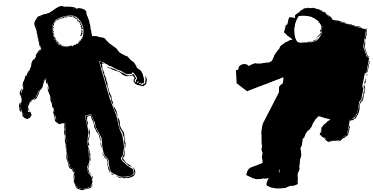


Astronaut Training



ASTRONAUT TRAINING

THE CHALLENGE

Cub Scouts will circulate through a series of activity stations to discover various aspects of life in space.

- Water-Cooled Underwear: Cubs will experience and describe how the cooling system in Extravehicular Mobility Units (EMU) works.
- Bottle Vacuum: Cubs will predict what would happen to an unprotected human being in space. They will simulate an astronaut in the vacuum of space using a balloon and a kitchen pump.
- Space Gloves: Cubs will follow a set of written and/or verbal instructions while wearing simulated space gloves. Cubs will describe and discuss some of the challenges of working in the microgravity environment wearing a spacesuit or Extravehicular Mobility Unit (EMU).
- Disorientation Maze: Cubs will discover how simple tasks can become difficult after experiencing some form of disorientation.

PLAN

Pack Scouters and Sixers will prepare the activity stations, based on the information provided on each Trail Card, and go over the necessary instructions with Cubs.

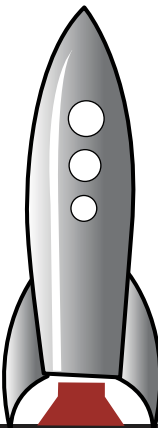
DO

Cubs will go through the stations in groups of 2 or 3 and follow the instructions on the Trail Cards in each station.

REVIEW

Following the review process in each station, the Pack comes together to reflect on the overall experience:

- What new things about space exploration did you learn today?
- What other challenges do you think astronauts might have in the space?
- What questions do you have about the activities you did? How do you think you can find the answers to your questions?



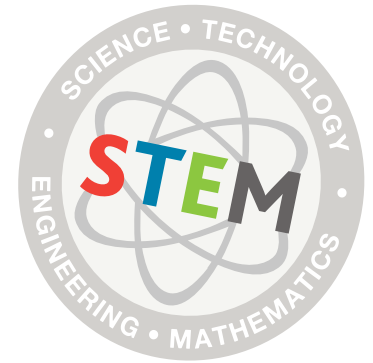
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Astronaut Training



ACTIVITY	TIME
Set up time	30 minutes
Presenting the problem and the material	15 minutes
Circulating through activity stations	10 minutes each
Review	10 minutes

MATERIALS NEEDED:

Station #1: Water Cooled Underwear

- Aquarium tubing (approx. 0.5 m)
- Siphon bulb pump
- 2 containers
- Towel or sock with toes cut out
- Ice water

Station #2: Bottle Vacuum

- Clear glass bottle
- Kitchen vacuum pump
- Small balloon

Station #3: Space Gloves

- Work gloves or hockey gloves
- LEGO blocks
- Needle and thread
- Paper and pencil
- Chopsticks
- Sponge
- 2 kitchen containers
- Marbles
- Job cards

Station #4: Disorientation Maze

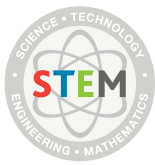
- Disorientation Maze template
- Mirrors
- Pencils
- Prisms (optional)



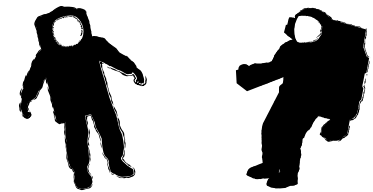
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Astronaut Training: Water-Cooled Underwear



ASTRONAUT TRAINING

THE CHALLENGE

Cub Scouts will experience and describe how the cooling system in Extravehicular Mobility Units (EMU) works.

PLAN

Pack Scouters and Sixers will prepare the station and go over the necessary instructions with Cubs.

- Fill a container with cold water and place it on a table. A second empty container should be placed on the floor and will act as a catch basin.

