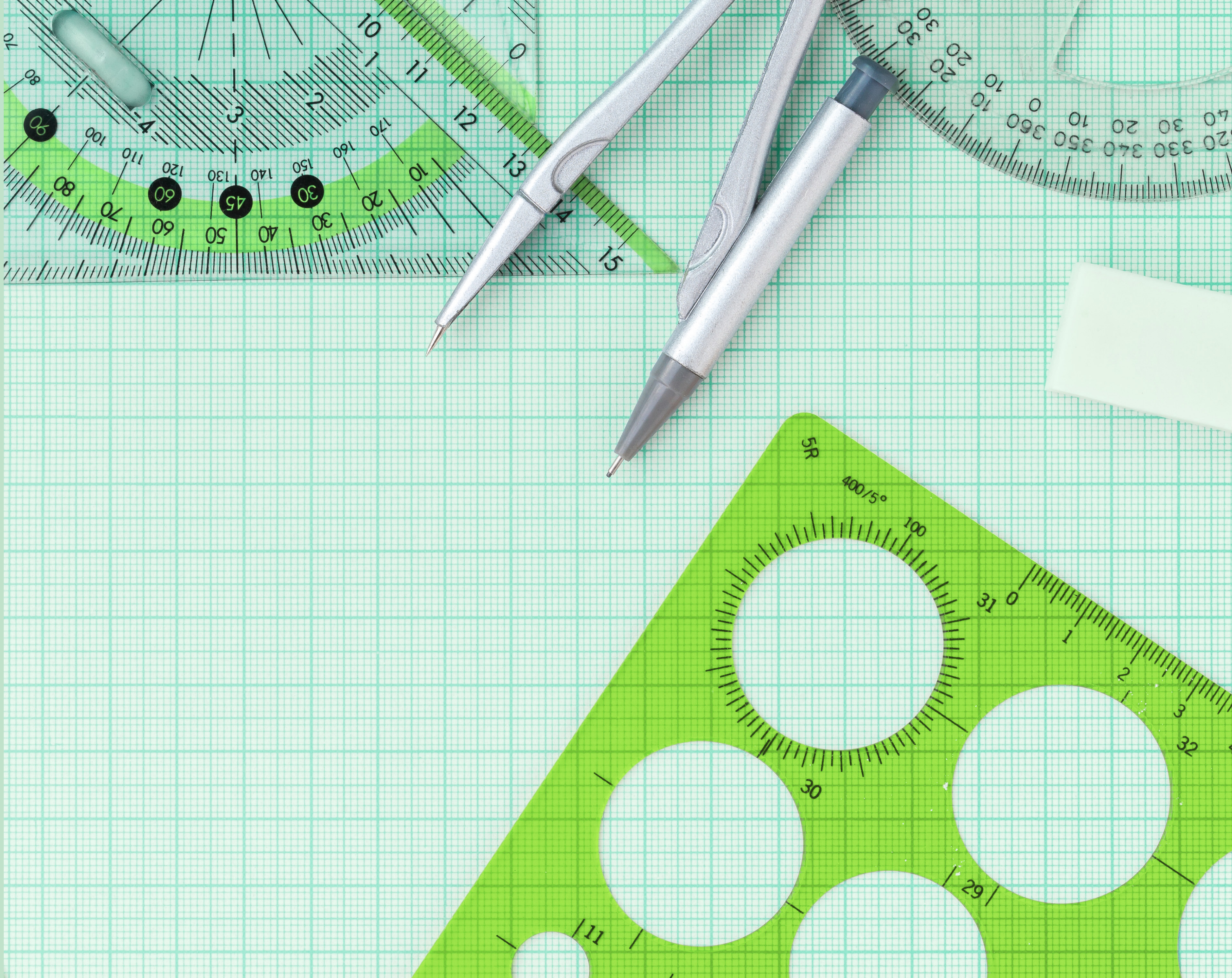


SCIENCE DESIGN: PENDULUMS



PENDULUMS

CONTENT

KEY CONCEPTS
SCIENCE DESIGN
MATERIALS
PRINTABLE PROTRACTOR
IDENTIFY VARIABLES
PREDICT

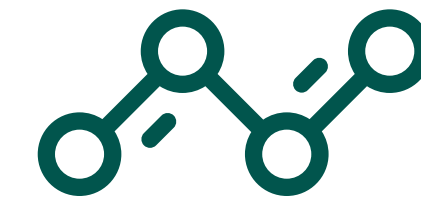
INVESTIGATE AND OBSERVE
MY SCIENCE JOURNAL
EXPLAIN AND SHARE
MATH EXTENSION
PHYSICS EXTENSION
NEXT GENERATION SCIENCE STANDARDS

KEY CONCEPTS

SCIENCE DESIGN: WORKING AS A SCIENTIST



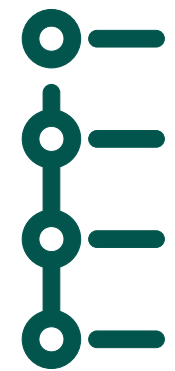
Scientific Investigation: The process scientists use to answer questions about the world around us.



Data: Facts or information gathered and used in a scientific investigation.



Evidence: Something that shows something else exists or is true.



Variable: Something in an experiment that can be measured or changed to answer a big question.

PENDULUMS

KEY CONCEPTS

KEY CONCEPTS

Pendulum: A weight hung from a point to swing freely back and forth under the action of gravity.

Bob: The weight at the end of the pendulum.

Mass: The amount of matter contained in an object.

