

Projecting Technology— Catapults and Trebuchets

Context

The Handball And Racketball Training Association has approached us to design an apparatus that will help in teaching the fundamentals and form of returns. The device must deliver a squash ball accurately and consistently to a target ten metres away.

Problem

Create an efficient device for consistently delivering a light-weight projectile (squash ball) on target.

Design Constraints

- The target is a 300 mm diameter hoop placed 1 metre above, and parallel to, the floor (horizontal)
- The device must be at least 10 metres, but no more than 12 metres from the target
- The projectile is a Dunlop ‘Championship S R-A Extra Slow’ squash ball
- The total cost must not exceed \$20.00 in purchased materials
- Must *not* involve chemicals, compressed air, or combustion propellants
- Must be safe to operate

Design Considerations

- Pay close attention to appropriate form of materials, simplicity, unity and economy
- Consider engineering principles such as energy transfer, fluid drag, motion, and trajectory (dynamics)
- Catapults and trebuchets work well but there are many other possible solutions
- Consider aesthetics and elegance of form in the device
- Remember that your device must deliver the projectile consistently over a series of trials
- Do your very best in your design and in finishing your creation
 - *No Sloppy Work!

Sequence

- Think about and sketch your overall designs
 - Choose appropriate forms and materials
 - Collect the materials that you need
 - Be sure you like your design and double-check to make sure it is designed well
 - Carefully layout and cut individual parts
 - Do your fastening, welding or painting of parts before you assemble
 - Assemble the device temporarily first
 - Test and assess your design
 - Retest and “permanently” fasten parts
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- Be sure to obey all safety rules when using tools and machines!
 - Remember to be polite to people who help you!

Management Issues

Place yourselves in groups of three

- End of Day 1 or 2: Approval of design sketches
- End of Day 2 or 3: Approval of materials
- End of Day 5 and 6: Test devices
- End of day 7: Final performance tests— Out of 5 trials
- End of day 8: Final reports due (Mathematical prediction of accuracy, drawings, calculations)

Related Studies

- Drafting and Sketching
- Dynamics
- Physics
- Engineering
- Materials Science
- Medieval History

Honest Self Evaluation

1. We stayed within the design constraints and deadlines— _____ out of 5 marks
 2. Our device is very much like our approved sketches— _____ out of 5 marks
 3. Our device was accurate in each of the 5 trials — _____ out of 5 marks
 4. Our device has a good example of design features— _____ out of 5 marks
 5. Our device's appearance represents quality work— _____ out of 5 marks
 6. Our report is complete and technical— _____ out of 5 marks
- _____ Total out of 30

Assessment

Student's Assessment

Student Total _____

Design Principles

- Appropriate Form _____ out of 10
- Unity _____ out of 10
- Performance _____ out of 10
- Economy & Simplicity _____ out of 10

Craft and quality _____ out of 15

Deadlines, Safety and Participation _____ out of 15

_____ Total out of 100