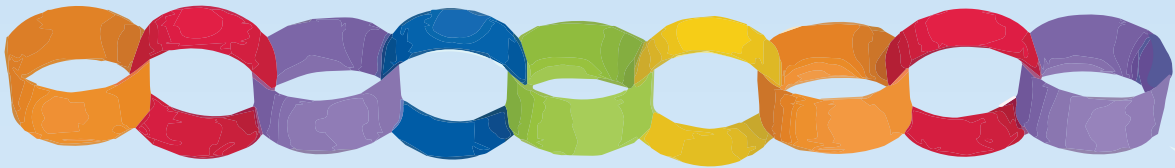




AT-HOME SCIENCE LEARNING



#10 PAPER CHALLENGES



This project is funded by the California Collaborative for Educational Excellence
in collaboration with the Office of the Fresno County Superintendent of Schools.

FOR THE TEACHER:

AT-HOME SCIENCE LEARNING

#10 PAPER CHALLENGES



Quick synopsis:

A simple piece of paper can be used for many different engineering challenges. Explore different ways to solve problems using prior knowledge, creativity, and perseverance.



Science Standards:

K-5

- **Engineering: Optimizing the Design Solution.** Because there is always more than one possible solution to a problem, it is useful to compare and test designs.
- **Crosscutting Concept: Structure and Function.** The shape and stability of structures of natural and designed objects are related to their function(s).



Connections to additional content standards:

MATH: Counting, measuring, comparing (more than, less than, equal to).

ELD: Standards Part I: Exchanging information with others, interacting with others in a variety of forms, offering and supporting opinions, adapting language choices.



Suggestions and Tips:

- Each activity is designed to take 15–30 minutes to complete.
- Share this unit with families by printing out a “Parent Guide” and “Student Journal” for each student (or you can share digitally). Give families a week or two to complete. Students can bring back their science journals to share their learning experiences with the class.
- Send an email or cover letter to families when sending out this At-Home Science Learning Unit. Suggestions for the wording you can include:

Parents, you are your children's first and most important teachers! “At-Home Science Learning” is about you and your children exploring science in fun, hands-on ways while supporting the learning happening in the classroom. Use the “Parent Guide” to help you support your children through the activities. Each activity is designed to take 15 – 30 minutes. Get your whole family involved!



Materials/Supplies:

- Electronic device connected to the internet to watch videos and play games.
- Many pieces of plain paper or construction paper, tape, scissors, ruler or measuring tape, pennies, a few thick books or blocks.
- Copy of the “Student Science Journal” and a pencil.
- Optional supplies: colored pencils or crayons.



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FOR THE PARENT:

#10 PAPER CHALLENGES

Overview: A simple piece of paper can be used for many different engineering challenges. Explore different ways to solve problems using prior knowledge, creativity, and perseverance.



Materials/Supplies:

- Electronic device connected to the internet to watch videos and play games.
- Many pieces of plain paper or construction paper, tape, scissors, ruler or measuring tape, pennies, a few thick books or blocks.
- Copy of the “Student Science Journal” and a pencil.
- Optional supplies: colored pencils or crayons.

Each of the activities is designed to take 15–30 Minutes.

Activity 1: Challenge #1 – Longest Chain

1. For this challenge, each person will need 1 piece of paper, a pair of scissors, and some tape (or stapler). If you have a young child, partner them with an older sibling or adult to do the cutting part of this activity.
2. The goal of this challenge is to make the longest paper chain using only one piece of paper. Using the scissors, cut the paper into strips and use tape or staples to secure the paper loops together to create the links of the chain (see image).
3. When everyone is done making their paper chain, lay the chains next to each other to see who made the longest chain!
4. Have your child go to their Science Journal – Activity 1 section. Help your child answer the questions.
 - a. If you have a measuring tape or ruler, help your child measure the length of their chain.
 - b. Count and record the number of links in each person’s chain. Make comparisons between the paper chains by using “less than,” “more than,” and “equal to” ($<$ $>$ $=$)
 - a. For example,
 - i. “My chain has fewer links than _____’s chain.”
 - ii. “_____’s chain has more links than _____’s chain.”
 - iii. “_____’s chain is equal to _____’s chain.”
 - c. Add all of the links together from all of the chains.
 - d. Estimate how many pieces of paper it would take to make a chain as long as the room using the type of chain your child made. Test it out!