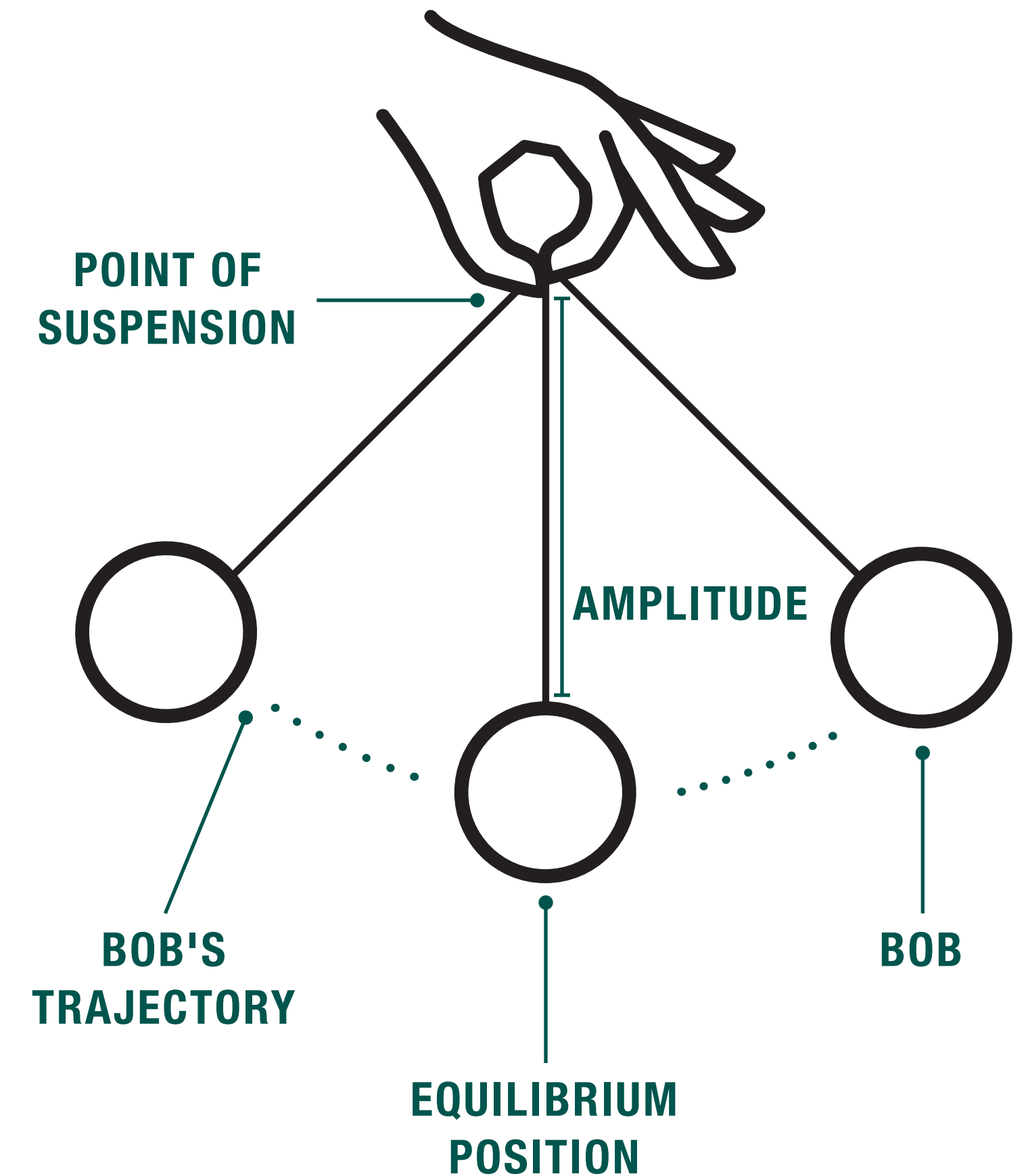
Force: A push or pull on an object.

Gravity: The force that pulls objects in the direction of the center of the earth.

Trajectory: The path a moving object follows.

Motion: The act of changing place or position.

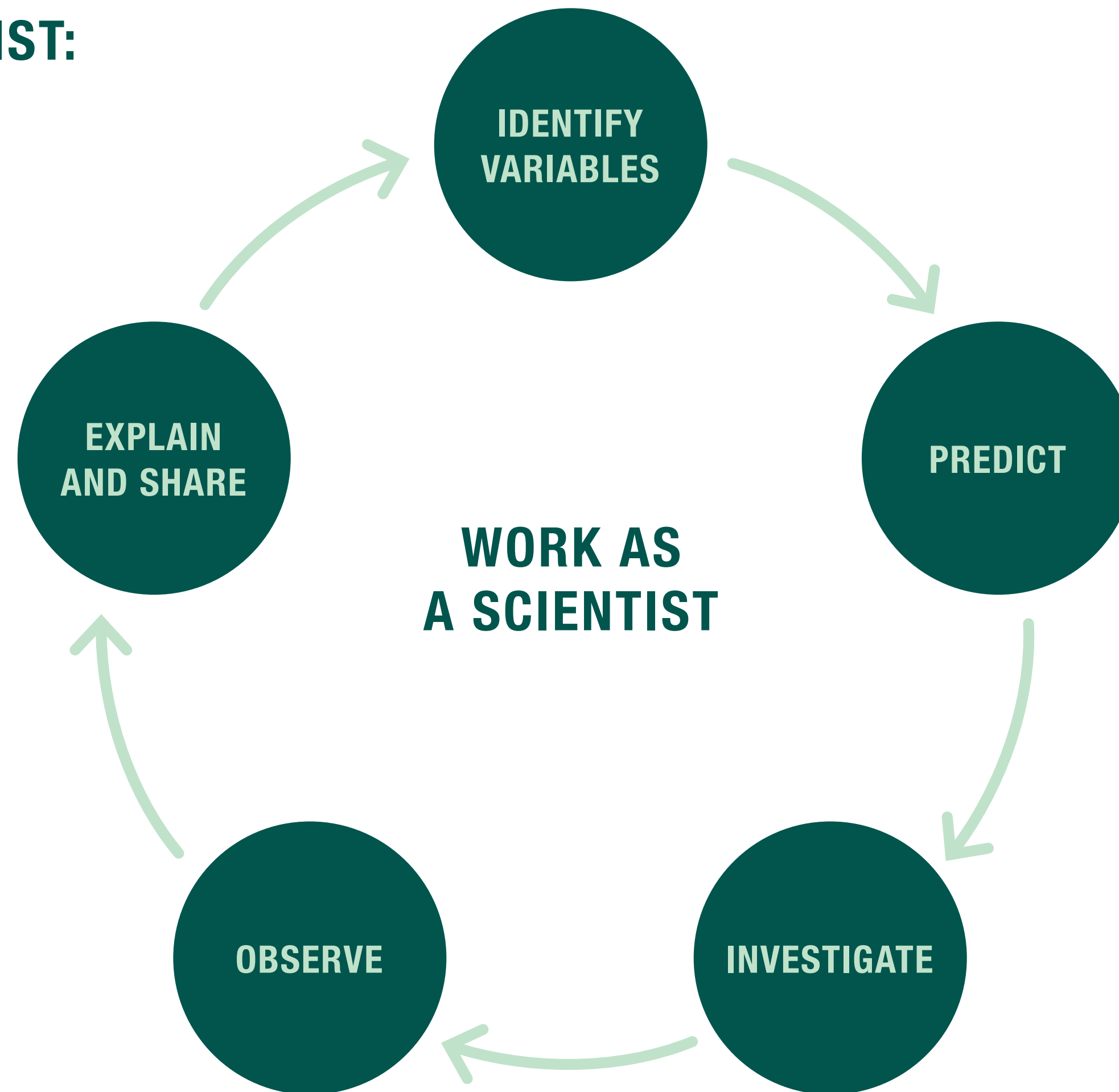
Period: Period of a pendulum is the completion of a swing left and a swing right.



