Name_____ per____

Period and Frequency - due Monday 1/7

I can use visual and mathematical representations to model the properties of waves.

In this activity, we will be using a pendulum to model period and frequency. We can measure these properties in both waves and pendulums. They move in a very similar way. This is called *simple harmonic motion*.

Materials

- Pendulum structure - built using LEGO Engineering Kits
- 1 washer
- String
- Timer - use a phone
- Unit vocabulary

A. Pendulum construction - The pendulum has these basic parts:

1. Base structure - the base structure must be stable and free-standing. You can hold the base of the structure when the pendulum is swinging. The base structure should be at least 20 cm tall.
2. **The pivot** - the pivot is what the string is attached to. It must move freely on the rod at the top of your base structure. Make this out of LEGO and tie the string to it, not the bar across.
3. **The bob -** Your bob is is just a washer tied to the end of a string.
4. The pendulum is really just the length from the pivot to the center of the bob (washer). Make sure your first pendulum is at least 15 cm long.

B. Testing your pendulum

We want to make sure our pendulums work well, so our data is accurate.

- A pendulum that is too short will not create the correct momentum to keep it going.
- Friction at the pivot will slow it down.
- Stability is also important. We want to avoid pendulums that sway back and forth too much.

*To test, pull the bob back about 30 degrees. Make sure it will pass the equilibrium point at least 20 times

C. Data collection

1. Work together to collect data for the period of your pendulum
   1. MEASURE THE LENGTH OF YOUR PENDULUM FROM THE PIVOT TO THE CENTER OF THE BOB. *Measure length to the tenths (ex: 17.4 cm)*
   2. Pull back the bob (with one washer) to about 30 degrees.
   3. Time how long it takes for 10 periods (use a timer). A period is one complete cycle from where you let go. *Measure time to the hundredths (ex: 21.34 seconds)*
   4. Divide your number by 10 to get the time for 1 period. Record your data in the data table.
   5. Test 3 times and take the average
   6. To find the frequency of the pendulum: $Frequency = \frac{1}{Period\ (T)}$

Length of Pendulum (cm)	Period (T) Trial 1	Period (T) Trial 2	Period (T) Trial 3	Period (T) Average	Frequency

Properties of a pendulum (not required)

Compare the properties of a pendulum to the properties of a wave. Try to measure the amplitude of your pendulum.

Structure redesign (not required)

1. Redesign your structure to hang off a table on it's own with a pendulum attached. Lengthen the pendulum about 20 cm and collect data (2nd row on the table).

Clean-up (required)

1. Cut the string from the washer and the structure.
2. Take apart everything and return the pieces to the correct place in the kit.
3. Check the floor for pieces.

Analysis (required)

1. Why do you think we measured the time for 10 periods instead of just 1?

2. Explain how you helped your group accomplish the task.

3. Draw a basic pendulum. Label the middle point and the amplitude of the pendulum. This doesn't have to be correct, but give it a good thought before you answer.

Science and Engineering Practices

Highly Proficient (4)	Proficient (3)	Close to Proficient (2)	Developing (1)
Science Practices ❏ An effective pendulum is built by the group. ❏ Frequency is calculated correctly. ❏ Student is a productive member of the group.	Science Practices. ❏ Pendulum is mostly built. ❏ Data is collected. ❏ Lab is complete. ❏ Frequency is attempted.	Science Practices ❏ Pendulum is not attempted or mostly incomplete. ❏ Student is not a productive member of the group. ❏ Work is incomplete.	Science Practices ❏ No group data was collected. ❏ No evidence of project ❏ No participation