Post-IGCSE Physics Course: Experimental Physics using Data Loggers and Computers

# 02 Spool (Rotational Mechanics

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#### Spool experimental setup



Pasco USB datalogger



Idea is to wind the mass on the spool and let go. As it falls the disc rotates faster and faster.

The data logger measures the times when dark sectors obscure the laser. From this angle vs time, angular velocity etc can be computed. Windows laptop running CAPSTONE software. Record voltage (proportional to rotation angle) and time



Light and dark wheel (blue-tack to spool cylinder) Retort stand clamped to desk



About 0.4kg mass

#### **Cushioned mats**



PASCO USB datalogger

## **CAPSTONE** setup

- 1. Switch on the laptop and wait for boot routine to complete. Load **Capstone** software (a shortcut should be on the desktop)
- 2. Check interface is setup. Click on **Hardware setup** and click on the active port. Select the **Photogate with pulley** option from the menu.



#### Set the Display to be a Table and Graph



## Click in the **axis tabs** to set Angle (rad) (y) vs time (x). Do this for the **table** as well.



To attach the spool of string, firstly make a small loop and place over the white cylinder which is glued to the wooden discs. Then start to wind.

Place the mass on the bench while you reattach the plastic disc and reposition the light gate, such that the laser beam ideally will strike the centre of the dark sectors.











Once you have gathered sufficient data, **stop** the recording and then **export** the data using the **File** menu.

Choose **.csv** (Comma Separated Variable) output. Save this to a memory stick and transfer to a PC for analysis. (Excel or equivalent).

### Analysis

Use a **spreadsheet** such as Excel to construct graphs of the data-logged parameters. Check that the angles given correspond to the actual angular deviation between dark blocks. The data logger records the time that each block passes the laser. All other parameters are worked out from this.



### Compare different scenarios e.g. different radius, or thickness of disc, size of mass etc.

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So until weight hits the floor, expect a *linear increase* in angular speed.