball is 1 kg.
3. Click on the red Recording button to start recording data. Start the experiment by clicking on the Start button and observe what happens. The experiment will stop when the ball reaches the bottom of the screen. A link will be generated in the Lab Book. This contains the velocity versus time data for the falling ball. Click next to the link and label it as Earth.
4. Click the Reset button to reset the experiment. Use the Gravity tab in the Parameters Palette to select the strength of gravity of a different planet. Repeat Step 3 to record the velocity of the ball as it falls. Do this on four different planets or moons. Try a big planet such as Jupiter and a small heavenly body such as Earth's moon.

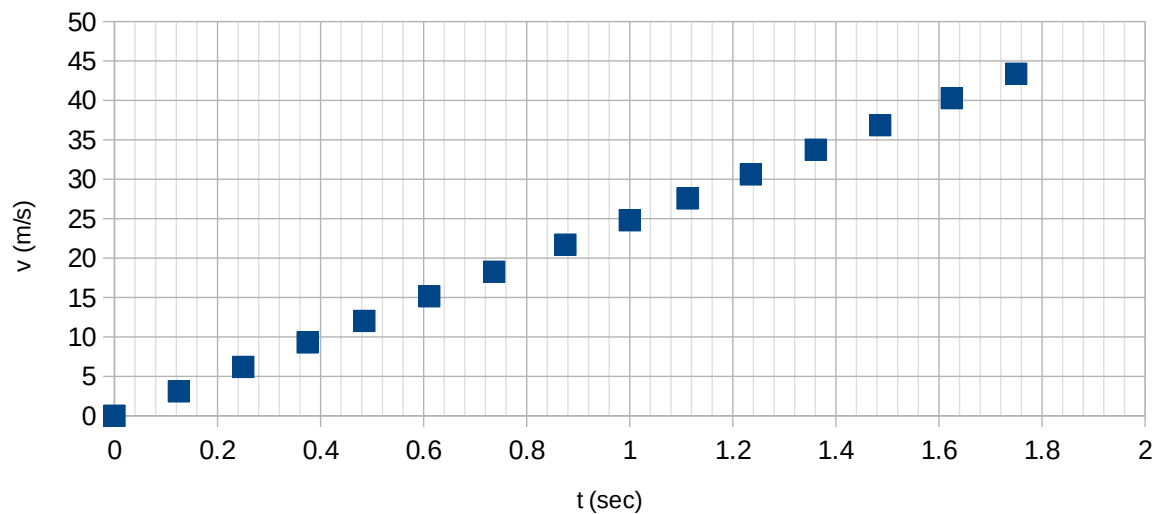
Questions & Data Analysis

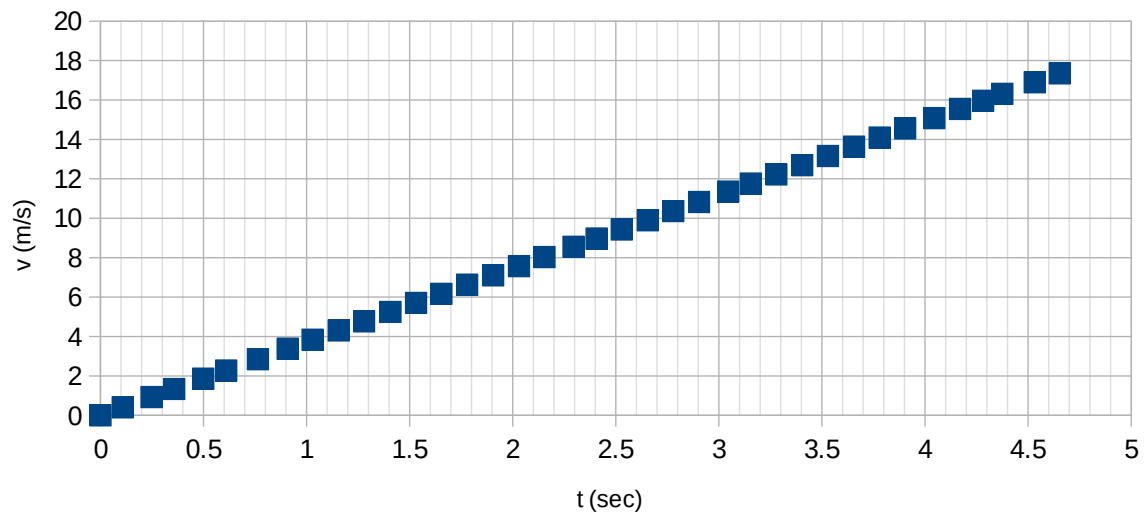
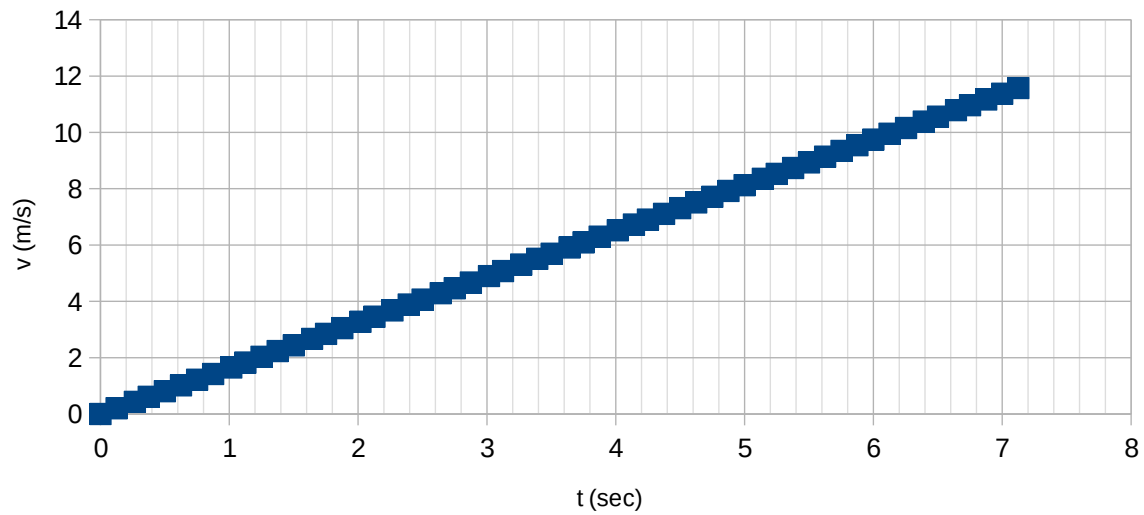
1. Plot the velocity versus time graph for each of the planets or moons the ball was dropped on. Make sure the plots have the appropriate titles and units and paste them below.

