NASA is looking for safe landing sites on the moon.

Once they find one, they need to design and build a spacecraft that can land there without injuring astronauts or damaging the spacecraft.

Today YOU will make a lander- a spacecraft that can land safely when you drop it on the floor.

As you test, you'll find ways to make it work better.

Improving a design based on testing is called the engineering design process.

But first...

Aug 26-6:14 AM

Place this document (also located on mrsmorin.weebly.com) in your science notebook. Use the CER model when writing conclusions to labs and other science writing. The RUBRIC considers the thoroughness and accuracy of your responses.

Claim – Evidence – Reasoning Model Front

Claim:
This is a statement of your understanding about a phenomenon or the results of an investigation that answers the original question and expresses what you are trying to help an audience understand and believe.

Evidence:
Cite data, observations and/or reports of empirical research others have done that support your claim.

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Reasoning:
Explain how the evidence correctly supports your claim. Describe the scientific knowledge, theory, or scientific principle that applies to a particular claim and evidence.

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Mrs. Morin's Policies and Procedures Back

WRITTEN SCIENCE WORK RUBRIC

LEVEL 3
There is evidence in this response that the student has a *full and complete understanding* of the question or problem.
- The supporting scientific evidence is complete and demonstrates a full integration of scientific concepts, principles, and/or skills.
- The response reflects a complete synthesis of information, such as data, cause-effect relationships, or other collected evidence.
- The accurate use of scientific terminology strengthens the response.
- An effective application of the concept to a practical problem or real-world situation reveals a complete understanding of the scientific principles. *

LEVEL 2
There is evidence in this response that the student has a *general understanding* of the question or problem.
- The supporting scientific evidence is generally complete with some integration of scientific concepts, principles, and/or skills.
- The response reflects some synthesis of information, such as data, cause-effect relationships, or other collected evidence.
- The accurate use of scientific terminology is present in the response.
- An application of the concept to a practical problem or real-world situation reveals a general understanding of the scientific principles. *

LEVEL 1
There is evidence in this response that the student has *minimal understanding* of the question or problem.
- The supporting scientific evidence is minimal.
- The response provides little or no synthesis of information, such as data, cause-effect relationships, or other collected evidence.
- The accurate use of scientific terminology may not be present in the response.
- An application, if attempted, is minimal. *

LEVEL 0
There is evidence that the student has *no understanding* of the question or problem.
- The response is completely incorrect or irrelevant or there is no response.

**On the Maryland School Assessment, the application of a concept to a practical problem or real-world situation will be scored when it is required in the response and requested in the item stem.*

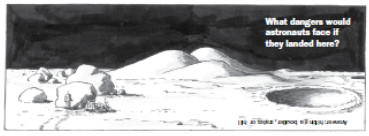
Aug 29-9:23 PM

The Challenge Handout (one at each table):

A NASA/DESIGN SQUAD CHALLENGE

TOUCHDOWN

Landing on the moon is tricky. First, since a spacecraft can go as fast as 18,000 miles per hour (29,000 km/hour) on its way to the moon, it needs to slow way down. Then it needs to land gently. That lander has astronauts inside, not crash-test dummies. Easy does it!



as built on TV.

MATERIALS (per lander)
- 1 piece of stiff paper or cardboard (approximately 4 x 5 in/10 x 13 cm)
- 1 small paper or plastic cup
- 3 index cards (3 x 5 in/8 x 13 cm)
- 2 regular marshmallows
- 10 miniature marshmallows
- 3 rubber bands
- 8 plastic straws
- scissors
- tape

WE CHALLENGE YOU TO...

...design and build a shock-absorbing system that will protect two "astronauts" when they land.

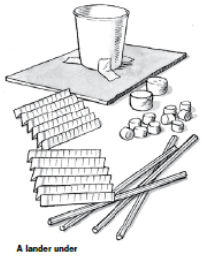
BRAINSTORM AND DESIGN

Think about how to build a spacecraft that can absorb the shock of a landing.

