Take a Hike Adventure Journal

Taking on the world, one engineering challenge at a time

Property of The Future Engineer, _____

Super Steep!

Hi GEERlings! I'm here in Switzerland and have fallen in love with the mountains, the snow, and the amazing views! My parents are here working on a power plant that gives everyone in the town and in the surrounding areas their electricity, and they've asked me to help them take pictures of the plant from high up on the mountain. Using your previous design, I was able to climb up the mountain, but now I need to get all of my engineering equipment and supplies up to our new lookout point. Engineers will have to stay here for a few days, and they will also need a small shelter, food, and water. I need to find a way to get these things up to the top of the mountain, but they're too heavy to carry with me as I climb up. Do you think you could help me? 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! Don't be afraid to get creative and think outside the box!

Good luck,

Flynn

Pre Quest Setup

Take a Hike

Mountain Setup

Place a stack of heavy books near the edge of a table. These represent the rocks at the top of the mountain, and they can be used to help with your design in any way other than damaging the books! You can use them an anchor, a weight, a counter balance; the sky is the limit!

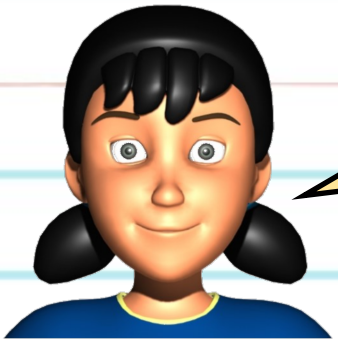
Material to Use for Weight

Since this quest requires the GEERlings to lift 6 ounces with only 3 ounces (or as little weight as possible), they need to be able to measure weight. If you want to add in the skill of measuring to this quest, you could have the GEERlings measure out their own 6 ounce equipment load. If you don't have a scale, you can get a small food scale at any major retailer.

You could use marbles, rocks, sand, or any other material you have available. We recommend measuring out the equipment load and putting it into a sandwich bag or plastic cup. We built our container into our solution for this problem (using a cup), so your GEERlings might want to do the same. Follow the same weight process for the 3 and 6 ounce amounts.

Instructions for GEERlings

Segment 1—Take a Hike



Guess what? Did you know that Albert Einstein developed the formula $E=MC^2$ in Switzerland? Now we know where that famous (and super useful) physics formula was born!

Inside Flynn's Supply Sack, you have items that represent things that Flynn either has around her from the environment or things she always carries with her. These will be the only items you can use to solve the problem. Here's what you have to work with:

Material:		**What it Represents:**
Nylon rope/string (6-7 ft)	⇒	Fishing line
Clothes pins (5)	⇒	Bamboo
Spools of thread (1)	⇒	Barrels
Coffee filters (3)	⇒	Newspaper
Small cups (3)	⇒	Coconut shells
Piece of cardboard (2)	⇒	Recycled from Flynn's hike
Toothpicks (20)	⇒	Twigs and grass
Toilet paper roll (1)	⇒	Bark from a nearby tree
Straws (5)	⇒	Medium sized twigs
Play-dough (3 large chunks)	⇒	Mud from a nearby stream

In addition to these materials, you will have scissors and tape. Feel free to use the spool with or without thread on it.

Your Challenge

Segment 1—Take A Hike

Your job is to design a solution to Flynn's problem – help her get all of her heavy equipment from the bottom of the mountain to the top without carrying it or pushing it up from the bottom.

Your device must transport 6 ounces 12 inches into the air. You must try to lift 6 ounces with less than 6 ounces of weight, and the overall goal is to use as little weight as possible. You cannot pull it up the mountain; we have to be able to measure the force or weight being used! Engineers in the future will use your device to get materials up to the look out when they need more supplies.

Before you start working, see if you can look over your materials and 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:

__ Nylon rope/String
__ Clothes Pins
__ Spool of Thread
__ Coffee Filters
__ Small Cups
__ Piece of Cardboard
__ Toothpicks
__ Toilet paper rolls
__ Straws
__ Play-dough

Let's Engineer It!

Segment 2—Take a Hike

Flynn needs a device that she can use to bring materials up from the bottom of the mountain. The engineering team will also use this device to transport their heavy equipment to the lookout station. Since Flynn has seen things before that help people move heavy equipment, her engineering intuition tells her that using simple machines may help you design a great device. Your job is to answer the questions below on simple machines, mechanical advantage, and pulleys. You can use websites to read, watch videos, or listen to explanations of different ways to build a device that will float. See if by answering these questions, you are able to ask and answer some questions of your own to further your learning!

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 explain your answers.

1. What is a simple machine?

2. List the types of simple machines and draw an example of each simple machine.

3. Look at a picture of a bicycle online or in a book. How many simple machines are used on the bicycle? How do they make your travel easier?

4. What is mechanical advantage?

5. Explain the different ways in which mechanical advantage can help do work and give examples of each way.

6. What is a pulley?

7. How could you use a pulley to lift something heavy? Draw a picture and explain it in your own words.

8. What are some things that you have seen that use pulleys?

9. Draw a 1, 2, 3, and 4 pulley system, one in each box below. Label where the force is applied and how it does the work.

10. What are the benefits of using more pulleys? What are the disadvantages of using more pulleys?

Write down any additional notes from your research below. Try to pick out a few things that you have seen that would help make your solution better! If you can successfully get 6 ounces off the ground, Flynn will be able to move the supplies!

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

Let's Put It All Together!