Activity 2: Story

1. Listen to this book titled “Rosie Revere, Engineer” by using your electronic device to access this link: tinyurl.com/book-engineer.
2. After listening to the story, have your child go to their Science Journal – Activity 2 section and record what they learned from the story. As you and your child complete the remaining challenges, remind your child that failure is okay as that is how we learn to make things better and to not get frustrated, just keep trying! Encourage your child to tell you their response before they write it. If they need help answering using complete sentences, you can give them some sentence starters to help them begin. For example,
 - a. Rosie wanted...
 - b. Rosie’s first design...
 - c. Rosies’s aunt said...

Activity 3: Challenge #2 – Tallest Tower

1. Decide if each member of your family will work individually or split into teams. For this challenge, each person or team will need 10 pieces of paper and a solid, flat surface (preferably the floor).
2. The goal of this challenge is to make the tallest tower using 10 pieces of paper. You can fold and tear the paper in any way you would like but you cannot use any other supplies (no tape, no staples).
3. After each person (or team) has had a chance to create their tower, compare the heights. Have your child go to their Science Journal – Activity 3 section and record the results.
4. If you have a ruler or measuring tape, help your child measure the height of each tower and record it in their journal. Your child can also draw a sketch of their tower and compare the different structures of their tower and why that structure worked or didn’t work.
5. Ask your child: What was the most difficult part of this challenge? How did you overcome that challenge?

Activity 4: Be an Engineer

1. Tell your child that building towers and other structures requires understanding science. A person who does this is called an “Engineer.” To understand more about what an engineer does, watch this short video by using your electronic device to access this link: tinyurl.com/video-engineer.
2. After watching the video, have your child go to their Science Journal – Activity 4 section and record what they learned. Your child can rewatch the video to look for the answers to these questions:
 - a. What is an engineer?
 - a. Answer: Engineers design and build things that solve problems
 - a. What are the 3 questions engineers ask?
 - a. What is the problem?
 - b. Who has the problem?
 - c. Why is this important?
 - a. What are the different types of engineers?
 - a. Civil engineer
 - b. Mechanical engineer
 - c. Electrical engineer
 - d. Software engineer
 - e. Aerospace engineer

Activity 5: Challenge #3 – Strongest Bridge

1. For this challenge, each person (or team) will need 2 pieces of paper, two stacks of books or blocks that are about 2-inches in height, tape, and lots of pennies.
2. Set up your books about 8-inches apart on a flat surface like on the floor or a table. Place one piece of paper between the two books (see image). The ends of the paper should be touching each stack of books, without sagging down and touching the table.
3. Have your child add pennies, one at a time, to the center of the paper. Count how many pennies it takes before the “paper bridge” collapses, or the pennies fall off one of the sides. Have your child record how many pennies the bridge held before falling in their Science Journal – Activity 5 section.
4. The goal for this challenge is to create a bridge that holds the most pennies using just paper. As your child has discovered, a flat piece of paper doesn’t hold much weight so encourage your child to think about ways they can fold the paper or combine the two pieces of paper to make a stronger bridge. They can use tape to keep the paper together if needed but cannot tape the paper to the books. Partner up younger children with an older sibling or adult and have a competition to see who can create a bridge that holds the most weight (the most pennies)!
5. Give your child opportunities to test and redesign their bridge to see if they can improve their design. Have your child record their results and answer the questions in their science journal.
 - a. Did your new bridge hold more pennies than the first one? If so, why do you think it was stronger? If not, what do you think went wrong?
 - b. What if you could use materials other than paper? What materials would you want to use to build your bridge?