- What kind of shock absorber can you make from these materials that can help soften a landing?
- How will you make sure the lander doesn't tip over as it falls through the air?

BUILD

1. **First, design a shock-absorbing system.** Think springs and cushions.
2. **Then, put your spacecraft together.** Attach the shock absorbers to the cardboard platform.
3. **Finally, add a cabin for the astronauts.** Tape the cup to the platform. Put two astronauts (the large marshmallows) in it. (NOTE: The cup has to stay open—no lids!)



A lander under construction

TEST, EVALUATE, AND REDESIGN

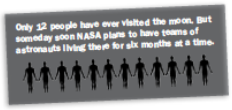
Ready to test? Drop your lander from a height of one foot (30 cm). If the "astronauts" bounce out, figure out ways to improve your design. Study any problems and redesign. For example, if your spacecraft:

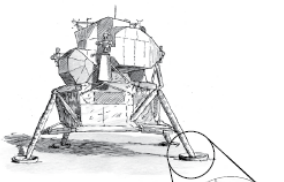
- **tips over as it falls through the air**—Make sure it's level when you release it. Also check that the cup is centered on the cardboard. Finally, check that the weight is evenly distributed.
- **bounces the astronauts out of the cup**—Add soft pads or change the number or position of the shock absorbers. Also, make the springs less springy so they don't bounce the astronauts out.

Check out NASA's moon missions at moon.msfc.nasa.gov.

THE COOLEST JOB AT NASA

When people asked Cathy Peddie what she wanted to do when she grew up, she would point at the sky and say, "I want to work up there!" Now an engineer at NASA, she manages the Lunar Reconnaissance Orbiter (LRO) project. She calls it "the coolest job at NASA." LRO will orbit the moon for at least a year and collect information to help NASA prepare for having people live and work there. Hear her describe the mission at: **learners.gsfc.nasa.gov/mediaviewer/LRO.**





BURIED ALIVE?

The first people who landed on the moon took a big risk. That's because the moon is covered with a thick layer of fine dust. No one knew how deep or soft this layer was. Would a spacecraft sink out of sight when it landed? Now we know—the layer is firm. In the picture, you can see that Apollo 11's lander pads sank only about 2 inches (5 cm) into the dust. What a relief! This helped NASA figure out the kinds of shock absorbers and landing systems its spacecraft need.

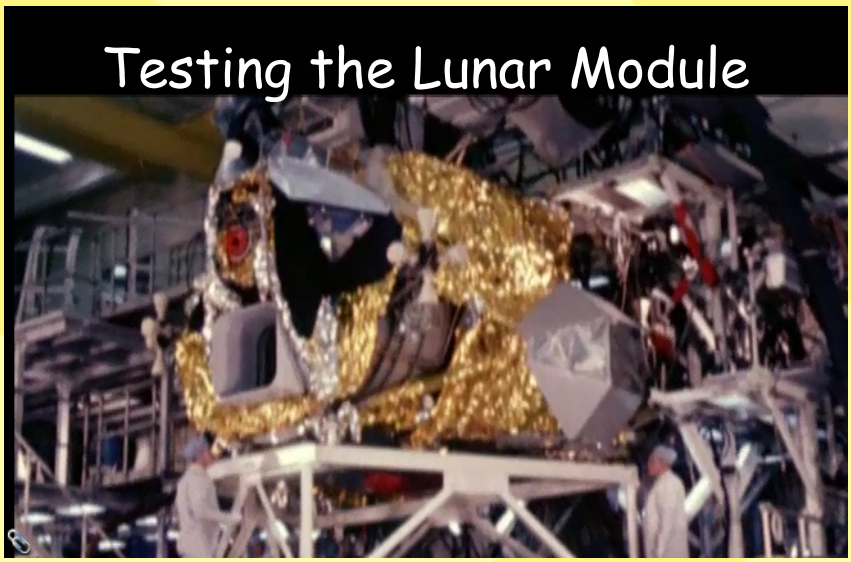
Watch DESIGN SQUAD on PBS or online at pbs.org/designsquad.

