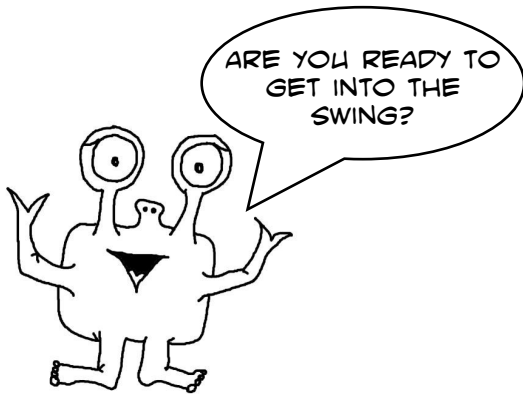


A Monster Sciences EXPERIMENT

FORCES

SWINGING PENDULUM



What you will need:

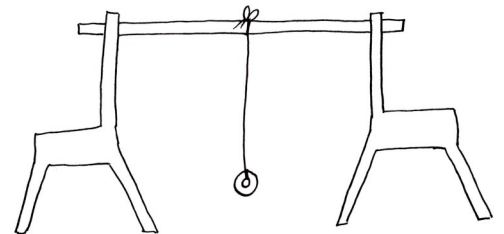
- String
- Weights—metal washers are ideal, but you can use anything you can tie onto the end of the string eg a small bag with marbles in it
- Long ruler or broom handle
- 2 chairs
- A stopwatch

What you will do:

- 1 Place 2 chairs back to back and put the ruler or broom handle between the chairs so that it is a reasonable height off the floor—you might need to put it on the top of the chair backs.
- 2 Tie the string around the weight leaving enough string to hang it from the ruler or broom so it hangs down close to the ground but can still swing freely.
- 3 Measure the string and make a note of it in your workbook.
- 4 Lift the weight to level with the broom handle, making sure the string is stretched out, and let it go—what does it do? Do it again and this time count how many swings it does in one minute. Write it down.
- 5 Change the length of the string by retying it to the broom handle. Measure it again and write it down and let it swing. Time how many swings it does it a minute. Write it down.
- 6 Try a few different lengths, remembering to measure the string each time and making notes of the string length and the number of swings in a minute.

What is going on?

You have made a pendulum and from physics we know that it will swing in a predictable arc. When you lift the bob and let it go gravity pulls it back toward Earth, but then it keeps swinging past the bottom of the arc (the closest part of the arc to Earth) because it has inertia. At a certain point gravity will pull it back again, then at the mid point of the arc inertia keeps it moving again, and so on. The time it takes for the pendulum to make a complete swing is called a period, and is affected by the length of the pendulum, the weight at the bottom and the angle of the starting point. How did changing the length of our pendulum affect the speed of the swing?



Monster Challenges:

- Try leaving the length of the pendulum the same and changing the weight. What do you think will happen?
- Research machines that use pendulums.

TEACHING NOTES:

Monster Sciences Experiment: Forces F07

Topic: Forces

Key Concepts:

- ◆ Properties of pendulums.

Resources:

- Investigation Record IR01– one copy per student
- Experiment Description Forces F07 – one copy per student
- 2 chairs, a long ruler or broom handle, string, Weights—metal washers are ideal, but you can use anything you can tie onto the end of the string eg a small bag with marbles in it, measuring tapes

Lesson Notes:

Remind students to listen carefully to instructions, and to OBSERVE their experiment.

As a class discuss the experiment prior to undertaking it, and students should complete the sections of their Investigation Report IR01 from "Title to "Hypothesis".

Students need to be reminded to measure carefully—both the length of the string and the number of swings in a minute, and record them carefully so that they can draw conclusions at the end of the experiment.

I recommend teaching the students some of the key terms for pendulums:

Pendulum—in this case the string

Bob—the weight on the end of the string

Angle—how high the bob is lifted to start the string

Arc—the path the bob will travel

Period—the time it takes for the bob to complete one arc.

What should happen in this experiment, and why?

A pendulum is particularly cool because it conserves energy—when it is dropped it has potential energy, but as it gains speed it converts to kinetic energy. It will only stop because friction from the air will make each swing slightly lower than the swing before so it will slowly come to a stop.

Longer pendulums will take longer to complete a swing, so therefore there will be fewer swings in a minute than for a shorter pendulum.

Follow up discussion questions:

- Does anyone know of a use for pendulums?
- What would happen if we were to set a pendulum going in space? (nothing—no gravity to pull on the bob),
- What would happen if we could eliminate the air from around the pendulum (it would swing forever because there would be no friction to stop it)
- Can you think of any toys that use a pendulum (eg swings)