Continue encouraging your child to respond to you before they write their responses and encouraging them to share using complete sentences. If they need help getting started, you can give them some sentence starters. For example,

- a. My new bridge was (weaker/stronger) because...
 - b. I think this is because...
 - c. I would want to use...
 - d. I think this would help because...
5. Optional: To understand more about real bridge engineering, use your electronic device to watch this video: tinyurl.com/video-bridges.



Activity 6: Challenge #4 – Farthest Flying Airplane

1. For this challenge, each person will need a piece of paper (a ruler or measuring tape is optional).
2. The goal for this challenge is to build a paper airplane that flies as far as possible.
3. Give each person a piece of paper and fold it to create an airplane. If you or your child needs some guidance, use one of the following resources:
 - a. Use this website to see 5 different ways you can fold a paper airplane:
tinyurl.com/video-paperairplane
 - b. Watch this video to get instructions on how to fold a basic paper airplane:
tinyurl.com/5paperairplanes
4. Test your paper airplane! Have everyone stand at a specific spot outside and throw their planes. Observe the flight of the plane – Does it fly straight? Does it curve up or down? Does it spin? Have your child go to their Science Journal – Activity 6 section and record their observations of their paper airplane’s flight. Also, have your child record whose plane went the farthest. Continue encouraging them to share with you before they write their responses. Optional: If you have a measuring tape or ruler, help your child measure the distance of each person’s airplane from the starting point to where the airplane landed.
5. Give everyone an opportunity to make a change to their airplane (refold, flatten, bend a wing, add a paperclip, change how you throw it, etc.) Test your airplanes again. Have your child record their observations and results in their science journal.
6. Continue redesigning the airplane and testing its flight until everyone is successful in creating a paper airplane that flies well. Help your child answer the questions in their science journal.
7. Optional: Create a “target” by using another piece of paper or other object from around the house or yard. The goal is to get your paper airplane to land as close to the “target” as possible.
8. Another option: Play this online game, Paper Flight www.crazygames.com/game/paper-flight.



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AT-HOME SCIENCE LEARNING

#10 PAPER CHALLENGES

NAME: _____



Activity 1: Challenge #1 – Longest Chain

Name	Number of links	Total length of chain

Compare the chain you made with the other chains.

Can you complete any of these sentences?

My chain has fewer links than _____'s chain.

_____ 's chain has more links than _____'s chain.

_____ 's chain is equal to _____'s chain.

If I add up the links in all of the chains created, there are _____ links.

I think it would take _____ pieces of paper to make a chain like mine as long as the room. Now TRY IT! Describe what happened.



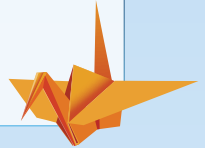
Activity 2: Story

After listening to the story, draw  or write  your answers to these questions:

What did Rosie want to create for her aunt?

What happened with Rosie's first design and test?

What did Rosie's aunt say about failure?



Activity 3: Challenge #2 – Tallest Tower

NAME	HEIGHT OF TOWER

After building our towers, _____ had the tallest tower.

The hardest part of this challenge was...





Activity 4: Be an Engineer

After watching the video, draw  or write  your responses to these questions:

1. What is an ENGINEER?

2. What are the 3 questions engineers ask?

3. What are the names of the different types of engineers and what do they do?

Engineer	What do they do?



Activity 5: Challenge #3 – Strongest Bridge



Record how many pennies your bridge was able to hold in this chart:

Paper Bridge Draw  or describe  your bridge	How many pennies did it hold?
Flat piece of paper	
Bridge #1 (first try)	
Bridge #2 (second try)	

Bridge #_____ was the strongest bridge.

I know this because...

Why do you think this bridge was stronger than your other bridges?



If I could build a bridge with a different material other than paper, I would use _____ because...



Activity 6: Challenge #4–Farthest Flying Airplane

When I flew my paper airplane the first time, this is what I noticed...

Record the name and distance for each person's airplane in this chart:

Name	The distance the airplane flew

Redesign your plane and test it again.

My paper airplane flew _____ compared to the first time. I think this happened because...



Draw your final paper airplane design here:

