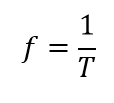
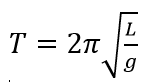
Physics Period Date Name

**Unit 6 | Simple Harmonic Motion | Pendulum Simulation**

**Background**: The time a pendulum takes to swing back and forth (*one cycle*) is referred to as one ***period***. The period of a pendulum is measured in seconds and is given by the formula shown to the right. The inverse of period is ***frequency***, the number of complete cycles each second. The ***equilibrium*** *position* is the point below the pivot, at a neutral position. The ***amplitude*** of the pendulum’s swing is the displacement from the equilibrium. The top of each swing is referred to as ***maximum displacement*** or ***maximum amplitude***.

**Procedure**: Run simulation <https://phet.colorado.edu/sims/pendulum-lab/pendulum-lab_en.html>

For all answers, ***type your responses in a color other than black!***

\*Note: For the analysis below leave the friction slider at “none”

1. Using a 1.00 kg pendulum, adjust the length of the pendulum ***only*** and determine the period. Complete the table below:

**Mass (kg) Length (m) Period (s) Amplitude (deg) gravity**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 1.00 kg |  |  |  | Earth |
| 1.00 kg |  |  |  | Earth |
| 1.00 kg |  |  |  | Earth |
| 1.00 kg |  |  |  | Earth |

2. Repeat the investigation but adjust the mass of the pendulum ***only***, leaving all other variables constant.

**Mass (kg) Length (m) Period (s) Amplitude (deg) gravity**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |

3. Repeat the experiment, but adjust the gravity (location) ***only*** leaving all other variables constant.

**Mass (kg) Length (m) Period (s) Amplitude (deg) gravity**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  |  |  | *Moon* |
|  |  |  |  | *Earth* |
|  |  |  |  | *Jupiter* |
|  |  |  |  | *Planet X* |

**Velocity and Acceleration Vectors**

4. Turn on the velocity and acceleration vectors.

5. Observe the magnitudes and directions of the vectors as the pendulum moves.

6. The green vector represents and the yellow vector .

**Lab Questions and Calculations**

1. What force causes the pendulum to speed up on the way down and slow down on the way up?
2. As pendulum length increases, the period of harmonic motion *increases / decreases / remains the same*.
3. As pendulum mass increases, the period of harmonic motion *increases / decreases / remains the same*.
4. As gravity on the pendulum increases, the period of harmonic motion *increases / decreases / remains the same*.
5. A pendulum is at maximum velocity *at the equilibrium position / at maximum amplitude*.

Hint: Click on *Show Energy*

1. A pendulum is at minimum velocity *at the equilibrium position / at maximum amplitude*.
2. A pendulum is at maximum acceleration *at the equilibrium position / at maximum amplitude*.
3. A pendulum is at minimum acceleration *at the equilibrium position / at maximum amplitude*.
4. A pendulum has maximum PE (potential energy) *at the equilibrium position / at maximum amplitude*.
5. A pendulum has minimum KE (kinetic energy) *at the equilibrium position / at maximum amplitude*.
6. Create a method for calculating gravity based upon your observations in this lab. Use that method to calculate gravity for:

a) the moon:

b) Jupiter:

c) Planet X:

Explain your method.