PENDULUMS

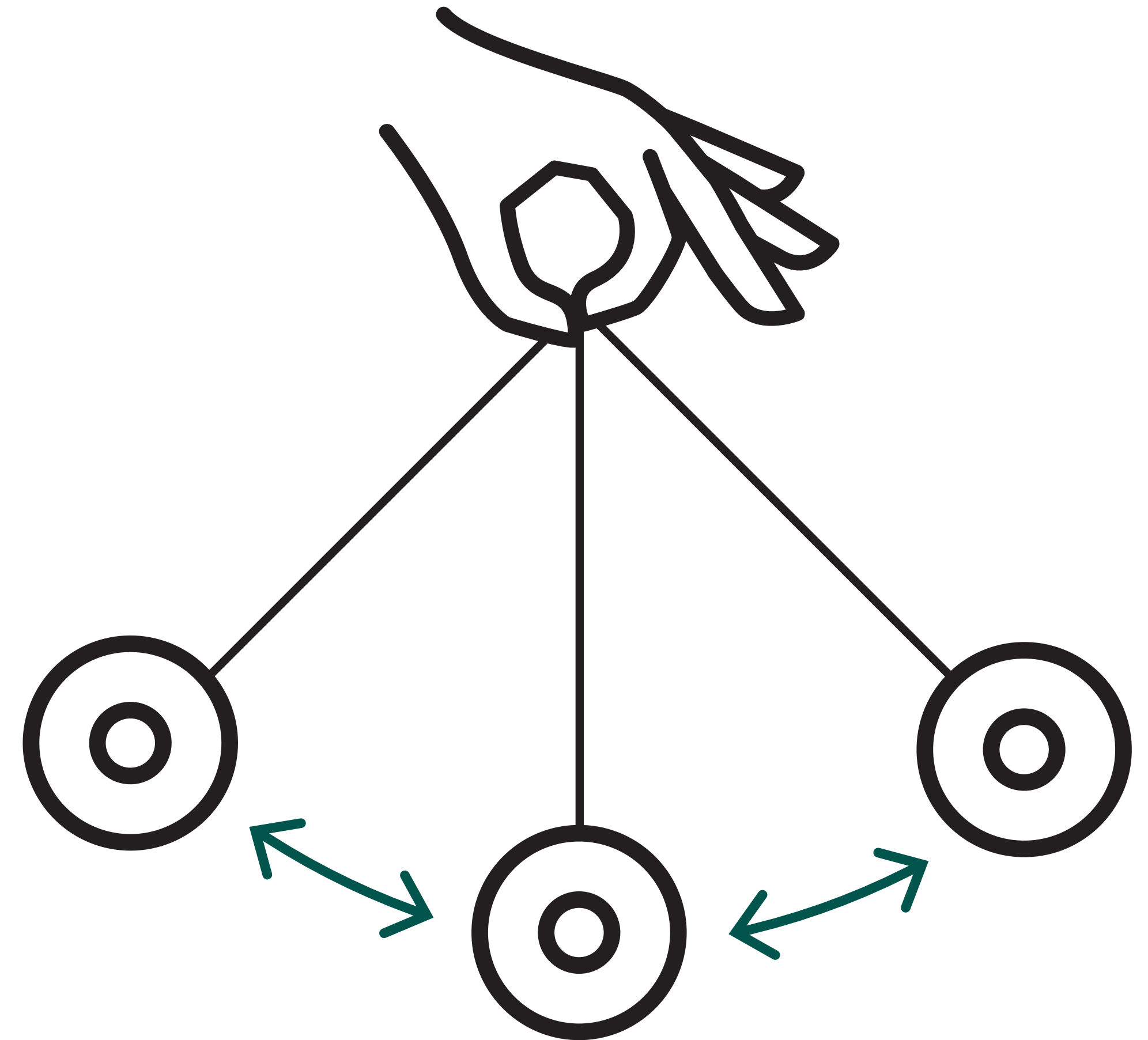
SCIENCE DESIGN

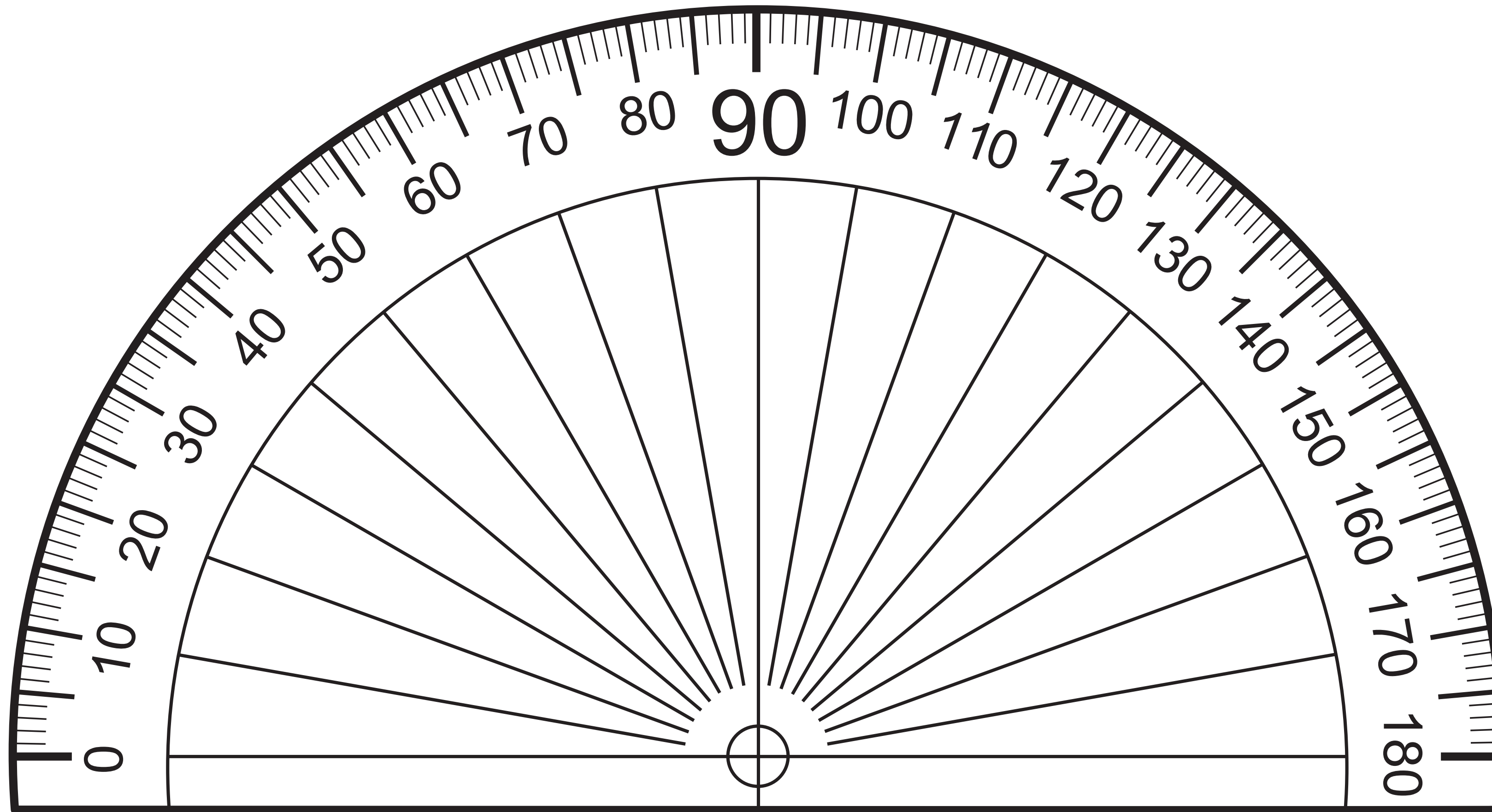
LET'S INVESTIGATE HOW A PENDULUM SWINGS, WORKING AS A SCIENTIST:



CREATE YOUR EXPERIMENT

- **3 bobs of equal mass:**
washers, marbles or something equivalent
- **1 bob which is heavier than the others**
- **String**
- **Timer**
- **Protractor to measure the angle of launching**
(a printable one is provided in the next page)
- **Science journal**
(available in the next pages)





IDENTIFY
VARIABLES

THESE ARE THE VARIABLES YOU ARE TESTING:

LENGTH OF STRING

- 1 Prepare two separate strings: a short one (S) and a long one (L).** (Example: one with 10 inches and one with 20 inches)
- 2 Add one bob, of equal mass, at the end of each of the strings.**
- 3 Find a support for your pendulum.** (Example: a doorknob or your phone)