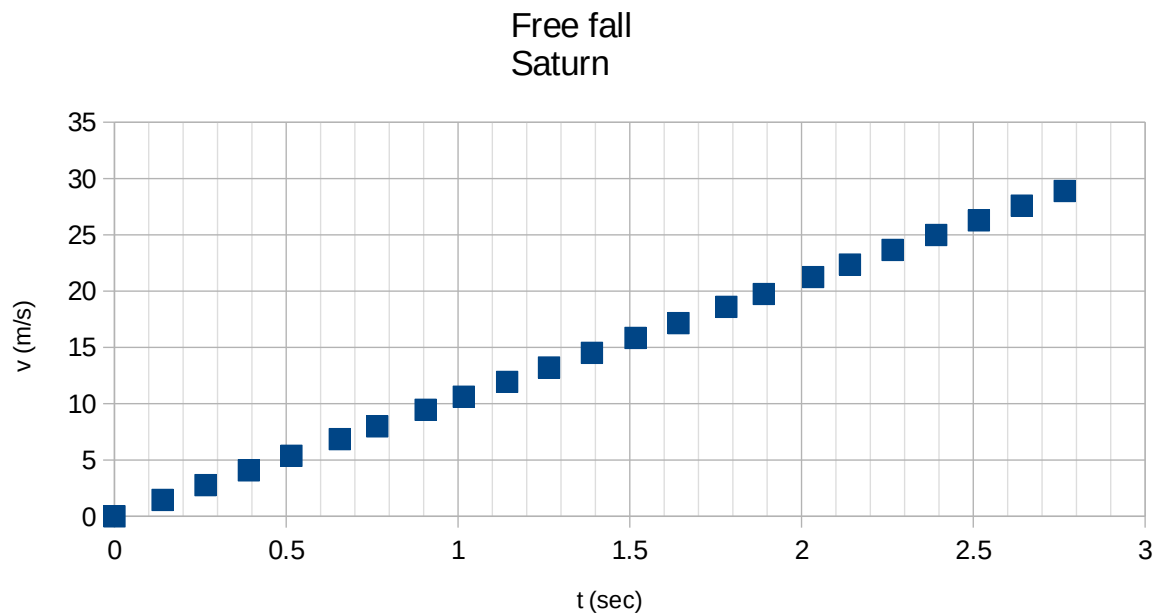
Free fall
Earth



Free fall
Jupiter



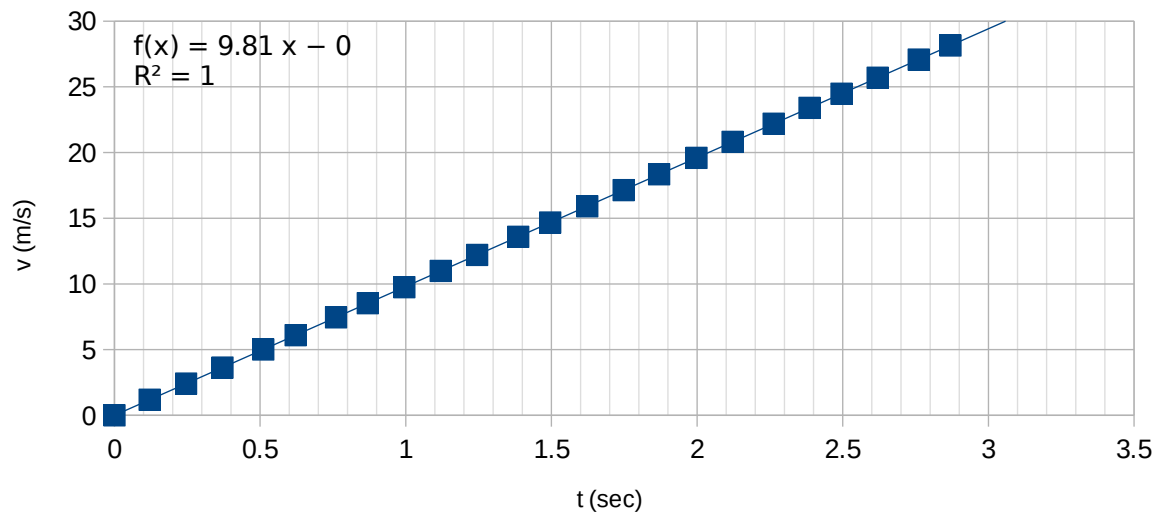
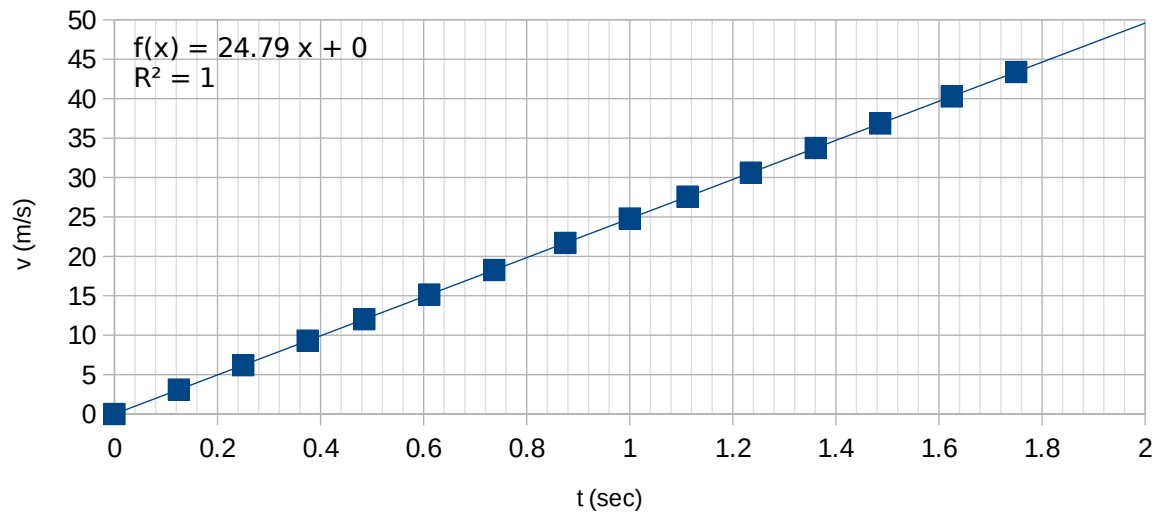
Free fall
MarsFree fall
Moon

