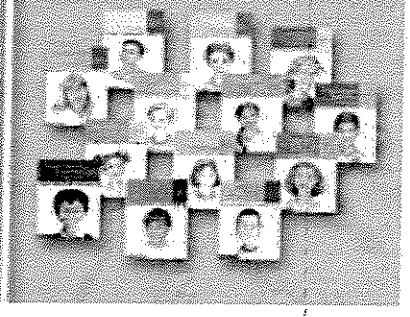
Engineering is Elementary

Problem Solving, Inquiry, and Innovation



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Engineering Design Process

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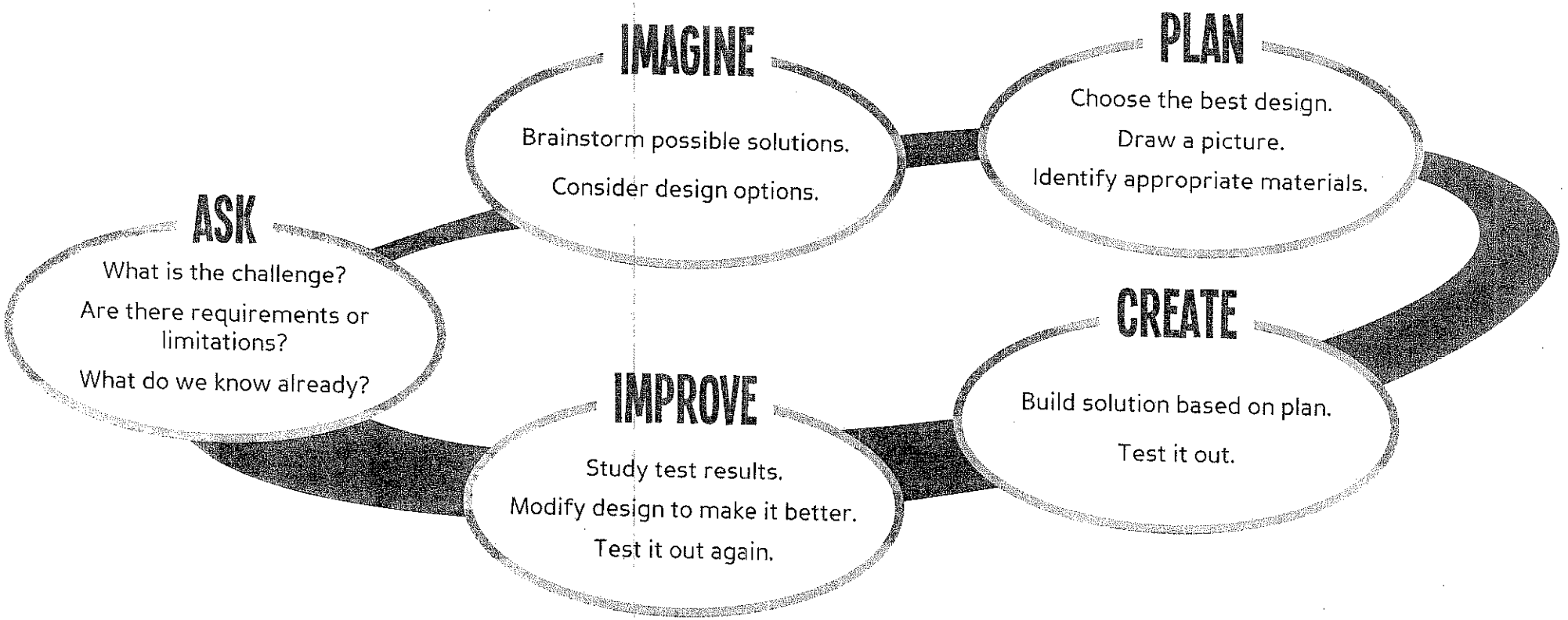