MASS OF BOB

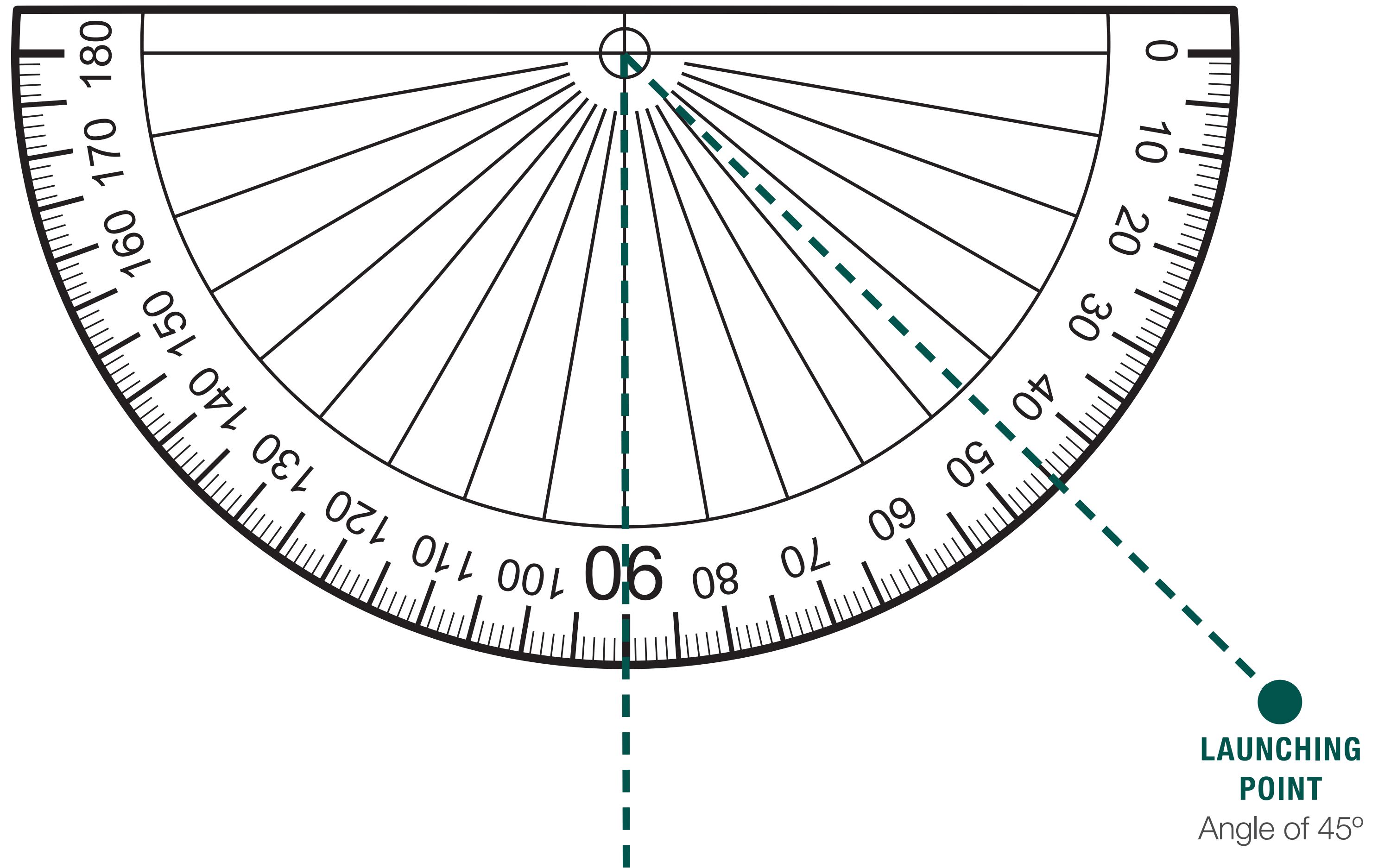
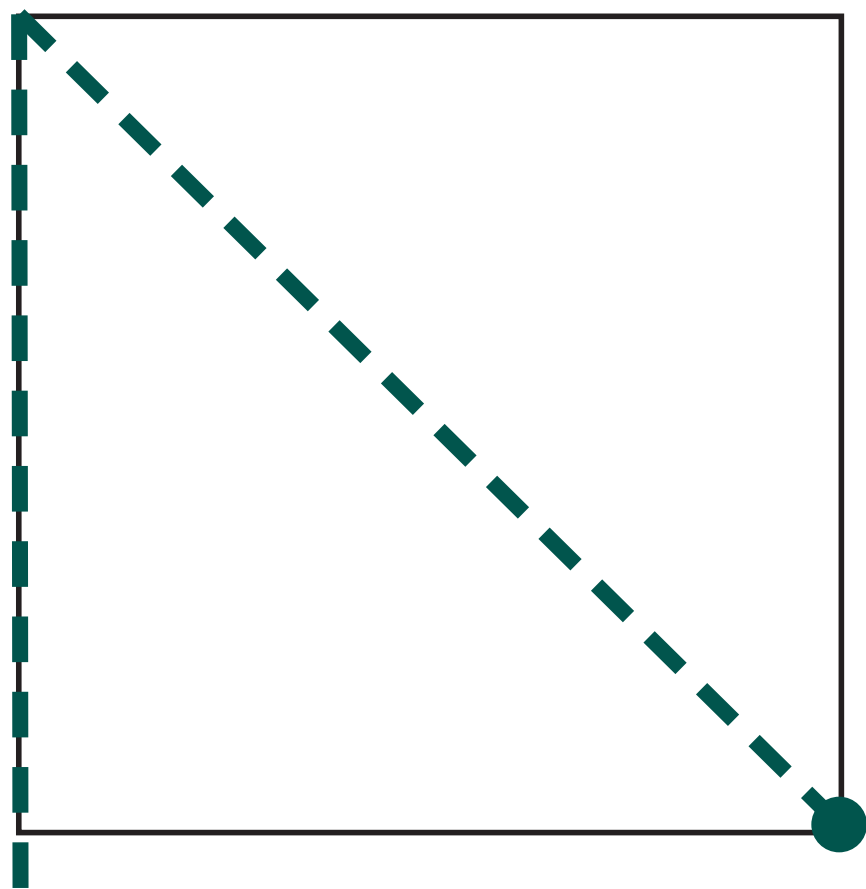
- 1 Prepare two strings (A) and (B) of the same length. Add a bob to (A) and a heavier bob to (B).**
- 2 Find a support for your pendulum.** (Example: a doorknob or your phone)

PENDULUMS

IDENTIFY VARIABLES

HOW TO LAUNCH A PENDULUM

Alternative: If you don't have a protractor and can't print one, you can make a center line on a piece of paper and then mark the highest point of a swing using a square.





WHAT DO YOU THINK WILL HAPPEN?

Scientific investigation is about making and answering questions, but also about making predictions.

Make predictions about the question we want to answer, called a **testable question**.

HOW DOES (YOUR VARIABLE) AFFECT THE NUMBER OF SWINGS?

PENDULUMS

INVESTIGATE AND OBSERVE

INVESTIGATE

OBSERVE

LENGTH OF STRING

- 1 Investigate:** Measure the length of both strings and record the number on your science journal.
- 2 Observe:** Use the protractor to set the launching point at 45° . Count the number of swings for 30 seconds. Repeat this three times. Each time is called a trial.

Record the number of swings in your science journal.

MASS OF BOB

- 1 Investigate:** Record the approximate mass of the pendulum bob on your science journal.
- 2 Observe:** Use the protractor to set the launching point at 45° . Count the number of swings for 30 seconds. Repeat this three times. Each time is called a trial.

Record the number of swings in your science journal.

PENDULUMS

MY SCIENCE JOURNAL

**EXPLAIN
AND SHARE**

MY SCIENCE JOURNAL

Name:

Date:

LENGTH OF STRING

MASS OF BOB

Shortest length:

Lightest bob:

Longest length:

Heaviest bob:

NUMBER OF SWINGS IN 30 SECONDS

NUMBER OF SWINGS IN 30 SECONDS

SHORTEST:

LONGEST:

LIGHTEST:

HEAVIEST:

Trial 1:

Trial 1:

Trial 1:

Trial 1:

Trial 2:

Trial 2:

Trial 2:

Trial 2:

Trial 3:

Trial 3:

Trial 3:

Trial 3:

PENDULUMS

EXPLAIN AND SHARE

Which variable affects the number of swings?

Can you think of other variables that can affect the number of swings?

