S.T.E.M. Challenge

Standing Strong

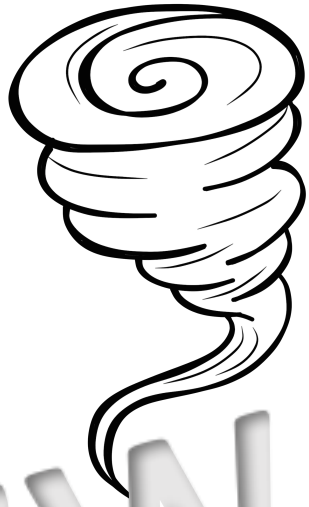
Designing Structures that can withstand Severe Weather

Created By The Owl Teacher

Materials

Materials (per group)

- "You're Hired" sheet
- "House Building Permit"
- "Standing Strong" planning sheets
- Recycled Materials (see list below)



Suggested Recycled Materials

- Cardboard (flatten cereal boxes)
- Styrofoam
- Glue
- Craft sticks (large and small)
- Cardboard tubes (paper towel, toilet paper)
- Water bottles
- Paperclips (large and small)
- Skewers
- Clothespins
- Rubber bands
- Plastic spoons
- Paper and plastic cups
- Tape (any type)
- Index cards
- String
- Paper plates
- Aluminum foil
- Pie tins

A note about the "severe weather" during this STEM Challenge

You can decide if you want to specifically label the severe weather as a tornado, hurricane, or thunderstorm. I did this based off of your region and class' knowledge. When testing the structures, you can use a high powered fan, a blow dryer, or for full effect, a leaf blower. However, if you choose to use a leaf blower, make sure that you are in a large open space, such as a gym or outdoors. Start from a bit of a distance (as any storm would be) and more move closer gradually. You may want to test ahead of time as to which item above you would like to use to test the students' structures best.

Helpful Hints

*Utilize anchor charts and reference them frequently during these activities.
*There are some students who are very visual and tactile. I would allow them to see the materials and manipulate them while in the planning stage if desired.
*If you experience students arguing over whose turn it is, or that their idea is not being heard, consider modeling to students how to share your idea, justify it, and work together as a team. I would also demonstrate good listening skills, asking questions, and taking turns – no matter what grade they are in.
*While some STEM challenges do not require **time limits**, I suggest having them. When they are broken up over several days or students have unlimited time, students tend to get off task and talk more instead of focus on the task at hand. I recommend considering giving time limits and **frequent reminders** of the time remaining.
*It's important to allow students to **make mistakes**; if students are struggling try scaffolding instead of stepping in and telling them what to do.
*If you are experiencing groups that **cannot get along**, discuss why it is important for them to get along and work as a team. Also discuss the value of compromise.
*If you see students **feeling frustrated**, suggest they discuss the problem with members of their group, or circulate the room to other groups for help. Many times they can discuss their problems.
*Remind students of the importance of lab safety. They should never eat or drink during any science lab.

Possible Extensions

*Break it up over a few days. On day, discuss the background information and ask the question. On day 2 brainstorm and plan both individually and as a group. On day 3, create the plans and on day 4 test them and so on.
*After the STEM challenge is over, create posters or displays showing the knowledge that you learned and any data from the challenge.
*Journal or write a creative piece. This could be a piece about the day in the life of...
*Add a competition spin to it by seeing who can build the structure first with it being set according to the rules and restrictions.
*Add a challenge to see who can build their construction the fastest! Build the structure in half the time!
*Change the dimensions in the challenge. Add some restrictions such as saying that there must be a structure that is this many inches by this many inches.
*Change the dollar amounts of the items being purchased.
*Change the amount of the money students are provided with.
*Change the activity to individually instead of as a group challenge.
*Have students research the various types of severe weather and compare and contrast them, including wind speeds.
*Watch related videos on severe weather.
*Have students create safety fliers for others that live in regions of severe weather.

You're Hired!

Congratulations! You have just been hired as an engineer to design and build a structure to withstand severe weather. This could be a tornado, a thunderstorm, or even a hurricane. Severe weather often comes with powerful winds and can be very damaging! We need to build a structure that can stay standing during those storms!

1.) Create a plan on paper by yourself and sketch out your ideas to solve the severe weather problem. You may want to come up with more than one idea.

2.) After several minutes, you will meet with your team members to discuss each of your ideas. You will all need to listen to each other carefully and share why your idea is a great one!

3.) Together, as a team, you will need to pick one plan that you all feel will be successful in solving this problem. Then sketch it out on the Team Plan Sheet.

4.) After you have created a plan together as a team, you will begin building your construction to solve the problem above. Remember to work together as a team. There may be times when you will hit a "snag" and need to problem solve. This is completely normal as an engineer. Remember that "two heads are better than one" and you can do it together!

5.) Make sure that you are following the orders of the mayor. Check the permit sheet to verify as you work. Also make sure that you record all your information as you work.

6.) As you work on your construction, you will need to test it regularly to determine if your plan is working. You may need to stop and reevaluate what is working and what is not. You also may need to make adjustments or improvements. Most engineers do not get it right on the first try.

