How does the length of a pendulum affect its period?

Background science

- **Pendulum: A pendulum is used to measure the acceleration of gravity,**

- **What energy is affecting the pendulum:A pendulum is primarily affected by the continuous conversion between gravitational potential energy and kinetic energy. As the pendulum swings, potential energy at the highest point converts to kinetic energy at the lowest point, with friction and air resistance eventually causing it to stop.**
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Hypothesis: When the string is longer, the time it takes for a full swing will be longer than when the string is shorter.

How is it related to the topic ¨energy¨.

Before the block picks up any speed at all, (but when the person is no longer affecting the motion of the block) the block has a certain amount of energy.

And since we are dealing with an ideal system (no friction, no air resistance) the system has that same amount of energy from then on. In general, while the block is oscillating, the energy is partly kinetic energy.

How is it related to the topic of ¨sustainability¨.

The pendulum swing helps contextualize current efforts by showing strong environmental regulation often follows eras of unchecked industrial expansion. Understanding this cyclical nature assists in preparing for potential future backlashes against sustainable policies or shifts in public attention away from environmental issues. It provides a long-term perspective on change management.

Independent variable

The length of the pendulum.

Dependent variable

The time it takes for a full swing.

How will the dependent variable be measured?

The method used is to have a metal stand with something metal holding onto it near the tallest point of the stand and tie a string around the metal clamp and make sure it is tight. Tie a weight with a hook if you can and tie it around the end of the string. Use a stopwatch to measure the time it takes for a full swing at 90 degrees.

Controlled variables

What will be controlled?	Why is this important?	How will it be controlled?
The stand	Because it needs to stay in place in order for the	

	angle to stay the same.	
The clamps degree	Because if it isn't straight then the swing will be off or will be all over the place.	
The weight of the ball/weight	Because if the weight changes then all of the measurements will be wrong because that isn't the one of the Iv or Dv.	
The angle of the string when dropped	Because if the angle isn't the same then the results won't be statistically accurate.	
The height of the clamp.	If the height is changed then the angle will change the effect on the swing.	

Data

Length of string	Time for 10 full swings
1. 50	7.71
1. 50	8.46
1. 50	7.75
2. 45	
3. 45	
4. 45	
3.	

3.	
3.	
4.	
4.	
4.	
5.	
5.	
5.	

Materials and methodology

Materials list	Methodology
Metal stand String Metal clamp Weight/bob with hook	

Safety, environmental and ethical considerations

- The pendulum bob must be securely fastened to a rigid support
- Ensure the setup is away from table edges. A box containing soft material (cloth, sponges) should be placed on the floor to provide a safe landing for the heavy bob if the thread breaks
- Wear safety glasses, especially if using a metal bob that could snap and fly off.

- Utilize durable materials (e.g., steel bobs, strong, reusable string) that can be used for multiple experiments, reducing waste.
- Any damaged or worn-out materials (like broken nylon thread) should be disposed of in appropriate, designated waste bins.
- Researchers must identify sources of error (such as air resistance, human reaction time with the stopwatch) and account for them by taking multiple trials and averages.
- It is the responsibility of the investigator to ensure that all safety precautions are strictly followed, especially in a classroom setting where others could be put at risk.