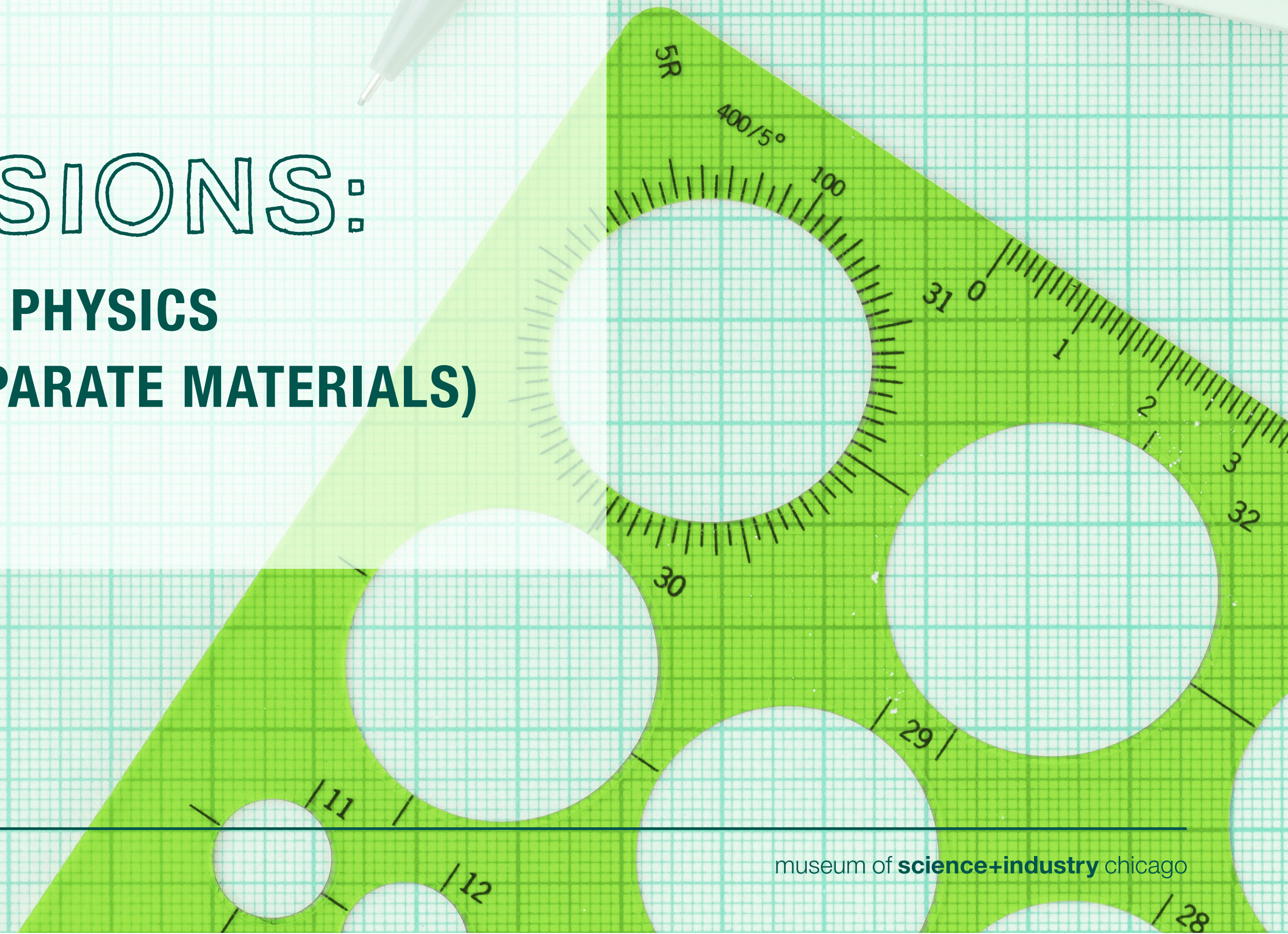
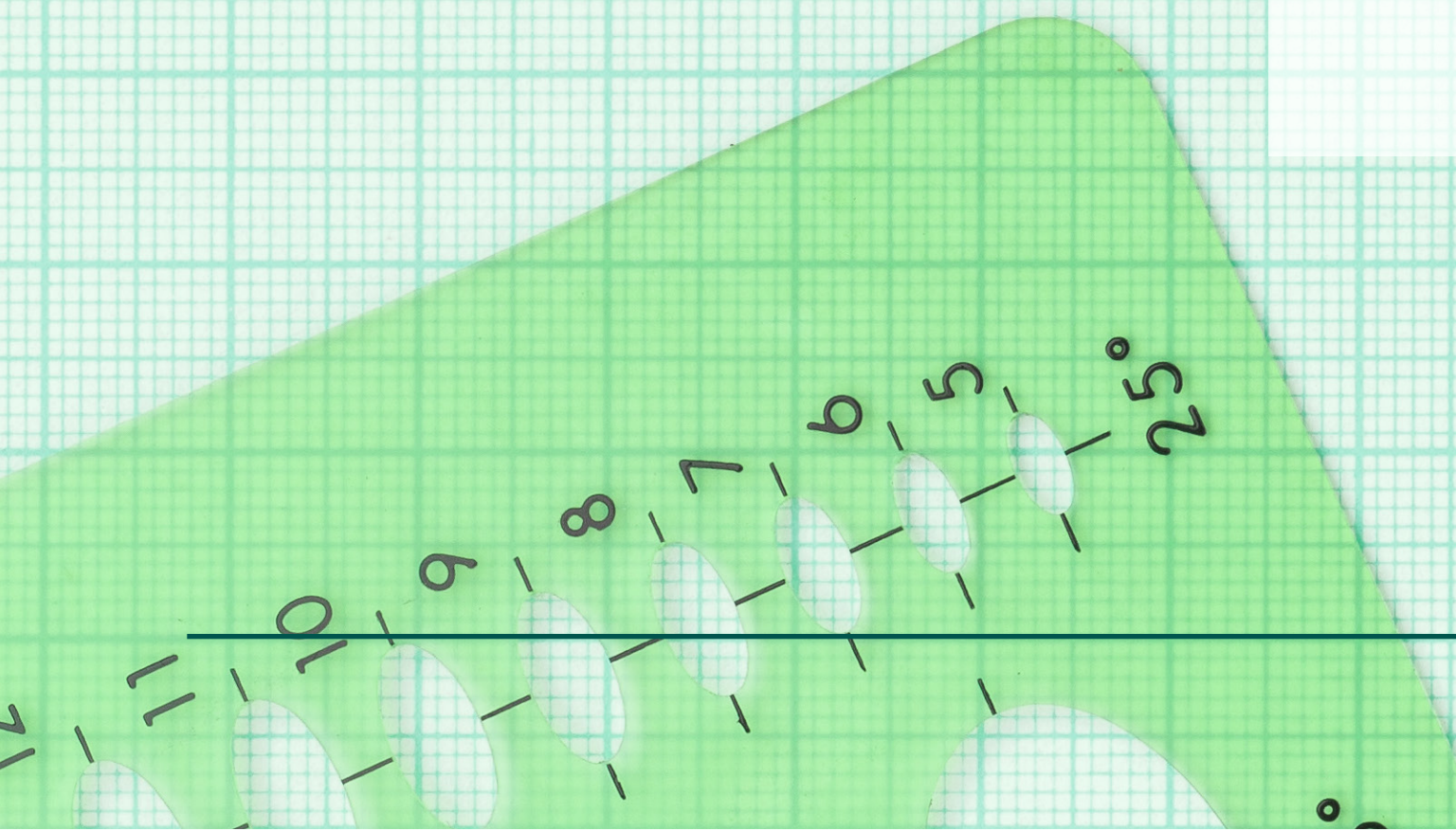
Using your own words or drawing, can you explain how a pendulum works?