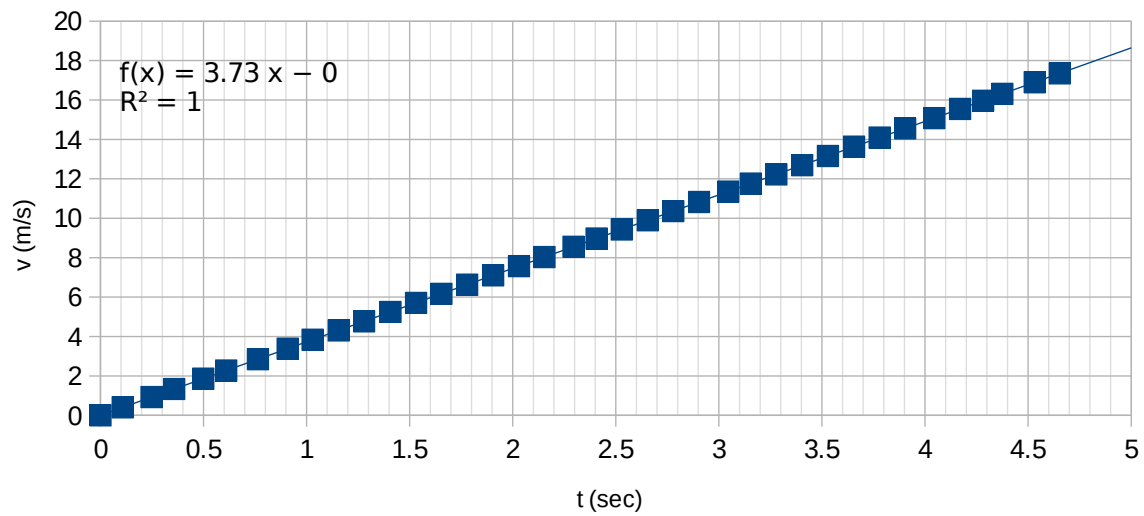
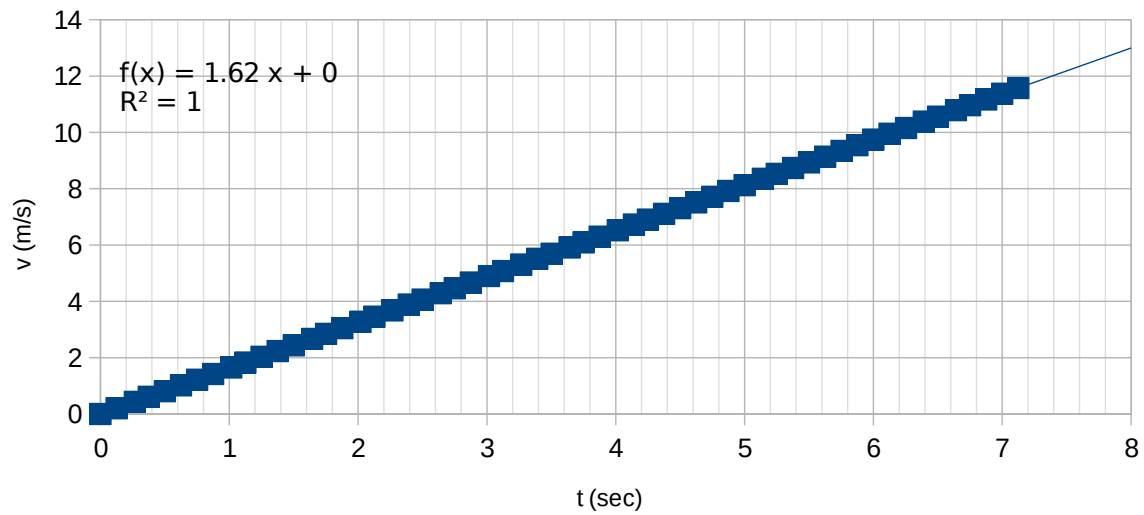


