

SLIPPING UP ADVENTURE JOURNAL

TAKING ON THE
WORLD, ONE
ENGINEERING
CHALLENGE AT A TIME

PROPERTY OF THE FUTURE ENGINEER,

Sweet For The Swiss!



Hi GEERlings! I'm here in Switzerland and have fallen in love with the mountains, the snow, and the wildlife! The mountains are really awesome, and I love hiking around and seeing the sights! My parents are here working on a power plant that gives everyone their electricity, and they've asked me to help them take pictures of the plant from high up on the mountain. I love to climb, but I'm having a difficult time walking through the deep snow. Each time I take a step, I sink into the snow all the way up to my knees! There isn't deep snow down below, but once you reach a certain height, it can get really deep. Walking is very tiring! I could really use your creativity and engineering intuition to help me climb up this mountain without constantly sinking into the snow! Check out the videos I posted on my website to see more details about what it's like here in Switzerland and the problem I am facing, and let's get those GEERS moving!

Good luck,

Flynn

Instructions for GEERlings

Segment 1—Slipping Up



Hey GEERlings! Did you know the capital of Switzerland is Bern, but the largest city is actually Zurich? Pretty cool names for cities!

Inside Flynn's Supply Sack, you have items that represent things that Flynn either has available to her due to her surroundings or things she always carries with her. These will be the only items you can use to solve the problem, so make sure you use your materials wisely! Here's what you've got to work with:

Material:

What it Represents:

Rubber bands (4)

⇒ Grape vines

Dental floss (3 Long Strands)

⇒ Fishing line

Shoelaces/String (1 Lace/1 String)

⇒ Flynn's shoe laces

Binder clips (3)

⇒ Fasteners for grape vines

Combs (1)

⇒ In Flynn's Supply Sack

Paper clips (20-25)

⇒ Carabiners

Cotton swabs (10)

⇒ Small twigs

Popsicle Sticks (10)

⇒ Medium twigs

Aluminum foil (Two 4x4 Pieces)

⇒ Sun reflector

Tape (1 container)

⇒ Sap covered leaves

Pool noodle pieces (2-3)

⇒ Styrofoam from lodge

You can also use scissors to change the materials. Don't forget to make a plan on the next page! It is such an important part of the engineering design process, and it is the first step of every engineering project.

Your Challenge

Segment 1—Slipping Up



Create a sturdy device that can stop Flynn from sinking into the snow with each step she takes. Your design must stop Flynn from sinking into the snow, weigh less than two pounds, and be able to be used without Flynn's hands!

All of your ideas should be your own. Remember, Flynn can only use the materials around them, so make sure you only use the materials in your Supply Sack. Good luck, GEERlings!

Before you start working, see if you can plan what you think your solution will look like in the space below.

My solution will look like this, and I will use this much of each material:

- ___ Rubber bands
- ___ Dental floss
- ___ Shoelaces/String
- ___ Binder clips
- ___ Combs
- ___ Paper clips
- ___ Cotton swabs
- ___ Popsicle Sticks
- ___ Aluminum foil
- ___ Tape
- ___ Pool noodle pieces

Let's Engineer It!

Segment 2—Slipping Up



Flynn needs a sturdy device that keeps her from sinking into the snow so she can get to the top of the mountain. Since Flynn has done research on living in snowy regions before, her engineering intuition tells her that increasing her surface area and distributing her weight more evenly will help her in this situation.

In order to design a device that will help, there are certain concepts you must understand first, like surface area, weight distribution, and ergonomics. Your job is to answer the questions below which will help you design a snow-worthy device. You can use websites to read, watch videos, or listen to explanations of different ways to build a device that will help Flynn.



Don't forget to use the links on the growinggeers.com website to help you with your research!

Remember that you don't want to copy something down that doesn't make sense to you. Feel free to draw pictures to help you!

1. What is surface area?

2. What would you have to do to increase the surface area of an object, such as a hand or a foot?



3. What is an example of something that changes an object's surface area?

4. What is weight distribution?



5. How would distributing Flynn's weight more evenly help her in the snow?

6. Can you think of an example when your weight wasn't evenly distributed over a surface? What happened?



7. What happens to weight distribution when surface area is increased or made bigger?

8. Will Flynn have to consider how much she weighs to create your solution or not?



9. What is the relationship between surface area and weight distribution? How do they affect each other?

10. What is ergonomics? How can ergonomics help Flynn in the snow?

Throughout your research on surface area, weight distribution, and ergonomics, take notes in the space provided below on what you might want to use to redesign your device. These can be drawings, words, or just ideas you have about how you want to revamp your design. Your device should prevent Flynn from sinking into the snow, weigh less than two pounds, and be able to be used without Flynn's hands. To test if Flynn will sink, your device must help to pop less bubbles in a bubble sheet than if you stood on it without your device. Good luck!

I think these ideas will help me to successfully redesign my solution:

Don't forget to listen to your team!
Split up the research that needs to be done, and come back and pull all your ideas together to create a fresh, new design!



Let's Put It All Together!

Segment 3—Slipping Up



Okay GEERlings, now that you have learned how to build a great device to help Flynn walk on the snow, it's time to use that information and your creativity to help Flynn easily take her pictures from high up on the mountain. If your device meets all the requirements, she should have no trouble getting up the mountain quickly!

Did you know that in Switzerland, you must own more than one pet if you have a house pet? The Swiss have very strict animal welfare laws, and they highly value allowing animals to be socialized with other animals!



I think I can build my device like this, and use this much of each material:

- ___ Rubber bands
- ___ Dental floss
- ___ Shoelaces/String
- ___ Binder clips
- ___ Combs
- ___ Paper clips
- ___ Cotton swabs
- ___ Popsicle Sticks
- ___ Aluminum foil
- ___ Tape
- ___ Mystery Material

Test For Success

Slipping Up



This process should be done once your **final** design is complete.

In order to know if you are successful, there has to be a comparison of two situations: one without your solution, and one with your solution. The control phase is first in order to have an outcome to compare with your solution's outcome.

Test for Success Control Phase:

1. Grab your sheet of bubble wrap from Flynn's Supply Sack.
2. Step carefully (no jumping!) onto the bubble wrap with one foot.
3. Step carefully back off the bubble sheet.
4. Count the number of bubbles that popped in the first bubble sheet and record it below.
5. If you have a solution that supports two feet, you may use more than one piece of bubble wrap if you have it!

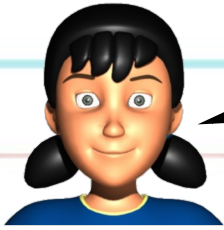
Test for Success Solution Phase:

1. Prepare your solution to be utilized.
2. Use your solution to put your body weight (no jumping!) onto the bubble wrap with your solution in place.
3. Step carefully back off the bubble sheet.
4. Count the number of bubbles that popped in the second sheet and record it below.

Phase	Number of Bubbles Popped
Control Phase	
Solution Phase	

If the number of bubbles popped in the solution phase is less than the number of bubbles popped in the control phase, your solution passed the test!

GEERling Vocabulary List



This vocabulary list shows you some definitions and pictures that might help you. While you are doing your research, you can add additional words that you want to remember!

Marmot: a rodent that closely resembles squirrels or prairie dogs. They live in mountainous areas including the Alps. They dig burrows for themselves and hibernate through the winter. They are very social and communicate with other marmots by whistling.



Hydroelectricity: a system designed by engineers that uses the movement of water to create energy.



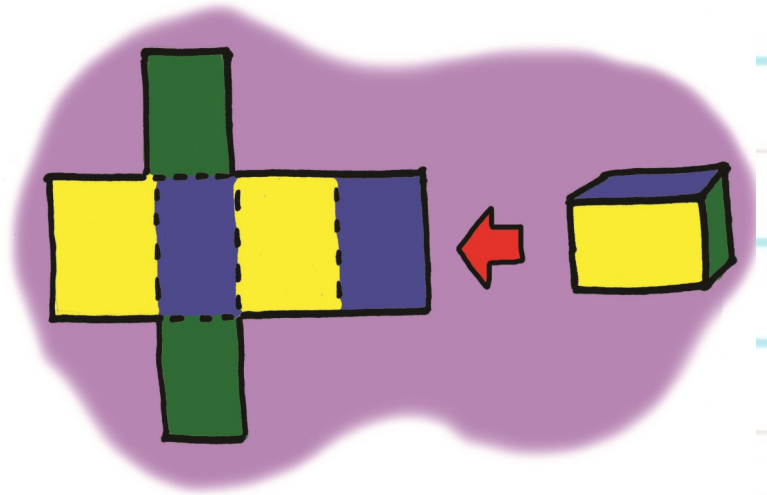
Ergonomics: the study of work and how we can design things. Examples include designing shoes that have padding so it's more comfortable to walk or putting soft handles on your bike so your hands don't get blisters.



GEERling Vocabulary List



Surface Area: the amount of space on an object that can touch other objects (the skin on your body is your surface area because it's the part of your body that can touch other objects).



Weight Distribution: the weight of an object is spread out over its surface area. When you stand up, your weight is spread out just over the surface area of your feet. This causes your weight distribution to be minimal. When you lay down, your weight is spread out over the area of your whole back, so your weight distribution is greater.