PENDULUMS



EXTENSIONS:

**MATH AND PHYSICS
(CAN BE USED AS SEPARATE MATERIALS)**



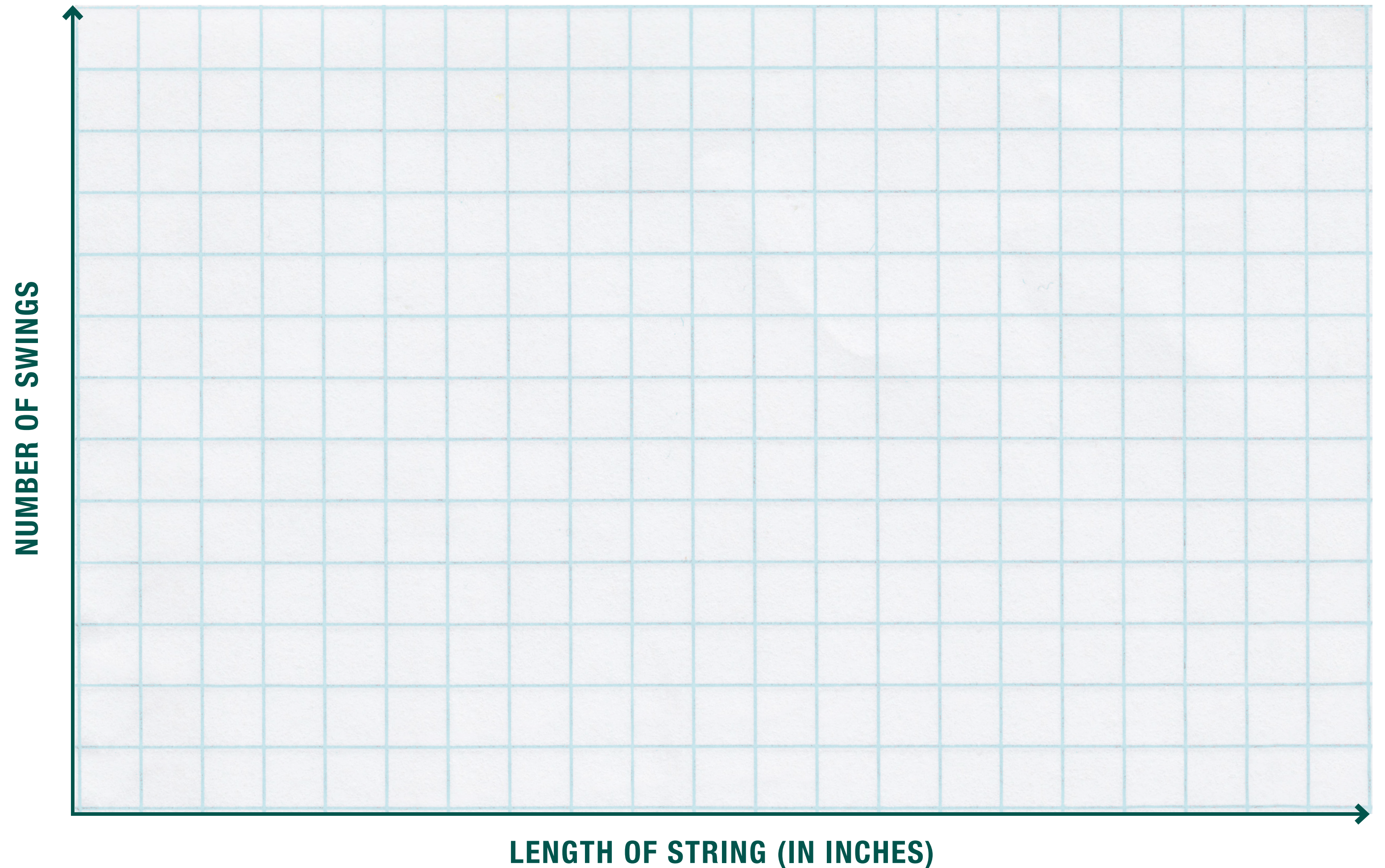
PENDULUMS

MATH EXTENSION

MATH EXTENSION

Graph: A representation that shows or illustrates data in an organized manner. A graph often represents the relationship between two or more variables.

Investigate the **number of swings** of your pendulum using **different lengths of string** and record the observations on the graph.



PHYSICS EXTENSION

There are forces acting upon a pendulum bob during the course of its motion.

Force: A a push or pull on an object.

Forces can be **balanced** or **unbalanced**:

A **balanced force** acts on an object when forces **equal** in strength being pushed or pulled in opposite directions.

An **unbalanced force** acts on an object when **unequal** forces push or pull in opposite directions. This happens when one force is stronger than another.

EXPLAIN
AND SHARE

Which forces are acting on the pendulum?

Is the motion of the pendulum due to forces?

