IB Physics SL Internal Assessment:

Sandglass and Newton's Second Law

Exam session:

School name: EF International Academy NY

Teacher:

Date:

Candidate No: 006047-0100

Course:

Name: Jie Ji

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How does a sandglass help to calculate the time?

Introduction:

1. **What is a sandglass?**
   A sand glass is a timing instrument, which usually made by three parts: Two glass ball and a narrow pipe for connection between the glass. People use the time of the sand travelled in the glass ball from the top to the bottom of the sandglass to calculate time. If all the sand in the sandglass is already in the bottom, then it can be flapped over to calculate time again. Normally, a small sandglass has a performance period of 1 minute.
2. **The history of sandglass**
   The earliest sandglass discovered in Western country nowadays is in 1100 B.C. According to the conjecture by historians, in the period of Alexander the great (356B.C. to 323 B.C.), people use sandglasses like we use watches today, they are also be used as an instrument on the sea. For example, sailors can calculate the time with the height of the sun and the sandglass.
3. **Effecting factors**
   The factors that effect the calculation of the sandglass are: The amount of filler, the shape of the inner wall of the glass ball, the width of the narrow pipe and the type of the filler that determining the mass. The earliest sandglass use marble powder, iron scraps or eggshell powder, which is irregular in shape. While nowadays people prefer tiny glass pearls. According to the Germany sandglass manufacturer KOCH's documents, a 30-mins sandglass can be controlled within a minute deviation.

Statement of Task:

The purpose of the internal assessment is to use knowledge of geometry and algebra, also a part of calculus to help find out the velocity of the filler in the glass ball so that we can find out how much time a sandglass would take to finish a complete performance period and to be totally set for the next period. The effecting factors written above are needed to achieve a common conclusion.

Plan of investigation:

My plan of the investigation is to use the data from the amount of the filler, the shape of the inner wall and the width of the pipe also the shape and mass of the filler to calculate how much time a sandglass need to finish a complete performance period. The gravity will also be considered for calculation. From the research and my own calculation, I can achieve to a common formula and then obtain a reasonable conclusion. We can solve this problem by using

the solid of revolution.