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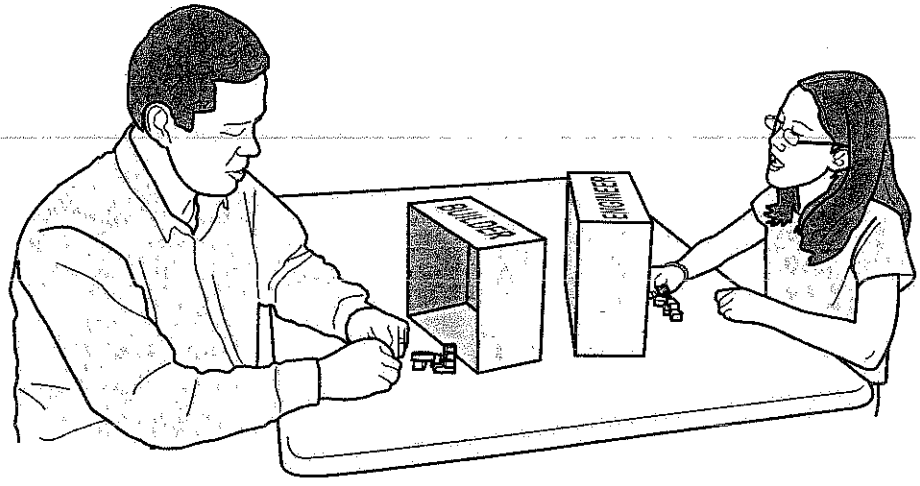
Exploring Engineering at Home:
Tips for Parents and Other Adult Caregivers

Encourage and support an interest in engineering

By showing an interest yourself, you'll build a positive attitude toward engineering in your children. Help them explore engineering on the Internet, find books or magazines about science and engineering at the library, watch movies or television programs that involve design and engineering, or try their hand at designing and building an invention of their own. Try out some activities from *Family Engineering* at home.



Model problem-solving strategies

Encourage children to find problems that need solving or ways of doing things that could be improved. Show them different strategies for solving problems:

- draw a picture or diagram
- talk it over with a friend or family member
- find an expert to offer advice
- break the problem down into smaller pieces
- brainstorm multiple options or approaches to a solution
- design and build a prototype for testing

Find opportunities to solve problems together as a family. Recognize when a solution or a design fails. Discuss what didn't work and how to use this experience to learn how to improve the solution.

Encourage questions

Teach children how to seek answers to their questions by reading books, using the Internet, experimenting, or taking things apart. Don't worry if you don't know the answers. Enjoy seeking out an answer with your child. Encourage children to ask good questions by posing open-ended questions yourself.

- *What happened?*
- *What should we try next?*
- *What will happen if?*
- *Can you show/tell me how this works?*

Help children "do it themselves"

Try not to simply give your children a solution or answer to a problem. Instead, encourage them to keep trying to find their own solution. Guide them with questions, hints, or clues. Let them make mistakes and correct themselves. Children who learn to work their way through problems, explore different solutions, and who learn to overcome their fear of failure become more capable and confident learners.

Support science and mathematics learning

Model a "can-do" attitude about science and math, recognizing the ways they are useful in daily life, such as counting change, predicting the weather, cooking, and fixing a flat tire on a bike. Help children develop good study habits and show an interest in what they are learning in school. Encourage participation in science and math activities outside of school, such as clubs, competitions, after-school programs, or museum classes.

Recognize the creative side of engineering

Creativity is important in engineering. Encourage your children's imaginations by providing open-ended toys, creative materials, and a safe place that allows them to design their own experiences, dream up imaginary worlds, invent interesting products, or design innovative structures.

Demonstrate how engineering improves the way we live

Take time with your child to look around and see how many items you can find that were designed by engineers. Help children see how engineered products are a part of everyday life, and that engineers design things that improve the way we live.

Challenge stereotypes about who does engineering

Find examples of female engineers or engineers from diverse cultures and backgrounds on the Internet, on television, or in your community and share these role models with your children.

