The Catapult

Scenario
Her Royal Highness, Queen Victoria, has issued an imperial decree. The Royal Army needs a new war machine – a catapult – to defeat her enemies.

Aim
The aim of this full-day activity is to design and build a catapult that can fire a tennis ball accurately over a long distance.

What to do
Each team has approximately three hours to build a catapult from various lengths of wooden dowel fastened together with string and packing tape. Its swinging arm receives energy from rubber bands.

Toward the end of the session, teams will be given a projectile (a tennis ball) and their catapults will be tested for distance and accuracy on the firing range.

Rules
Catapults must have a swinging arm. Slingshots and ballistas are not allowed.

All power must be provided by the rubber bands.

Firing can only be done on the firing range under the direction of Event Staff.

Your team will be given five minutes to set up, fire and remove your catapult.

There are heavy fines for students who behave dangerously.

Do not dismantle your catapult until the end of the session. At that time, clean up all the dowels and return them in one piece to the Event Staff.

Scoring
After calibration, each team has three shots at the 8 metre target. This process is repeated for the 16 metre target. (The most points are scored for a bullseye at 16 metres.)

Your team will also be allowed three distance attempts. The greatest distance (to the first bounce) will be rewarded with 2 points per metre.

The final score is calculated by adding the sub-totals for these three tests together, and deducting any fines.

Tips
Building a good catapult is not difficult, but building a great one is more challenging. It is important, if you want to beat the competition, that you work together as a team and use your imagination!

Experimentation is also very important!
STUDENT NOTES
The Catapult

The problem
The aim of this activity is to design and build a catapult. Teams gain points for how far and how accurately their construction can throw a tennis ball. The catapult must have a swinging arm to throw the ball; sling shot mechanisms will be disqualified!

Duration
This activity runs for a full day (approximately 4 hours).

Materials
Each catapult is built from wooden dowel of various lengths. It is fastened together with string and packing tape, and receives energy from rubber bands.
The projectile is a standard tennis ball.

Rules
1. Catapults, by definition, have a swinging arm. Slingshots and ballistas (cross-bow mechanisms) are not allowed.
2. All power must be provided by the rubber bands. The catapult is fired by pulling back and then simply letting go of the swinging arm.
3. You will have access to the firing range throughout the design and build process. This will allow you to test and improve your design before the official tests begin. You must obtain permission from the Event Staff each time you want to use the firing range. Firing tests can only be carried out under the direction of these Staff.
4. Your team will be given five minutes for each official test (8m accuracy and 16m accuracy, plus distance). During this time the catapult must be set up, fired and moved off the range, ready for the next team.
5. The testing must be run safely; there are heavy fines for all offenders (refer to the score sheet).
6. The poles may be joined with string and/or tape but they are not allowed to be cut.
7. All poles must be cleaned up and returned at the end of the session. Points will be deducted from teams that do not return the poles in good condition.
8. Please do not dismantle your catapult until instructed by the Event Staff at the end of the session, when all tests are complete.
Scoring
Points are awarded for accuracy and distance.

Teams attempt the **accuracy tests** first.

Before the official tests, you will be allowed two free shots to calibrate your catapult. After calibration, you are allowed three shots at the 8 metre target. This process is repeated for the 16 metre target.

For the **distance test**, your team will be allowed three shots. The best distance (to the first bounce) will be rewarded with 2 points per metre.

Tips

- **Don’t forget to bring these notes with you to the Challenge.**
- The following basic catapult design works, but it may not work well enough to win you the competition; use your imagination!
- Power is provided by stretching the rubber bands, then releasing the arm.

Figure 1: A basic catapult design
This page is intentionally blank so the score sheet starts on new page.
# SCORE SHEET
## The Catapult

**School name:** ____________________________

### Accuracy at 8 metres

<table>
<thead>
<tr>
<th>Attempt</th>
<th>Short of target</th>
<th>Past target</th>
<th>Hit net</th>
<th>Circle 1</th>
<th>Circle 2</th>
<th>Bulls Eye</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>One</td>
<td>4</td>
<td>9</td>
<td>13</td>
<td>17</td>
<td>21</td>
<td>25</td>
<td></td>
</tr>
<tr>
<td>Two</td>
<td>3</td>
<td>7</td>
<td>11</td>
<td>15</td>
<td>19</td>
<td>23</td>
<td></td>
</tr>
<tr>
<td>Three</td>
<td>2</td>
<td>5</td>
<td>9</td>
<td>13</td>
<td>17</td>
<td>21</td>
<td></td>
</tr>
</tbody>
</table>

Add the scores for each attempt to get sub-total (A)

### Accuracy at 16 metres

<table>
<thead>
<tr>
<th>Attempt</th>
<th>Short of target</th>
<th>Past target</th>
<th>Hit net</th>
<th>Circle 1</th>
<th>Circle 2</th>
<th>Bulls Eye</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>One</td>
<td>8</td>
<td>18</td>
<td>26</td>
<td>34</td>
<td>42</td>
<td>50</td>
<td></td>
</tr>
<tr>
<td>Two</td>
<td>6</td>
<td>14</td>
<td>22</td>
<td>30</td>
<td>38</td>
<td>46</td>
<td></td>
</tr>
<tr>
<td>Three</td>
<td>4</td>
<td>10</td>
<td>18</td>
<td>26</td>
<td>34</td>
<td>42</td>
<td></td>
</tr>
</tbody>
</table>

Add the scores for each attempt to get sub-total (B)

### Distance

**Score is 2 times the distance. Only the best distance counts**

<table>
<thead>
<tr>
<th>Attempt</th>
<th>Distance (metres)</th>
<th>Distance x 2</th>
<th>Highest score</th>
</tr>
</thead>
<tbody>
<tr>
<td>One</td>
<td></td>
<td></td>
<td>Sub-total (C)</td>
</tr>
<tr>
<td>Two</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Three</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Penalties

**Circle all fines that apply and add together at (D)**

<table>
<thead>
<tr>
<th>Reason</th>
<th>Penalty</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deliberately break, damage or cut a pole</td>
<td>2</td>
</tr>
<tr>
<td>Fire in an area other than firing range</td>
<td>10</td>
</tr>
<tr>
<td>Dangerous behaviour (e.g. use sticks as swords, standing in front of the catapult, not wearing safety glasses)</td>
<td>10</td>
</tr>
<tr>
<td>Deliberately fire without supervision or toward a person</td>
<td>15</td>
</tr>
<tr>
<td>Not cleaning up and returning equipment at the end of the session</td>
<td>35</td>
</tr>
</tbody>
</table>

Sub-total (D)

\[(A) + (B) + (C) - (D) = \text{FINAL SCORE} \]

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