**Projectile Launcher Design Challenge**

**Challenge**

* To build a launcher capable of launching a projectile as precisely as possible.

**Rules**:

* The launcher can be made of any materials (eg. popsicle sticks, elastic bands, binder clips, etc)
* The launcher should be as precise as possible. On the due date, students will attempt to hit a target at least 1.5 m away as consistently as possible. They will then compete in a mystery competition.
* The launcher must be free standing and able to launch from the ground (i.e. no handheld slingshots).
* Students must create their own launcher individually, however they are encouraged to work collaboratively in groups to share ideas and provide feedback.
* Students will present their design logs and video analysis (see below) individually to the teacher.

**Timeline**

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| --- | --- | --- |
| **Day** | **Goals** | **By the end of class you...** |
| 1 | Do some preliminary research and begin to plan your launcher. Using given materials start to build a functional prototype. | will:   * Do some initial research * Sketch out a plan for your prototype * Create a list of materials   should:   * Start to build a prototype launcher |
| 2 | Build a functional prototype. Test your design and note areas for improvement. Decide on your final design and start building. | will:   * Test a working prototype   should:   * Begin to make changes to improve your launcher |
| 3 | Build your final product. Test it to see how often it can hit a target at least 1.5 m away. Determine how reliable it is and whether it is likely to break. | will:   * Build you final launcher * Download and install logger pro software   should:   * Test it for precision and reliability. |
| 4 | Perform video analysis. Take a video of your projectile launching. Use the logger pro software to collect and analyze the data of the launch. Use the software to create graphs | will:   * Take a video of your launcher in action   should:   * Perform video analysis and create required graphs |
| 5 | LAUNCH DAY! | will:   * Test your launcher * Present your results to the teacher   should:   * Successfully defend your territory from the invading hordes! |

**Assessment**:

Each individual will perform a video analysis of their launcher. This will include using LoggerPro software to collect data and generate graphs that describe the motion of their projectile. These graphs include:

* dx vs.t
* dy vs. t
* Vx vs. t
* Vy vs. t
* dy vs dx
* The quadratic function that describes the trajectory of the projectile.

Students will present their results to the teacher in a short interview and should be prepared to answer questions related to their projects and the underlying physics of projectiles.

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| --- | --- | --- | --- | --- |
| **Physics** | **Beginning** | **Developing** | **Accomplished** | **Exemplary** |
|  | Video analysis is incomplete | Video analysis is complete | Students are able to answer questions about projectiles concepts in familiar situations | Students are able to answer questions about projectiles concepts in unfamiliar situations |

As a group students will attempt to hit a target that is placed at least 1 m away. Students may choose the location of the target.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Results** | **Beginning** | **Developing** | **Accomplished** | **Exemplary** |
|  | Misses the target | Hits target 1/5 times | Hits target 3/5 times | Hits target 4/5 times |

Each **individual** must complete a design log that notes their progress. See below for sample.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Design Log** | **Beginning** | **Developing** | **Accomplished** | **Exemplary** |
|  | Design log is incomplete | Design log is complete | Design log is complete and well organized | Design log is complete and offers clear insight on the process |

**Sample Design Log:**

|  |  |  |  |
| --- | --- | --- | --- |
| **Date** | **Accomplishments** | **Next Steps** | **Questions** |
| Day 1 | What did do this block?  What worked well?  What were you unable to do? | What would you like to accomplish in your next work block?  What needs to be done before the project is complete? | What problems do you still need to solve?  What do you need to understand in order to improve your design? |
| Day 2 |  |  |  |
| Day 3 |  |  |  |