

ACTIVITY: DESIGN A HEAT SHIELD

Directions:

NASA is looking to hire a team to design a heat shield able to protect a heat sensitive cargo, represented by a piece of chocolate, for a period of 180 seconds (3 minutes) on a hot plate, simulating a spacecraft reentering Earth's atmosphere. Your team is not the only team competing for the job. Your team must budget for, design, build, and evaluate your own spacecraft heat shield. The team that has the most successful design with no melting chocolate and the least amount of money spent, wins the challenge!

You have these materials available to you, but keep in mind your team only has \$1,000 in your budget to spend:

- A. The sensitive cargo or "astronaut"
 - chocolate squares (1 per group)
- B. To generate the heat (for teacher/adults to manage during experiment):
 - Hot plate
 - Steel Ring Stand Set to rest projects on ring clamp 3-4 inches above the hot plate

C. Heat Shield Material:

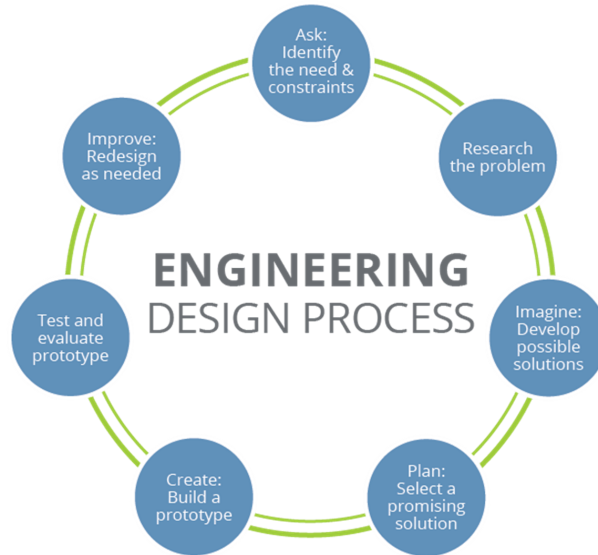
"High price" items:

- Graham Crackers: \$300 each
- Aluminum foil 6"x 6" square: \$300 each
- Tissue paper 6"x 6" square: \$200 each
- Cardboard piece: \$150 per piece

"Low price" items:

- Paper clips: \$50 each
- Craft sticks: \$20 each
- Coffee filter: \$20 each
- Construction paper: \$20 each sheet

Look at the engineering design process model below. Write down some notes for each step. **Graphic Credit: TeachEngineering.org**



1. Start with *Ask*. What do you need to do? What are your limitations?
2. Research the problem. You can use the internet, books, or explore your other knowledge.

3. *Imagine and Plan* possible solutions. Sketch the solution you choose to use.

4. Go shopping for your materials and start building! List your materials and their price here:

5. *Test, evaluate and redesign.* Record all your results so they help you find ways to improve.

| Team | Materials used and total cost | Results <i>Did the chocolate melt?</i> | Improvements to design for retesting. |
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