LANCASTER
SCIENCE FACTORY

Scientific Achievement Pin

Activity Packet for Girl Scout Cadettes

To get your Lancaster Science Factory pin:

Complete all 5 required experiments
at these exhibits:

1. Leverage Learning
2. Period Pendulums
3. Whisper Dishes/Whisper Tubes
4. Minimal Surfaces
5. The Truss Bridge

Plus complete 4 out of the 7 experiments
at these exhibits:

1. Light It Up
2. Scope on a Rope
3. Airplay
4. Conductors & Insulators
5. Giant Arch
6. Identical Tracks
7. Rockin' Radiation

At each exhibit: complete the experiment, answer the questions, and get a signature from your troop leader.

Turn the page and read on to find out what you have to do!

REQUIRED EXPERIMENTS

1. Leverage Learning

What is a lever and what are its major parts?

What do you notice about the levers that are easier to lift?

Mechanical Advantage is a number that tells you how the machine you are using is changing the amount of force that you are putting into it. The higher the number, the less effort you have to apply to use the machine.
What two measurements (lengths) do you need to calculate Mechanical Advantage?

Calculate mechanical advantage for each lever:

But we still don't know how many pounds of force (effort) we need to use to lift the weights.
What two numbers do you need to calculate effort?

Calculate the effort for the lever with the greatest Mechanical Advantage:

Leader's Initials _____

2. Period Pendulums

What is the period of a pendulum?

Do three experiments to find out which variable of a pendulum affects it's period. Try the first one (on the left). Pull the pendulums towards you but pull one closer to you than the other. Now let them go at the same time so they can swing.

This one measured amplitude. What is amplitude?

Try the same experiment with the other two experiments (except make sure that both pendulums are pulled back just as far). Make sure you release the pendulums at the same time.

Which one worked? In other words, what variable can change on a pendulum to affect it's swing?

What two things do you need to know to calculate the period of a pendulum?

If you have a pendulum that is 4 times _____ than another, it will take _____ as long to swing.

Leader's Initials _____

REQUIRED EXPERIMENTS

3. Whisper Dishes vs. Whisper Tubes

Communicate with a friend from each end of the Whisper Tube.

Did she hear you and did it take a long time for her to get the message (you can probably tell if you watch each other's lips move)?

Look up and see how long the Whisper Tube really is: 130 feet! Think about how quickly your whisper got to your friend in that distance. How long do you think our tube would have to be if we wanted it to take a full second for her to hear you?

The energy of sound is heard because a movement is caused by your vocal cords. What are these vocal cords moving when you speak, which then moves your friend's eardrum?

Now head over the Whisper Dishes and do the same thing.

The Dishes accomplish the same effect with sound as the Tube but they are doing it a little differently. Explain how.

Leader's Initials _____

4. Minimal Surfaces

The main ingredient in our bubble mix breaks up the surface tension of the water. What is surface tension?

We've added a secret ingredient to our bubble mix for the elasticity. Can you guess what it is (hint: jello)?

Play with the bubbles on the other side too (the one with the strangely-shaped wands).
What do we mean by "minimal surfaces"?

Give at least one reason why it's helpful for us to understand bubbles.

Leader's Initials _____

5. The Truss Bridge

Build the bridge as shown in the diagrams.

What are the long horizontal and vertical pieces called?

A truss bridge is based on what simple shape?

Try different designs based on different slopes and arrangements of diagonals. Draw below the design that was the strongest.

What are the two forces that cause stress on a bridge's design?

Leader's Initials _____

ELECTIVE EXPERIMENTS

1. Light It Up

Which bulb is the most expensive *per year*?

How is light energy wasted in some of these bulbs?

What are some of the different materials inside bulbs that make them glow?

Leader's Initials _____

2. Scope on a Rope

Use the scope to magnify samples on the wall, at the carpet or even your clothes and skin. Try looking at money, writing utensils, pieces of paper, or whatever else you have in your pockets. Turn it into a game- see if the others in your group can tell what's under the scope.

Can you see everything under our scopes? What are some examples of things that you know to exist that are too small to be seen with our scopes?

What is the most crucial piece of a microscope (microscopes would be impossible without them)?

Leader's Initials _____

3. Airplay

How does air pressure balance around the ball to cause it float?

What is wrong with the air flow in the first tube?

Try floating balls in each of the tubes at the same time.
Is the ball in the first tube being sucked down? Why or why not?

If the air is coming out with high speed, does that mean that it has high pressure?

Leader's Initials _____

4. Conductors & Insulators

How is a conductor different from an insulator?

What's the difference between voltage, an electrical current, and an electrical circuit?

Based on the experiment at the exhibit (on the right), what types of materials are conductors?

Can you think of anything else that might work?
Try moistening your fingers with the nearby baby wipes and then putting them in the gap in the circuit.

Leader's Initials _____

ELECTIVE EXPERIMENTS

5. Giant Arch

You need a lot of people to do this one and you must work as a team!
Place the arch foundation blocks in the taped sections and start putting the pieces on top of each other, starting with number 1 and continuing in order on each side.

Which piece or pieces were the hardest to place?

How many people did it take to assemble a self-standing arch?

How are these blocks holding together and what is trying to take them apart?

Can you tap it a little to see if it will waver, without knocking it down?

Where is the weakest spot?

Leader's Initials _____

6. Identical Tracks

Which letter position along the tracks do you think will get a rolling ball to the bottom of the track the fastest?

Test your guess by rolling the ball from each letter. Then to make it easier, try releasing a ball from each track at the same time, but at different letter spots.
Which letter position is fastest?

Explain why a ball rolling from a higher position moves differently from a ball rolling from a lower position.

Leader's Initials _____

7. Rockin' Radiation

What is radiation and where does it come from?

What is a Geiger Counter?

Use the Geiger Counter on the objects in front of you. Which one has the most radiation? Which one has the least?

Go through the exercise with the keypad to find out how much radiation you are exposed to and write the answer here:

Leader's Initials _____

BONUS QUESTIONS!

1. What was your favorite exhibit or experiment? Why?

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2. Which exhibit or experiment was the most difficult? Why?

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