Segment 3—Take A Hike

Now that you have learned more about pulleys and other simple machines, it's time to use that information and your creativity to help Flynn transport her materials from the bottom of the mountain to the top. If your device can move 6 ounces into the air 12 inches using less than 6 ounces of weight, then it will be able to help Flynn and future engineers to move their supplies without having to carry them up the mountain!

Did you know that more than half of the domestic electricity in Switzerland is produced by 556 hydroelectric power plants? That is a lot of power thanks to their 1,500 lakes!

In the space below, draw a diagram of what you think your revised device may look like and list the materials you plan to use.

I think I can build my shelter like this, using these materials:

__ Nylon rope/String
__ Clothes Pins
__ Spool of Thread
__ Coffee Filters
__ Small Cups
__ Piece of Cardboard
__ Toothpicks
__ Toilet paper rolls
__ Straws
__ Play-dough

Test For Success

Take a Hike

How to Use Weights For Test:

Since this quest requires you to lift 6 ounces with only 3 ounces (or as little weight as possible), you will receive two measured amounts of rock to use to test your solution.

One container will be a cup with 6 ounces of rocks already in it. It will be labeled as the "Equipment Load". Do not remove any rocks from this container. You are permitted to modify the cup if you think it will help you to lift it.

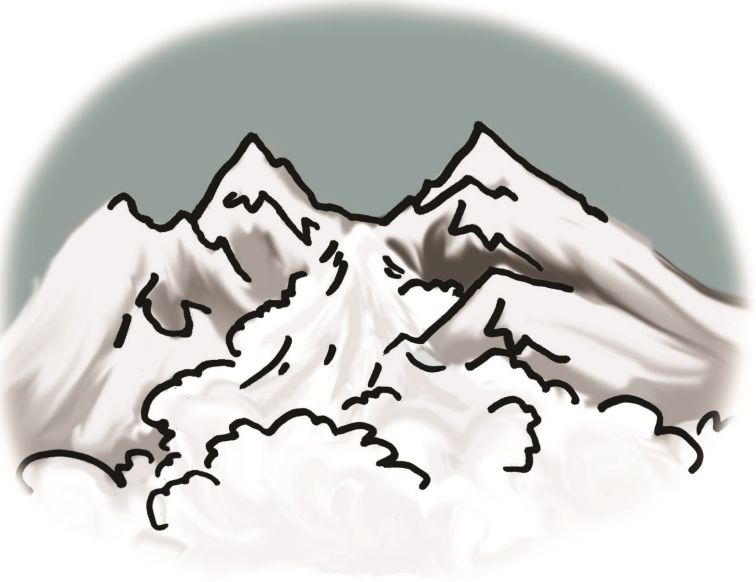
The other weight you have is 3 ounces of rocks. This is in a sandwich bag. This is the weight you have to lift the 6 ounces off the ground. You can utilize these rocks however you wish.

Remember, the test requires you to lift the equipment load 1 foot off of the ground without carrying the materials or using your hands. If you can do that using the two weights provided, you have passed the test!

Use this space for doodling or brainstorming if you need to!

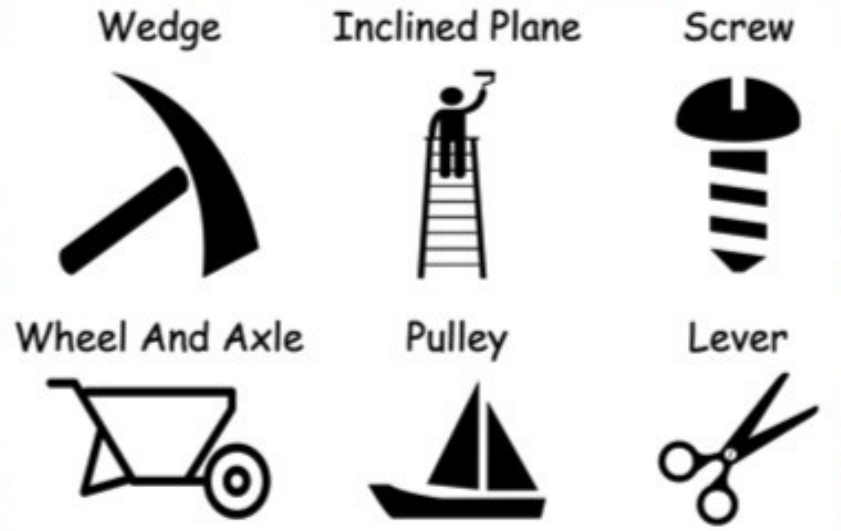
GEERling Vocabulary List

Take a Hike



Avalanche: a combination of rocks, snow, and ice falling down a mountainside. An avalanche can be caused by temperature, slope angle, or snow pack conditions.

Simple Machines: simple tools that help us do work by giving us more force or reducing the force it takes to do a job. For example, when we try to move something that is too heavy for us to lift, we may put it on a cart with wheels. The wheels and axles, a type of simple machine, help to move objects that we wouldn't otherwise be able to move on our own. Other examples of simple machines are: screws, wedges, inclined planes, pulleys, wheels and axles, and levers.



GEERling Vocabulary List

Take a Hike

Pulley: a type of simple machines that makes pulling objects easier. Using a round object with a rope, cord, or chain wrapped around it, a pull is exerted on one side of the pulley while the object on the other side is lifted up. Pulleys can be used to change the direction of a force, like when pulling a bucket full of water out of a well, or to reduce the force needed to lift an object, like cranes on a construction site.

Mechanical Advantage:

the help that a simple machine can give a person who uses it. For example, a person who uses a cart with wheels to move a heavy object is gaining a mechanical advantage.