BALANCING BEARS

Duration: 20 minutes
Institution: Museum of Science, Boston
Skill level/Age Level: Grades 2-12
Group size: 5-30 participants

INTRODUCTION (HEADING 1)

Working individually or in small groups, participants use recycled materials to design, build, and test a device to balance upright on an unbalanced platform and travel down a sloped tight rope. The goal of this challenge is to build a device to hold an Ewok action figure as high up off the platform as possible and still travel safely down the tight rope without flipping over. Participants think and build like engineers as they experience the design process to make improvement to their devices through redesigning and retesting prototypes.
MATERIALS AND TOOLS (STYLE: HEADING 1)

*Essential Materials:*
- Tight-rope tracks
- Balance carts
- ½” metal nuts
- Pipe cleaners (can reuse, but will wear out over time)
- Wooden dowels
- Plastic Sticks with holes
- Pipette trays
- Pipette trays with adhesive Velcro
- Cups, Dixie or plastic (can reuse, but will wear out over time)
- Binder clips
- Bear (or other figures)

*Optional Materials:*
- Example balancing demo to help think about weights, placement of weights

HOW TO OR STEP-BY-STEP

1. Use as much of any material as you want. Build and test prototype devices at balancing testers and then test at the sloped track.
2. As an added goal, see how tall you can make your device with the Ewok as high off the platform as possible.

3. Your goal is to balance on the platform with the platform above the tight rope, not below it.

**DESIGN CYCLE**

*Ask/Imagine/Plan*
Think of how things balance. Explore the materials. How could you use them to balance your device? Which materials are heavy? Which are light? How could you use their weight in your design? Brainstorm designs for a device to make the cart balance. Then select from these ideas and develop the idea further. How will your device stay on the cart? What materials will you use? Where will the bear be? Focus on making a device that balance first, and then try to make it taller.

*Create*
Begin constructing your device according to your plan. If something isn’t working ask a Design Challenges staff member for help, or go back and revise your plan. Be sure to think about how to attach or place your device on the cart.

*Test*
When you have built your device, test it out on one of the short test tracks to see how it balances. Try sliding the cart back and forth to simulate the movement of traveling down the wire. If your cart balances well, you can test it on the large inclined track. If not, think about why it is falling over, then go back through the design cycle to solve the problem. Feel free to test more than one design and compare the results.

*Improve*
Which design worked best? What did you learn from your tests? Choose that design or select certain aspects from multiple designs and combine them into a new device. Then attempt to build a taller structure on top of the cart.
FACILITATION TIPS

Facilitation Questions for Students:

- When a tightrope walker is balancing on a wire that forces are influencing his or her ability to balance?
- What is the balance point?
- What is the center of mass?
- On Earth, is the difference between center of mass and center of gravity?
- Can you balance a ruler on your finger? What happens when you add additional weight to one end of the ruler? Can you still balance the ruler?
- Is it easier to balance with more weight above or below the balance point?
- Which is more stable, fixed weights or swinging weights, and why?
- Why would engineers be interested in balance?
- What is the Engineering Design process?

KEYWORDS (STYLE: HEADING 1)

- Outdoor
- Indoor
- Balance
- Mechanical engineering
- Design challenge
- Physics
- Forces