

E 101: Introduction to Engineering & Problem Solving

BUBBLE BLOWING MACHINE

Competition Criteria

Objective: Design and build a machine that automatically produces bubbles and launches those bubbles from the machine to float through the air. The team that meets all the basic competition requirements with the most points wins.

Requirement & Constraints:

1. The design must operate automatically using one approved power source.
2. The design may **not** incorporate any parts of commercial bubble-blowing machines. Commercially available bubble wands are acceptable.
3. The team must develop a bubble solution; commercial bubble solution may **not** be used. The recipe for the bubble solution must be submitted during competition.
4. The design is restricted to only one power source. The team must choose either one of the following design challenges:
 - a. **Electric DC power source only.** The team may choose a design using either one of electrochemical batteries, indoor photovoltaic cells, or low power dynamo coupled to a supercapacitor to generate power a mechanical system. Any wind power sources (e.g. fans) must remain within the voltage and current specifications above. Points will be awarded for any design other than electrochemical batteries (e.g. AA commercial batteries).
 - b. **Wind power source only.** The team may use a portable, plug-in fan of their choice in their design to generate power a mechanical system. The wind source must remain constant once powered and cannot be manipulated to change bubble size or bubble frequency. **Electric power sources (e.g. batteries, etc.) other than the power outlet provided for your fan are not allowed.** Points will be awarded for this design.
5. The design must produce a continuous stream of bubbles for at least one (1) minute.
6. Each of the bubbles must detach from the machine (i.e. no drooling allowed). Points will be awarded for the most detached bubbles produced within one (1) continuous minute.
7. Electrical safety is a primary concern. Designs for electric power sources are restricted no more than 9 source volts (voltage can vary, but a 1.5 volt battery will be considered as such even if it measures 1.6 or 1.4 volts) and to no more than 30 source microamps. Designs for wind power source must work with 120VAC 60 Hz wall outlet or power strip. Also, consider that power sources generate heat and plan for this element in your design. Ask the guru if unsure or concerned about safety.
8. Portability – The design must be portable from the team table to the competition area.
9. Points will be awarded for changing bubble size (e.g. small to large) and bubble frequency (e.g. slow to fast). This change may be accomplished either automatically or by a team member making a discrete adjustment to the machine

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in less than 10 seconds. More points will be given to those designs incorporating automatic adjustments.

10. Power outlets will be available at Design Day; however, your team must supply an extension cord and power strip for the competition.
11. Points will be awarded under “creativity in concept” for including fun, party-themed design components (e.g. music, lights, glow-in-the-dark bubbles, etc.). The design is restricted to same one power source as the bubble blowing machine.
12. As with all FEDD projects, this project must be completed within a \$40 budget. Found, borrowed or previously owned materials are not considered part of the project budget.
13. **Research Component:** All teams must present a printed poster at FEDD to qualify for competition.
 - a. The poster must include a budget, list of materials used, solution recipe, literature review (see below), references cited, and details of the team’s engineering design process (Ask, Imagine, Plan, Create, Improve). Exemplary posters should show concept development, concept selection, prototyping, testing, project milestones, economic considerations, and failure analysis in a clear, concise, polished manner with an attractive, professional appearance. Audio and visual displays are optional yet highly encouraged.
 - b. Choose one based upon whichever power source used in your design:
 - i. **Electric DC power source only.** Review literature on basic electric circuits, resistors, switches, motors, etc. Provide a brief summary of your research and present both a written explanation and a diagram that describes the makeup of the electric circuit you used in your bubble blowing machine, which should include any switches, resistors, etc. you may have used. Use at least five reliable sources including two from peer reviewed journals (maximum of two internet-based). Your sources must be presented in a standard format such as APA or MLA.
 - ii. **Wind power source only.** Review literature on wind turbines as well as simple machines. Provide a brief summary of your research and present both a written explanation and a diagram that describes the makeup of the wind-powered design you used in your bubble blowing machine. Use at least five reliable sources including two from peer reviewed journals (maximum of two internet-based). Your sources must be presented in a standard format such as APA or MLA.

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- c. Patents promote innovation by granting property rights protection to anyone who invents or discovers any new and useful process, machine, article of manufacture, or composition of matter, or any new and useful improvement thereof. In return for these protections, inventors must fully disclose their invention and how it works in the patent, which make patents a valuable catalyst for creative thinking as well as starting points to imagine newer cutting-edge technologies. To maximize points awarded for “creative in concept,” include a cited U.S. patent in your research and written explanation of how your team’s design concept is new and useful beyond the current technology.

Strategy Hints:

- The U.S. Patent and Trademark Office (USPTO) and Google provide free online patent searches.
 - <http://patft.uspto.gov>
 - <https://patents.google.com>
- USPTO provides guidelines on how to conduct a thorough patent search, such as brainstorming keywords and search terms (<http://www.uspto.gov/learning-and-resources/support-centers/patent-and-trademark-resource-centers-ptrc/resources/seven>). Also, much of the pertinent prior art will have the current U.S. patent classification (USPC) class/subclass numbers:
 - 446/15
 - 446/16
 - 40/408

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Questions? Contact Mr. Myles Robinson at myles_robinson@ncsu.edu.

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Competition Judging & Winning: The team that is assessed the most points based on the following competition rubric will win the competition. Judges can assess up to the maximum number of points listed per category, based on how well the individual design performs in that category. In the event of a tie, competition judges will make the final decision on place. On Design Day, the judges must be able to verify that the design meets the above criteria; otherwise the team will be disqualified.

Bubble Blowing Machine Judging Rubric

FRESHMAN ENGINEERING DESIGN DAY

Team Name: _____

Team Members: _____

Section/Instructor: _____

Competition Criteria	Points
Meets basic competition requirements. Any unchecked box disqualifies the project from the competition but can still be scored:	<input type="checkbox"/>
No commercial bubble-blowing parts	<input type="checkbox"/>
Recipe submitted	<input type="checkbox"/>
Automatically powered by one power source	<input type="checkbox"/>
Continuously and automatically operates for 1 minute	<input type="checkbox"/>
Bubbles detach from the machine (no drooling)	<input type="checkbox"/>
Poster includes all research components	<input type="checkbox"/>
Alters Bubble Size (e.g. small to large)	/5
Alters Bubble Frequency (e.g. slow to fast)	/5
Bubble Volume (number of bubbles within 1 minute)	/10
Creativity in Concept (e.g. patent research, music, lights)	/10
Power source is other than commercial electrochemical batteries	/15
Craftsmanship (professional appearance and presentation)	/20
Total Points	/55