- Pack Scouters explain to Cubs that you are going to simulate the temperature regulation system of the astronaut's spacesuit, the Liquid Cooling and Ventilation Garment (LCVG).



DO

Cubs Scouts follow the below instructions to simulate the training:

- Wrap your bare arm with the plastic tubing. Grasp the end and point it toward the plastic container on the ground. Place the opposite end of the tube into the plastic container full of water on the table.
- To feel like you are wearing a garment with the tube sewn in (like the LCVG), you can slide a sock with the toes cut out over your arm and

wrap the tube around it.

- Attach the siphon bulb pump to the bottom end of the tube. Make sure the siphon bulb's outlet is pointed toward the container on the floor.
- Start a siphon from the water container through the tube by pumping the siphon bulb until water begins to flow.

REVIEW

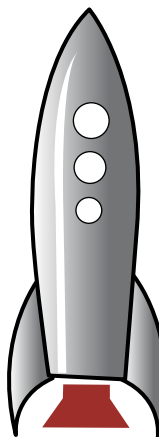
- Did you notice a temperature change?
- Spacesuits are designed to be very well-insulated, so why is a water cooling system necessary? When would an astronaut on a space walk want to increase the amount of cooling? (When the spacecraft is directly exposed to sunlight.)

- What would it be like if the tube were wrapped all around your body? Is there anything about this simulation that would not work in space?
- How could you improve this design to ensure it worked in microgravity? (e.g. The siphon wouldn't work in space because there is no gravity to "power" the siphon. Water must be pumped through the LCVG.)

MATERIALS

- Aquarium tubing (approx. 0.5 m)
- Siphon bulb pump
- 2 containers

- Ice water
- Towel or sock with toes cut out

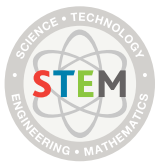


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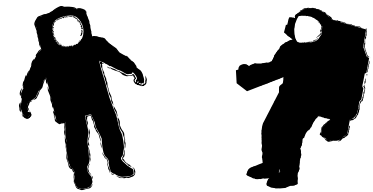
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Astronaut Training: Bottle Vacuum



ASTRONAUT TRAINING

THE CHALLENGE

Cub Scouts will predict what would happen to an unprotected human being placed in the environment of space and demonstrate the results by simulating an astronaut in the vacuum of space using a balloon and a kitchen pump.

PLAN

Pack Scouters and Sixers will prepare the station and go over the necessary instructions with Cubs.

- Obtain an empty clear glass bottle and a kitchen vacuum pump.
- Place a tiny amount of air into a very small balloon. Tie off the balloon and insert it into the bottle.
- Discuss atmospheric pressure with Cubs.

DO

Cubs Scouts follow the instructions below to simulate the training:

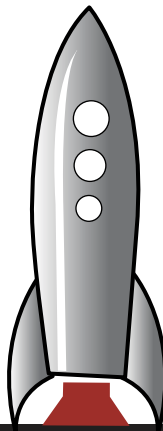
- Place the kitchen vacuum pump on the bottle and begin pumping. Keep your eyes on the balloon.
- Note your observations afterward.

REVIEW

- What would happen to the balloon if the atmospheric pressure within the bottle were lowered? (This is what you achieved with the vacuum pump.)
- Discuss the importance of pressurized aircraft and space suits. What other kinds of environments require pressurized suits? (deep sea diving, scuba diving, etc.)

MATERIALS

- Clear glass bottle
- Kitchen vacuum pump
- Small balloon

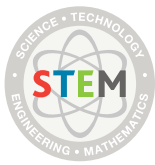


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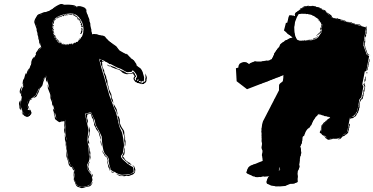
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Astronaut Training: Space Gloves



ASTRONAUT TRAINING

THE CHALLENGE

Cub Scouts will follow a set of written and/or verbal instructions while wearing simulated space gloves. Cubs will describe and discuss some of the challenges of working in the microgravity environment wearing a spacesuit or Extravehicular Mobility Unit (EMU).

