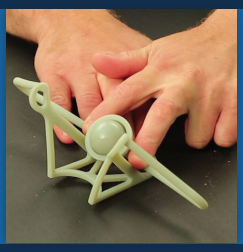
LESSON GUIDE



Designing a Catapult

Guiding Design Questions

1. What is the most effective historic design (catapult, trebuchet, crossbow)? Can you think of a new design that is more effective given the lesson guidelines?

2. What is the most effective spring design given the model material properties (tension, flexure, torsion)?

3. How can the 3D printing technology allow you to create a more effective design (complex shapes and profiles, weight savings by “trimming” non-load bearing areas, 3D printing your design)?

Design Tips for 3D Printed Parts Using PolyJet Technology™

1. The minimal wall thickness that can be reliably printed is 0.6 mm. For the size constraints of the competition the thickness of the spring component should be in the range of 5-8 mm.

2. For the trigger you can print axels and moving parts in one model. Simply leave a clearance of 0.1-0.2mm and enough access to remove the support material.

3. Use fillets. Sharp corners can cause premature failure. Printing a smooth, complex design is just as easy as printing a box.

4. Know the material limitations. Look at the material datasheet. Consider printing a simple model to get the feel in your hand and design accordingly.

5. The most suitable PolyJet material for this challenge is Digital ABS as it has the best mechanical properties and toughness. However, any rigid resin can be used successfully.

Lesson Guidelines

1. The ball is a 3 cm diameter printed model (weight ~13 grams).
2. When ready to launch, the device must be smaller than 20 x 20 x 20 cm.
3. The device must weigh less than 50 grams.
4. The entire device must be made of printed material (no springs, rubber bands, adhesives, bolts).
5. The device may be composed of several parts, but they must fit within one printer tray and, as mentioned above, connect without external means (no adhesive, bolts, etc.).
6. The device must have a trigger that fixes it at the launch-ready position and allows activation and launch.

Optional:

6. Look at the part arrangement on the printer tray and make sure the load bearing faces that will be under tension are printed in Gloss as this will ensure they are as strong as possible.

7. Use mechanical analysis/simulation software to help you reach an optimal design.

8. Print prototypes of your design, test them and improve it accordingly.

9. You can make your design modular. For example, the frame will be constant but you can use it to test various spring designs.

Safety - Wear safety goggles

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