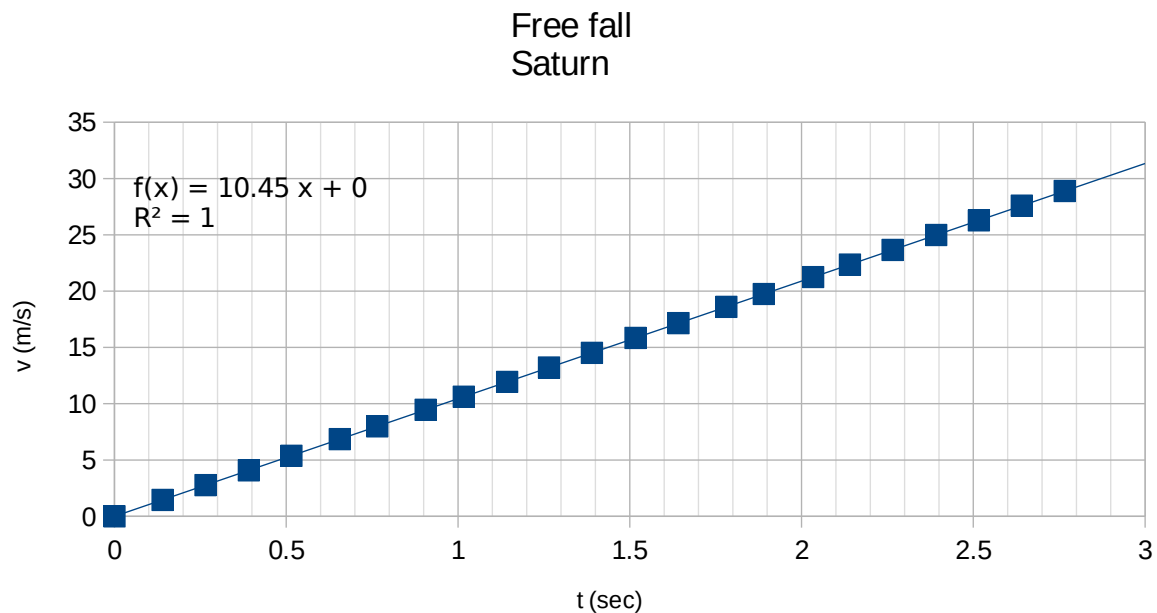
2. What is the trend of the data plotted in each of the graphs (linear, quadratic, exponential, etc.)? What does this imply about the acceleration?

Linear, this indicated that the acceleration is constant on a given planet/moon.

3. Fit each of the graphs plotted in step 1 to the appropriate equation which is determined from your answer of step 1. Make the graphs have the appropriate trendlines, R-squared value, units, and titles. Paste the graphs below.

Free fall
EarthFree fall
Jupiter

Free fall
MarsFree fall
Moon



4. Which kinematic equation does your choice of fit equation correspond to?

The fit corresponds to the following equation:

$$v_f = v_i + at$$

5. What is the acceleration due to gravity on each of the planets or moons you conducted your experiment on? Does this agree with values that you can look up on the internet?

	Earth	Jupiter	Mars	Moon	Saturn
Experimental	9.807	24.792	3.728	1.625	10.445
gravitational acceleration (m/s ²)					
Expected	9.807	24.79	3.711	1.62	10.44
gravitational acceleration (m/s ²)					
Agrees?	Yes	Yes	Yes	Yes	Yes