Brainstorming Invention Ideas

Find a problem to solve!
- Think about problems that you'd like to be solved.
- As you go about your day, note down anything that is annoying to use, since that represents a problem that can be solved with an invention!
- Ask your friends and family what problems they'd like solved, or what things are difficult or annoying.
- Choose any object or activity, apply the SCAMPER technique to it, and see if that sparks an idea for an invention.
- Don't worry yet about whether your invention is possible. Be creative, and we'll adjust based on feasibility later.

Examples of Invention Ideas
(Each idea is a phrase or sentence that explains the general idea behind the invention. No details are needed yet, but feel free to add anything that comes to mind. These examples are all things that were invented by kids in the last few years!)
- An improved bottle cap that avoids spills for people with shaky hands
- A better hairbrush that prevents hair from falling to the floor
- A machine that generates electricity from the wind of a moving car
- A more user friendly charging dock that works with any device
- A device that makes it easier to eat a popsicle once you get to the bottom

Brainstorm in your engineering notebook!

Narrow Down your Invention Ideas

1. **Useful**: Does your invention solve a problem?
   a. Who does this problem affect?
   b. Ask people if they would use your invention.
2. **Novel**: Does your invention already exist?
   a. Spend a few minutes online searching for a similar product.
   b. We'll learn how to do a formal patent search next week.
3. **Designable**: What would it take to figure out the full details of your invention?
   a. Is it a purely mechanical device or does it require electronics?
   b. Does it require technology that does not exist yet?
   c. Think of a mechanism and draw out a potential design
4. **Manufacturable**: Can your invention be easily manufactured?
   a. What raw materials would you use?
   b. What machine would you use?

Types of Engineering

Overall Categories
1. **Civil** Engineering
   a. Environmental Engineering
   b. Structural Engineering
2. **Mechanical** Engineering
   a. Aerospace Engineering
   b. Nuclear Science and Engineering
3. **Electrical** Engineering
   a. Computer Science and Engineering
4. **Chemical** Engineering
   a. Materials Science and Engineering
   b. Biochemical Engineering

At MIT
1. Civil and Environmental Engineering
2. Mechanical Engineering
   a. Ocean Engineering
3. Materials Science and Engineering
4. Electrical Engineering and Computer Science
   a. Electrical Engineering
   b. Computer Science
5. Chemical Engineering
6. Aeronautical and Astronautical Engineering
7. Biological Engineering
8. Nuclear Science and Engineering

Within Mechanical Engineering
1. Mechanics and Materials
2. Dynamics and Controls
3. Thermodynamics, Fluids, and Heat Transfer
4. Manufacturing
5. Product design

Grand Challenges

Advance Personalized Learning	Secure Cyberspace
Make Solar Energy Economical	Provide Access To Clean Water
Enhance Virtual Reality	Provide Energy From Fusion
Reverse-engineer The Brain	Prevent Nuclear Terror
Engineer Better Medicines	Manage The Nitrogen Cycle
Advance Health Informatics	Develop Carbon Sequestration Methods
Restore And Improve Urban Infrastructure	Engineer The Tools Of Scientific Discovery

Your Grand Challenge: _____

Description of Challenge in your own words: _____
_____

Brainstorm before researching: What problems/solutions might your challenge involve?
-
-
-
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Research online:
What solutions exist that

...have already been developed?	...are currently in development?	...could be developed in the future?

What are the biggest difficulties in developing those solutions?_____
_____
_____

Choose one of those difficulties and expand on it. Why is it difficult? How could you improve it?
_____
_____

Invention ideas:

Machines

	Flat	Not Flat
Metal	Waterjet	Mill, lathe
Plastic	Laser cutter	3D printing, mill, lathe

- Mill
  - Vertical machining center = VMC (table moves)
  - Gantry style router (tool moves)
- Lathe
- Manual vs CNC
  - CAM, Gcode
- Waterjet
  - Cutting width
- Laser cutter
  - Only certain materials
  - Metal and PVC very bad
- Precision machines vs prototyping machines

Machining tools	Processes
- Endmill - Drill bit - Turning tool	- Anodizing - Welding - Splining

Shop tools
- Drill press
- Band saw
- Grind wheel
- Hydraulic Press
   - Bearings
- Sheet metal brake
- Cordless Drill
- Sandblaster
	Hand tools
	- Wrench (need two!)
	   - Socket + ratchet
	   - Torque wrench
	- Caliper
	- File
	- Deburring tool
	- Screwdriver, nutdriver
	- Allen key / allen wrench

Fasteners
- Screw / bolt assembly
  - Socket head, hex head, phillips head, flathead
  - Nut, washer
- Shafts: retaining ring / e-clip, shaft collar
- Locking: Cotter pin, safety wire, locknut, locktite

Learning Resources

Making things! (built projects in your free time, highly recommended)
- Instructables
- Make magazine
- Maker share
- Electronics: Adafruit, Sparkfun
- CAD / 3D printing: grabcad, thingverse

Youtube channels
- Science and math
  - Science: Scishow, Minute physics, Veritasium, Vsauce, AsapScience
  - Math: Numberphile, 3Blue1Brown, Mathologer
  - Projects: Applied Science, Tesla500
- Engineering
  - General: Learnengineering, Engineering.com, Engineerguy
  - Machining: This Old Tony, Oxtoolco, RobRenz, NYC CNC
  - Woodworking: Matthias Wandel, Izzy Swan
- Any subject
  - Ted talks
  - Crash course

Learning entire classes
- Khan academy
- MIT OpenCourseWare (usually better for high school)
- Coding: code.org, codecademy, Scratch

Websites with good information
- Howstuffworks
- Explain that stuff
- All about circuits