For more information about NASA missions and educational programs, visit nasa.gov.

A copy may be found on HAC and mrsmorin.weebly.com

Aug 26-6:14 AM

Before you begin, please watch this short video clip:



Aug 29-7:58 PM

Now, let's go over the handout together.

A NASA/DESIGN SQUAD CHALLENGE

TOUCHDOWN

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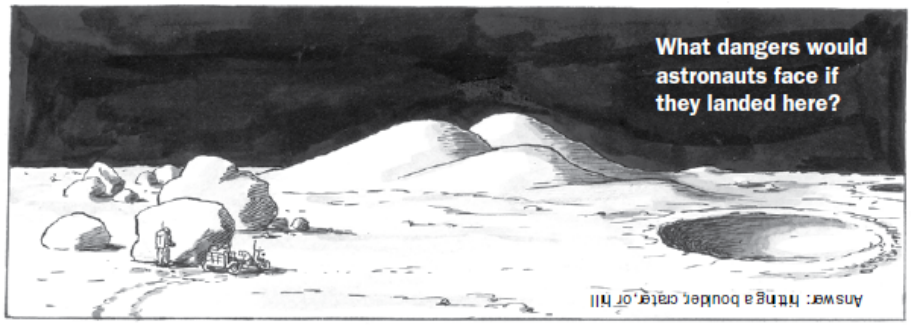


Aug 26-6:14 AM

WE CHALLENGE YOU TO...

...design and build a shock-absorbing system that will protect two "astronauts" when they land.

BRAINSTORM AND DESIGN

Think about how to build a spacecraft that can absorb the shock of a landing.

- What kind of shock absorber can you make from these materials that can help soften a landing?
- How will you make sure the lander doesn't tip over as it falls through the air?

Time Limit: 10 minutes

Aug 26-6:14 AM

Carefully consider the materials you have available to build your lunar-lander and their properties.

MATERIALS (per lander)

- 1 piece of stiff paper or cardboard (approximately 3½ x 4¼ inches)
- 1 small paper or plastic cup
- 3 index cards (3 x 5 in/8 x 13 cm)
- 2 regular marshmallows
- 10 miniature marshmallows
- 3 rubber bands
- 8 plastic straws
- scissors
- tape

METER stick

Answer these questions in your Science notebook:

- What kind of shock absorber can you make from these materials that can help soften a landing?
- How will you make sure the lander doesn't tip over as it falls through the air?

Aug 26-6:14 AM

Consider the following ideas; think of your own.

When you jump off a high step, you bend your back and knees to absorb some of the energy and break your fall.

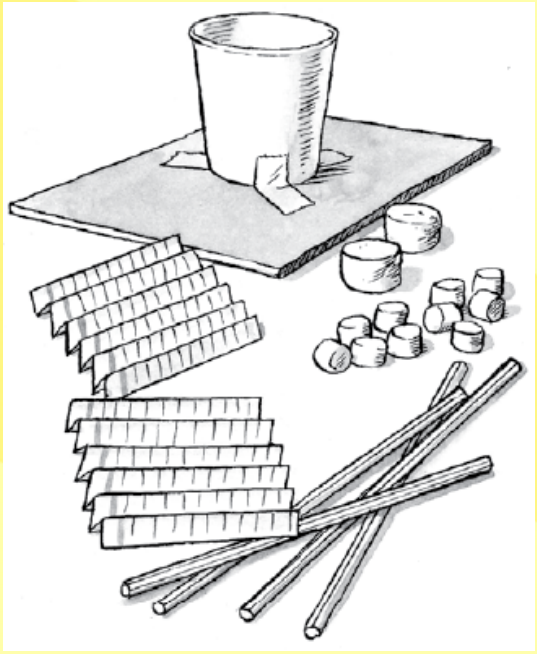
That's what a shock absorber does - absorbs the energy of an impact.

Soft things, like marshmallows, cotton balls, foam, and bubble wrap absorb shock well.