Why does the pendulum stop?

PENDULUMS

PHYSICS EXTENSION

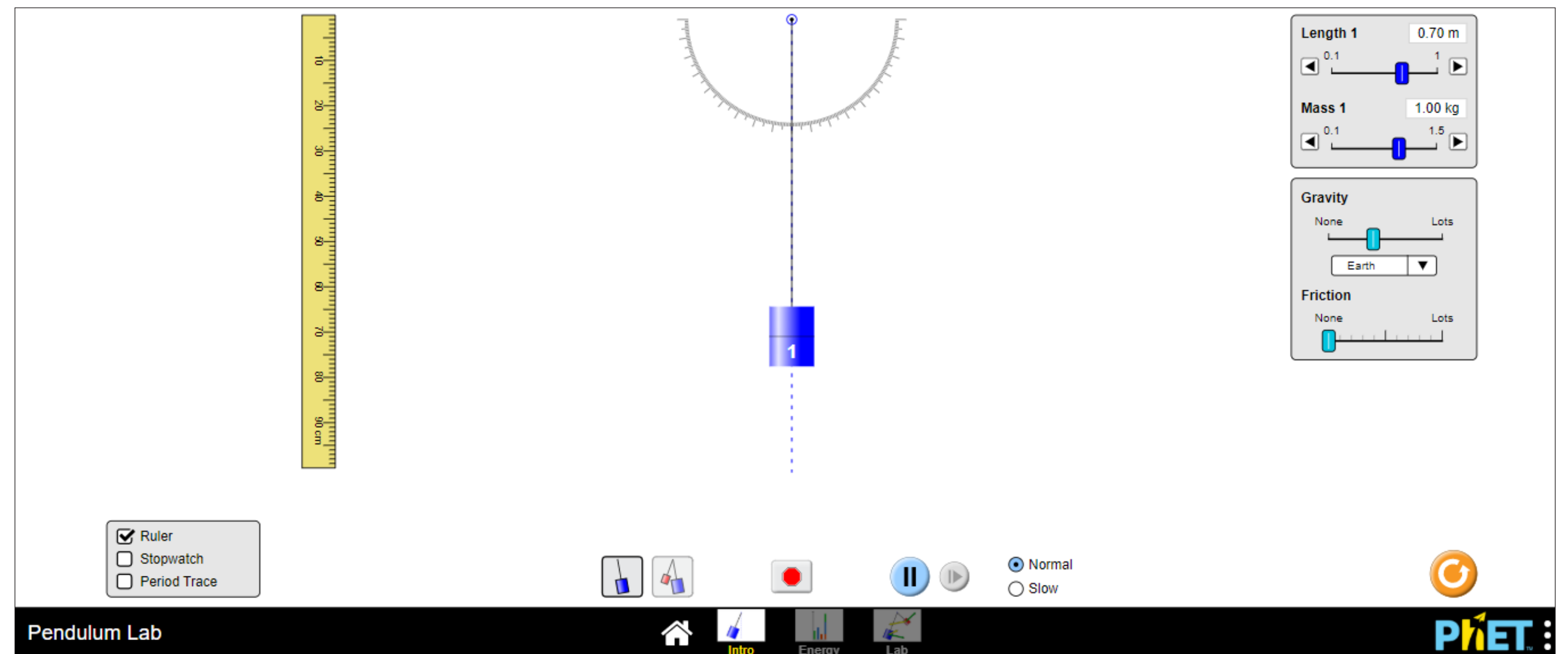
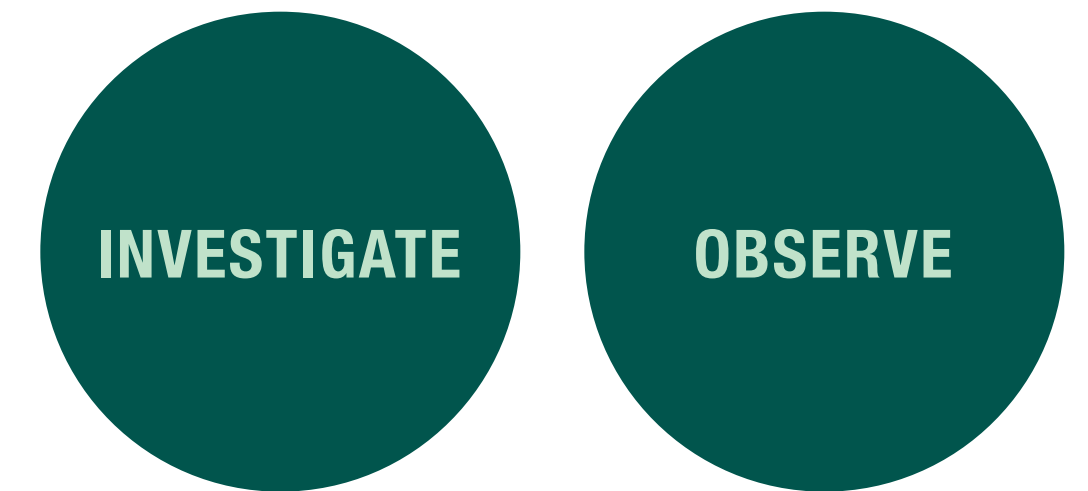
PHYSICS EXTENSION:

Keep exploring your pendulum and make observations.

Scientists use **models** and **simulations** that allow testing of different variables.

Simulation: A **computer model** that works as an approximate imitation of the operation of a system.

Play with different variables and forces:
https://phet.colorado.edu/sims/html/pendulum-lab/latest/pendulum-lab_en.html



PENDULUMS

NEXT GENERATION SCIENCE STANDARDS

NEXT GENERATION SCIENCE STANDARDS

Our lesson has connections to the following standards:

Science and Engineering Practices:

- Asking questions and defining problems
- Developing and using models
- Planning and carrying out investigations
- Analyzing and interpreting data
- Using mathematics and computational thinking
- Constructing explanations
- Engaging in argument from evidence
- Obtaining, evaluating, and communicating information

Crosscutting Concepts:

- Patterns
- Cause and Effect
- Systems and system models

SCIENCE DESIGN: PENDULUMS

SHARE YOUR EXPERIMENTS WITH US:

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