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Event Planning Checklist

8-12 Weeks Ahead

- ☐ Assemble a planning committee
- ☐ Identify target audience
- ☐ Identify and secure partners and contacts necessary to reach this audience
- ☐ Identify and secure an event location
- ☐ Set event date and time—reserve rooms/space at event location
- ☐ Determine maximum number of participants event space will accommodate

4-8 Weeks Ahead

- ☐ Recruit volunteers and facilitators or schedule staff to help host the event
- ☐ Set date for a training session
- ☐ Invite engineers or engineering students to participate as career role models, volunteers, or activity facilitators
- ☐ Choose activities for event and try in advance or assign to activity facilitators
- ☐ Prepare event schedule
- ☐ Develop plan for registering families for the event—printed registration forms, call-in phone number, email, etc. Registration information should include family name, number of adults and children expected to attend, ages of children, and contact information for follow-up reminder emails or phone calls.
- ☐ Create flyer for promoting the event, with detachable form, contact phone number, or email for family registration (see *Family Engineering Event Flyer* in Appendix E)
- ☐ Conduct other event advertising such as newsletters, email blasts, posters, etc.

3-4 Weeks Ahead

- ☐ Distribute flyers to target audience
- ☐ Confirm volunteers/staff for training session and event
- ☐ Arrange childcare (if needed)
- ☐ Secure raffle prizes (if needed)

1-2 Weeks Ahead

- ☐ Finalize event schedule
- ☐ Confirm engineers/engineering students as career role models
- ☐ Conduct volunteer/staff training session. Include engineers/engineering students if available. Distribute the *Working With Families: Tips for Event Volunteers* to all volunteers/staff.
- ☐ Monitor registration numbers and conduct additional promotion if needed
- ☐ Confirm details with event location—event schedule, room set-up, sound system, trash containers, after hours access if necessary
- ☐ Organize and prepare all materials/supplies

Week of the Event

- ☐ Send reminders or place follow-up calls to pre-registered families to confirm attendance
- ☐ Confirm all volunteers/staff and engineers/engineering students career role models
- ☐ Prepare nametags for volunteers/staff and engineer/engineering student career role models
- ☐ Purchase/gather refreshments and necessary serving supplies
- ☐ Make welcome signs, directional signs, and/or event programs (if needed)
- ☐ Make copies of handouts, activity signs, activity cards, and evaluation forms
- ☐ Double check materials based on estimated audience size (always prepare for extra)
- ☐ Prepare welcome and closing comments
- ☐ Invite the media (local newspaper or television station)

Day of Event

- ☐ Use a detailed event schedule for organizing and monitoring set up, volunteer/staff orientation, event activities, and clean up (see *Sample Event Schedule* on pages 30-31)

After the Event

- ☐ Thank volunteers/staff and event location hosts
- ☐ Thank sponsors and/or donors
- ☐ Store re-usable materials, signs, and planning tools for use with your next event
- ☐ Congratulate yourself and your team on a job well done!

Event Materials Checklist

- ☐ Welcome signs and event programs
- ☐ Volunteer/staff nametags
- ☐ Additional *Working With Families* handouts (for volunteers/staff)
- ☐ Blank nametags and markers for event participants
- ☐ List of registered participants
- ☐ Sign-in sheet and pencils
- ☐ Directional signs as needed
- ☐ Refreshments
- ☐ Activity handouts
- ☐ Activity materials
- ☐ *Exploring Engineering at Home* handout (for families)
- ☐ *Family Engineering Event Feedback Forms* and pencils (for families)

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Sample Event Schedule for Multiple Small Groups Event Format

6:00 - 8:00 pm

4:00 - 5:15 pm — **Event Setup**

- ☐ *Set up crew and activity facilitators arrive*
- ☐ *Finalize table arrangement in all rooms*
- ☐ *Test sound system (if using one in large gathering area)*
- ☐ *Set up Opener activities*
- ☐ *Activity Facilitators set up individual rooms and supplies for Engineering Challenge activities*
- ☐ *Set up welcome table*
- ☐ *Set up refreshments*
- ☐ *Post welcome, directional, and room signs*

5:15 - 5:45 pm — **Event Volunteer Orientation**

- ☐ *Additional volunteers arrive*
- ☐ *Review event schedule and assign or confirm responsibilities*
- ☐ *Distribute volunteer nametags*