You can also use paper, like this index card made into a spring by folding it like an accordion.

As a group, you decide how to use the available materials.

Aug 26-6:14 AM



A lander under construction

Student #1 at each table will pick up the group's materials from the student table.

Each zipper bag contains the materials shown to the left.

Meter stick (to test your module at height) and scissors are in red containers at the student table; tape dispensers are there as well. One each per group please.

Aug 29-7:44 PM

TEST, EVALUATE, AND REDESIGN

ONE METER

Ready to test? Drop your lander from a height of [redacted]. If the "astronauts" bounce out, figure out ways to improve your design. Study any problems and redesign. For example, if your spacecraft:

- **tips over as it falls through the air**—Make sure it's level when you release it. Also check that the cup is centered on the cardboard. Finally, check that the weight is evenly distributed.
- **bounces the astronauts out of the cup**—Add soft pads or change the number or position of the shock absorbers. Also, make the springs less springy so they don't bounce the astronauts out.

Time Limit: 20 Minutes

Aug 29-7:44 PM

THE COOLEST JOB AT NASA

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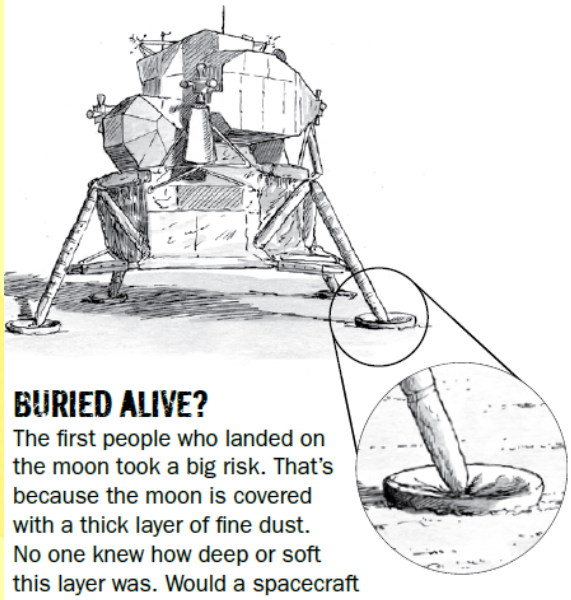

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Aug 29-9:19 PM

Let's have a little healthy competition! Remember, the goal is that Buzz and Neil survive the lunar landing. They only get ONE chance!

Each group describes the process that led to their final design (the properties of the materials you used to your advantage).

No more than ~~2~~ 1 minutes per group.

Then, drop your lunar-lander from 100 cm (1 meter).

I will record 2 deaths, one death or no deaths.

We then will have a discussion.

