**IBDP Physics**

Internal Assessment (IA) Proposal

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1. **Research Question**

What is the relationship between the length of the filars and the period of a bifilar pendulum?

1. **Variables**

|  |  |
| --- | --- |
| Independent Variable: | Length of the Filar, *l* |
| Dependent Variable: | Period, *T* |
| Controlled Variables: | Radius of the suspended rod, *r* |
|  | Moment of inertia of the suspended rod, *I* |
|  | Mass of the suspended rod, *m* |
|  | Acceleration due to gravity, *g* |
|  | Angle at which the suspended rod is released |
|  | Type of filar used |

1. **Relevant physics concepts and its formula**

This research question is relevant to many aspects of classical mechanics, combining concepts such as tension, torque, simple harmonic motion, and the Newton’s Second Law of Angular Motion.

The formula is given by:

where:

|  |  |  |
| --- | --- | --- |
| **Symbol** | **Description** | **Unit** |
|  | Period, time taken to complete one full oscillation |  |
|  | Length of the filar |  |
|  | Radius of the suspended rod |  |
|  | Moment of inertia of the suspended rod |  |
|  | Mass of the suspended rod |  |
|  | Acceleration due to gravity |  |

More information for the derivation of the equation above (involves differential equations that would otherwise be hard to derive here): https://physlab.org/wp-content/uploads/2017/05/Bifilar-Pendulum-1.compressed.pdf

1. **Apparatus**

2x G-clamp

2x Clamp and Stand

2x Rod (1 as the supporting beam, 1 as the rod itself)

2x String

1x Ruler

1x Mass

1x Camera

1x Lifting jack

1. **Diagram of the setup**
2. **Procedures**
3. Set up the experiment according to the diagram above.
4. Secure a lifting jack at a point.
5. Rotate the rod such that it is stopped by the lifting jack.
6. Start the recording of the camera.
7. Lower the lifting jack so it allows the suspended rod to rotate freely.
8. After 30 oscillations, stop the reading of the camera.
9. The period of each oscillation will then be determined by finding the average of each period of each oscillation.
10. Repeat steps 3-7 for other ranges of the IV.