5:45 - 6:20 pm — **Families Arrive, Opener Activities Available**

- ☐ *Sign in and make or distribute nametags*
- ☐ *Families are assigned or sign up for Engineering Challenge activities*
- ☐ *Families interact with Opener activities*
- ☐ *Refreshments available*

6:20 - 6:30 pm — **Welcome and Introductions**

Engineer/Career Role Model Presentations (optional)

6:30 - 7:50 pm — **Engineering Challenge Activities**

Multiple activity facilitators lead 30-40 minute activities for small groups of 20-30 participants in separate rooms. After 30-40 minutes, families rotate to a second activity room.

6:30– 7:10 pm	Engineering Challenge Session One
7:15 -7:55 pm	Engineering Challenge Session Two

7:55 - 8:00 pm — **Wrap Up (completed by activity facilitator in final activity room)**

- ☐ *Ask families to complete evaluation forms*
- ☐ *Thank sponsors, families, and volunteers*
- ☐ *Encourage continued engineering exploration at home*
- ☐ *Distribute Exploring Engineering at Home handout*
- ☐ *Raffle prizes (optional)*

8:00 - 8:30 pm — **Event Cleanup**

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Event Sign-In Sheet

Family Name	List number of children in each grade level									Number of Adults
	PK	K	1st	2nd	3rd	4th	5th	6th	7th-8th	
1.										
2.										
3.										
4.										
5.										
6.										
7.										
8.										
9.										
10.										
11.										
12.										
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22.										
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24.										
25.										

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Working With Families: Tips for Family Engineering Event Volunteers

As a member of the Family Engineering event team, you play an important role in engaging families in a positive and meaningful experience with engineering. Here are some tips and guidelines to help you make engineering accessible, interesting, and fun for families.

Be welcoming and friendly

Smile and interact with families to help them feel relaxed and comfortable.

Promote family interaction and involvement

Invite the whole family to work together by encouraging parents to join their children in doing the activities. Watch out for adults who "take over" during an activity and encourage families to involve all family members.

Allow families to explore and discover on their own

Try not to show or tell families how to complete an activity. Use encouragement, questions, and hints to help them explore on their own.

Ask questions

If families are stuck, confused, or just need a little encouragement, ask questions to get them back on track. Spark their creativity, help them problem-solve, or try a new approach by using the following questions.

- *What do you think will happen?*
- *What is happening?*
- *What could you do next?*
- *What is the problem you are trying to solve? What is your goal?*
- *Is there another way to think about this problem?*
- *What information do you have? What additional information do you need?*
- *How could you change your design?*
- *Would you like to try it another way?*
- *Would you like to explore how other families are approaching this challenge?*

Be enthusiastic and positive about engineering

Promote engineering as an exciting field that everyone can explore.

Make connections to engineering

Help families recognize how the activities connect engineering to their everyday lives. Point out when they are doing things that engineers do, such as problem-solving or using the engineering design process.

Share your experiences with engineering

Share with families how your own life is involved with engineering. If you are an engineer, what got you interested in engineering, what do you do in your daily work, and what do you enjoy about your job? If you are not an engineer, how do you interact with engineering and why do you think engineering is important?

Enjoy yourself!

Relax and have fun interacting with the families.

Thanks for helping to make the Family Engineering event a success!

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Working With Families: Tips for Engineers

A Family Engineering event is a great opportunity to inspire children and their parents and increase their interest in engineering and engineering careers. As a role model, you can bring engineering to life for families and help them see engineering as a rewarding and accessible career option. During the event, talk to families about what you do and what you like about engineering. Ask them about their own interests and, if possible, make personal connections to engineering. Most importantly, have fun and help families have a positive experience with engineering!

Messages to keep in mind while interacting with families

- Engineers are creative problem-solvers and contribute to society in meaningful ways.
- There are many different fields of engineering.
- Engineering, and the products of engineering, are parts of everyday life.
- Communication, teamwork, creativity, and problem solving are important skills in engineering. Point out when families are using these skills.
- Point out when families are engaging in the engineering design process (Ask, Imagine, Plan, Create, Improve).