PLAN

Pack Scouters and Sixers will prepare the station and go over the necessary instructions with Cubs.

- Lay out the following objects on five separate tables.
 - LEGO blocks, and Job Cards
 - needle, thread and Job Cards
 - paper, pencil and Job Cards
 - chopsticks, sponge, kitchen container and Job Cards
- kitchen container, marbles and Job Cards
- Explain to Cubs that these objects represent space tools. They will don (put on) their EVA gloves and attempt to follow the appropriate checklist of duties.
- Discuss the types of tasks that might be difficult to do while wearing a spacesuit. How does the suit and/or the environment limit what type of work astronauts can accomplish?

DO

Cubs Scouts follow the instructions below to simulate the training:

- Put on the gloves and move through the five stations completing the tasks on the Job Cards:
 - a. assemble the Lego blocks
 - b. thread the needle
 - c. write your name on a piece of paper
 - d. use the chopsticks to place pieces of sponge in the container
 - e. place three marbles in the container
- Compare the difficulty of doing these tasks with and without the space gloves

Ideas for further study

Challenge Cubs to design tools that could help astronauts do their work in space more efficiently. Designs could be illustrated and then presented to the group orally. If possible, have them build prototype models for testing.

REVIEW

- Which tasks were most difficult? Would working in a microgravity environment make things easier or more difficult? Did working in the space gloves get easier with practice?

MATERIALS

- Work gloves or hockey gloves
- LEGO blocks
- Needle and thread
- Paper and pencil
- Chopsticks
- Sponge pieces
- 2 kitchen containers
- Marbles
- Job cards

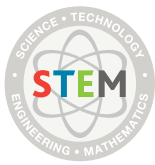


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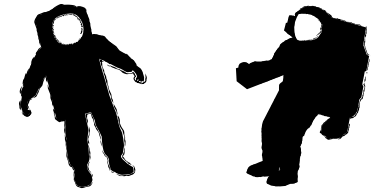
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Astronaut Training: Disorientation Maze



ASTRONAUT TRAINING

THE CHALLENGE

Cub Scouts will discover how simple tasks can become difficult after experiencing some form of disorientation.

PLAN

Pack Scouters and Sixers will prepare the station and go over the necessary instructions with Cubs.

- Photocopy the Disorientation Maze template and distribute to Cubs. Have lots of extra copies available to repeat the activity.
- Place Cubs in pairs.

- Inform Cubs that in space, many of the things we take for granted here on Earth no longer apply. For example, because gravity no longer controls you or your environment, up and down, right and left become meaningless.

DO

This activity must be done in pairs.

- Draw a path through Maze "A" as quickly as you can. How many times did you "bump" into the walls?
- Next, ask your partner to place the mirror next to Maze "B", ensuring that you can see the maze clearly in the mirror. Your partner will also hold a piece of paper over your writing hand. This ensures that you are only using the mirror and are therefore "disoriented".
- Draw a path through the maze while looking in the mirror; you should not look directly at the paper or pencil! Count how many times you "bumped" into the walls, and write that number down.

- Have your partner do the same.

Ideas for further study

1. Have Cubs repeat Maze "B" to see if their performance improves.
2. Have Cubs attempt a maze using a prism. The prism rotates the beam of light by 90 degrees and presents quite a challenge!
3. Repeat the activity using a star-shaped maze. The more acute angles present a much greater challenge.

REVIEW

- Did performance improve with practice? What can astronauts do to practise dealing with disorientation?

MATERIALS

- Disorientation Maze template
- Mirrors
- Pencils
- Prisms (optional)



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