7.) When time is up, your teacher will be around to test your model. You will need to present to the class what you did, what worked, what didn't, and any other important information about your construction.

8.) Then, you will answer the questions on your reflection sheet individually.

Good luck and have fun!

House Building Permit

1.) It must be appealing. Neighbors are not going to want to look at a "trashy" building. People pay good money for their property.

2.) You only have 25 minutes total to build your construction. Timelines are realistic in the real world.

3.) You must use recycled materials.

4.) It must be less than 40 cm wide and less than 30 cm tall.

5.) It must have four walls, a roof, and a floor (base).

6.) You must use one idea from each person in your group.

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Name _____

Standing Strong

Problem: Design and build a structure that can withstand a severe storm.

Write what you know about severe weather.

Write your plan below. Include reasons why your plan is best.

Write your team's plan below. Include reasons why this plan was chosen.

Sketch the plan above here.

Sketch the plan above here.

Was your team's plan successful? Why or why not?

What problems did you encounter?

How did you solve these problems?

What would you do differently next time? Why?

What was your favorite part?

What was your least favorite part?

What did you notice about other people's structures?

Name _____

Standing Strong

	1 Point	2 Points	3 Points
Background	The student did not demonstrate the use of background knowledge in the challenge.	The student demonstrated some use of background knowledge in the challenge.	The student demonstrated the use of background knowledge in the challenge.
Planning	The student did not brainstorm ideas, and/or did not meet the design rules and requirements.	The student brainstormed some ideas, and/or meet some of the design rules and requirements.	The student brainstormed ideas, and did not meet the design rules and requirements.
Testing	The student did not problem solve, did not conduct the challenge carefully, nor recorded results accurately, and did not reflect on the successes and failures of the challenge.	The student problem solved some, conducted the challenge minimally, recorded some results, and/or reflected on some successes and failures of the challenge.	The student problem solved, conducted the challenge carefully, recorded results accurately, and reflected on successes and failures of the challenge.
Teamwork	The student did not stay on task, share responsibilities, contribute ideas, and/or respect others during the challenge.	The student stayed on task some, share responsibilities a little, contribute some ideas, and/or did not respect others during the challenge.	The student stayed on task, shared responsibilities, contributed ideas, and respected others during the challenge.
Effort and Attitude	The student did not put forth his or her best effort and/or did not maintain a determined attitude.	The student put forth some best effort and/or did maintain some of a determined attitude.	The student put forth his or her best effort and maintained a determined attitude.
Presentation	The student did not explain the ideas of the challenge well.	The student explained some of the ideas of the challenge well.	The student explained all of the ideas of the challenge well.

Comments:

Total _____ / 18

Expert Engineer: 16 - 18 pts

Skilled Engineer: 13 - 15 pts

Novice Engineer: 0 - 12 pts

Putting It Together

No matter where you live in the world, you are likely exposed to severe weather at some point. Severe weather is any kind of weather that can be destructive, which means to destroy things, or life-threatening. Most of the time the weather we experience is gentle, such as rain or snow. However, there are times that weather events can become dangerous.

There are many types of severe weather. Did you know that thunderstorms are actually considered severe? That's because a thunderstorm can produce thunder, lightning, heavy rains, and strong winds. In some cases it can even produce hail. A thunderstorm is just one kind of severe weather.

A tornado has powerful, rotating winds that form in a funnel and moves across land. It moves fast and damages most things along the way. A hurricane, or cyclone, is another type of severe weather. It is a large storm that forms over the ocean and works its way up over land. It has strong winds and heavy rain. Just like with tornadoes, hurricanes can damage, and in some cases, destroy property. Often trees will blow over and there is major flooding.

While most of these types of severe weather often occur during warmer temperatures, there are some that occur during the winter. For instance, some experience blizzards. A blizzard is a storm that has lots of snow, strong winds, cold temperatures, and sometimes ice. It becomes difficult to see and it often buries cars, plants, and buildings under snow. In some cases it has even made it difficult to open doors to buildings. Another type of severe weather that occurs in the winter is an ice storm. During an ice storm, freezing rain occurs and can cause extreme damage. Just like it sounds, everything becomes covered in ice and it becomes difficult to walk or drive. On many occasions the weight of the ice knocks down trees and power lines. This can cause damage to buildings.

In this activity, the force of wind was applied to the building you created. During severe weather, the force of wind is pushed against the outside of a building and passed along the roof to the outside walls and then to the bottom. Buildings are often destroyed when the energy from the wind is not transferred properly to the bottom of the building, as you may have discovered.

Buildings are not the only things that can be harmed during severe weather. People can also be harmed. It is best to stay away from windows when there are strong winds and stay inside with rain. During a thunderstorm, do not stand under a tree or use electrical devices. When a tornado is coming, it is best to find a basement or a flat, low place. If there is a winter storm, it is best to stay inside where you can be warm and dry.

Name _____

Severe Weather

1.) What is severe weather?

2.) Name all the types of severe weather that may have strong winds.

3.) Do you have to worry about severe weather if you live in Alaska? Explain.

4.) What kind of damage could occur during severe weather?

5.) Why do you think your building collapsed or didn't collapse?

6.) How can you protect yourself from strong winds during severe weather?