Tips for engineers serving as guest presenters/speakers at a Family Engineering event

- Provide a brief, non-technical description of your work.
- Describe how your work relates to the everyday lives of families or how your work helps others.
- Discuss what you enjoy about your work.
- Tell families how you got interested in engineering and how you prepared for your career.
- Bring along any special tools, equipment, or interesting attire used in your work.
- Limit your comments to 5-10 minutes. Allow time for a few questions from families.

Frequently asked career questions

- What is it like to be a _____?
- Can you describe a typical day at your job?
- How much do you make? (Providing a range for starting or mid-career salaries is best.)
- How much schooling is required to become an engineer? What classes helped prepare you for a career in engineering? (math, science, writing, public speaking, computer science)
- What advice would you give someone entering the engineering field?
- What is your favorite project/product that you have been involved with?
- Can you describe a problem you have solved or are trying to solve at work?
- How does your job reward you? (opportunities to learn, travel, helping others, etc.)
- What skills besides engineering are important to your work? (communication, teamwork, creativity)
- When you were young, what did you like to do that stimulated an interest in engineering? (design/build things, take things apart)
- What did you learn in elementary school that is useful in your engineering career?
- What do you do in your free time? What are your hobbies?

Thanks for helping to make the Family Engineering event a success!
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Event Feedback Form

We are always interested in improving our Family Engineering events.
Please circle the number that best describes your family's response to each of the statements below:

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1. Our family enjoyed the event.	1	2	3	4	5
2. The event encouraged our family to work together.	1	2	3	4	5
3. We have a better understanding of how engineering impacts our daily lives.	1	2	3	4	5
4. We would recommend Family Engineering to friends.	1	2	3	4	5

5. Share something your family learned about engineering.

6. How could the Family Engineering event be improved?

7. Anything else you want us to know?

Write additional comments on the back. Thank You!

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Write additional comments on the back. Thank You!

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Please join us for

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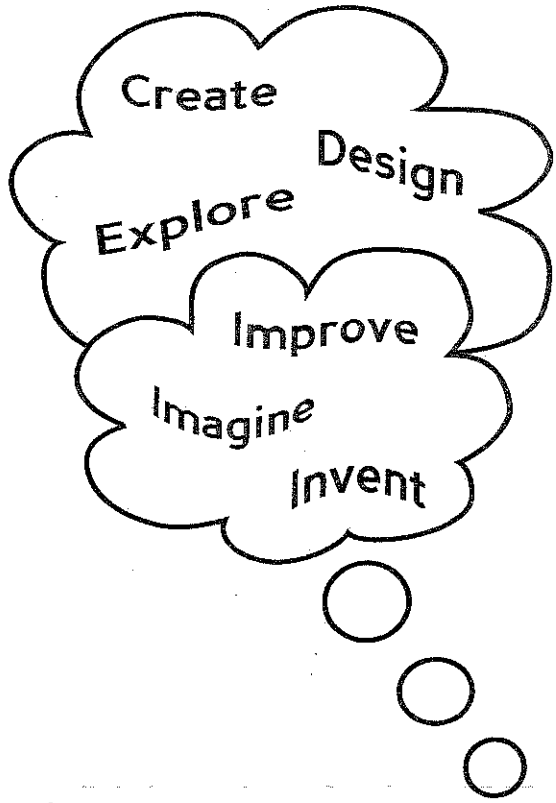


Hosted by:

Discover the fun of engineering through hands-on activities for the whole family!

Date: **Time:**

Place:

- **Children ages 7-12 and their families explore engineering together!**
- **Have fun with your family!**
- **Free admission. Snacks!**

For more information, contact: _____

To register, fill in the form below and return to:

_____ by _____

Yes! Sign us up for Family Engineering!