Aug 29-9:57 PM

12A T4 1d; T1 1d; T2 1d; T6 Ød; T3 0d; T5 0d

36A T5 2d; T1 t; T4 Ød; T3 Ød; T6 Ød; T2 Ød

78A T4 Ød; T6 Ød; T5 0d; T2 t; T3 t; T1 0d

12B T6 Ød; T2 Ød; T3 t; T5 Ød; T1 Ød; T3 i

36B T5 t; T1 it; T3 2d; T6 t; T4 Ød; T2 1d

78B T4 i; T6 t; T5 t; T2 1d; T3 t; T3 t

0d = no deaths
t = tipped over i = injury

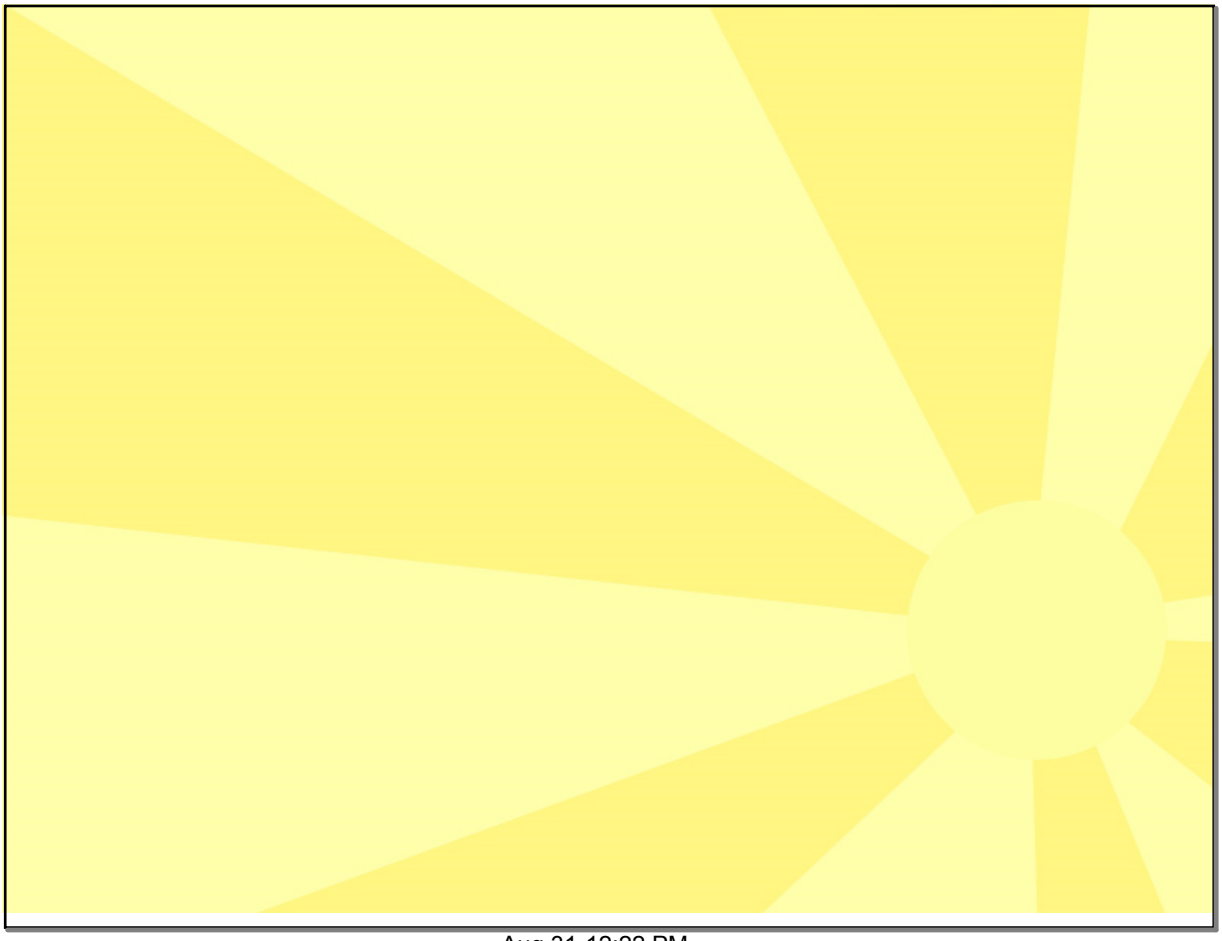
Aug 30-8:33 AM

Carousel Discussion Activity

Group 1: What design features helped make lunar modules successful (no deaths)?
Group 2: What design considerations were flawed?
Group 3: What team strategies guaranteed success.
Group 4: What team behaviors guaranteed success.
Group 5: What individual strategies contributed to the team effort?
Group 6: What individual behaviors contributed to the team effort?

Each group:
1) BRAINSTORMS, then answers the question on their poster paper (3 minutes) using the color assigned to them. Your color follows you.
2) Each group then rotates the each other group's discussions (clockwise) and either ADDS comments or stars/circles ideas already stated to which they agree (1 minute each).
3) End up at your original question and pick the three you consider the best by consensus (time remaining). Circle them.

Aug 29-9:19 PM



Aug 31-12:22 PM

Attachments

WWLE_Landing the Eagle_F_2Mb.mp4