Last Name: _____

Number of Adults: _____

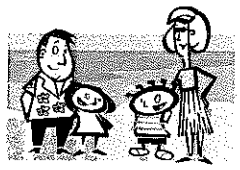
Number of Children: _____ Ages of Children: _____ _____ _____ _____ _____

Phone Number: _____ Email: _____

WELCOME TO FAMILY ENGINEERING NIGHT AT JOHN MARSHALL UPPER ELEMENTARY

****

- Families will attend **THREE 25-minute** activities from **6:05-6:30 pm,** and **6:35-7:00 pm, 7:05-7:30pm.**
- Families will attend activities together. Students will wear a name tag with a colored dot to indicate the schedule of activities that their family will attend.



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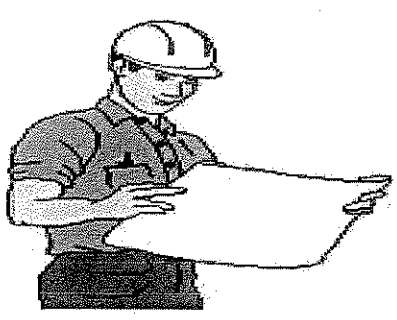
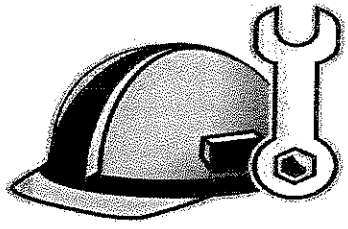
Family **Engineering** Night Activity Schedule

	1st Activity 6:05-6:30	2nd Activity 6:35-7:00	3rd Activity 7:05-7:30
Blue Group	Brain Savor Room: 111	Engineering Activity Stations (on your own) Location: Small Gym	Team Up Room : 110
Pink Group	Team Up Room: 110	Engineering Activity Stations (on your own) Location: Small Gym	Brain Savor Room: 111
Red Group	Launcher Room: 108	Mining for Chocolate Room: 109	Engineering Activity Stations (on your own) Location: Small Gym
Orange Group	Mining For Chocolate Room: 109	Launcher Room: 108	Engineering Activity Stations (on your own) Location: Small Gym
Yellow Group	Engineering Activity Stations (on your own) Location: Small Gym	Assembly Line Room: 105	Engineering Charades Room: 107
Green Group	Engineering Activity Stations (on your own) Location: Small Gym	Engineering Charades Room: 107	Assembly Line Room: 105





~OVER~

Engineering Challenge Activity Descriptions

Brain Saver Room 111

Why do we need to wear helmets for some activities? Pretend your brain is an egg and design a helmet that will protect your egg (head) in a crash.

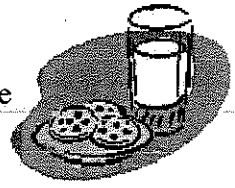
Team Up Room 110

Families "team up" to build a structure using only their collective creativity, effective communication skills, and pipe cleaners.

Launcher Room 108

Launchers work by storing potential energy and then releasing it as kinetic energy (energy of motion) which is used to propel an object. In this activity, families will design their own "launchers".

Mining for Chocolate Room 109



We use minerals for nearly everything. Is it possible to mine the Earth and still keep the Earth healthy for plants and animals, and growing the food we need? Families will attempt to extract the valuable minerals (chocolate chips!) from a cookie while trying to minimize their "environmental impact."

Assembly Line Room 105

How quickly can a team of engineers assemble a product? Family members will reverse engineer a ballpoint pen to discover how it was designed and assembled. Then, working as a team, they will create an assembly line to re-assemble all of their ballpoint pens in the least amount of time.

Engineering Charades Room 107

This game will introduce families to a variety of engineering fields and careers, and helps them recognize that many familiar objects we use every day are, in fact, engineered.

Engineering Activity Stations in the Small Gym

1. All the right tools	7. Inspired by Nature
2. Arches	8. Make it Loud
3. Boxing Beans	9. Shifting Shapes
4. Domino Diving Board	10. Solid Ground
5. Let's Communicate	11. Who Engineered It?
6. Glue is the Clue	12. Your Foot, My Foot