Cupcake Delivery

Who says all the fun has to happen at The Tech Interactive? This DIY engineering activity can be done with inexpensive supplies and things you find around your home!

Introduction

Imagine you want to deliver a yummy cupcake (or precious package) to someone special. It's a very windy day, so you've decided to build a wind-powered device to carry your gift. But you're going to have to think carefully to make sure your gift is delivered safely without getting smashed or broken! In this wind-powered delivery challenge you'll use household items to engineer a device that can transport your gift safely.

Design Challenge

Design and test a wind-powered device that can safely deliver a gift.

Materials

Before you start hunting for materials around your house, think about what you want your device to be able to do. What features do you want it to have? What could you use to create it?

Some questions you may want to consider are:

- What materials will help you keep the gift safe?
- What materials could help provide structure to your device?
- What materials could provide a surface area for the wind to push against to move your device?
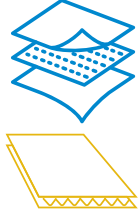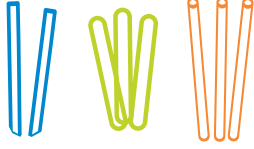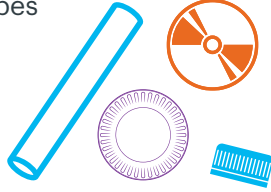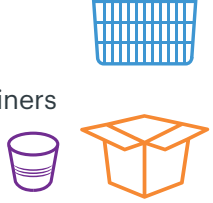
Subject:
Hands-on engineering

Age:
6+

Time:
30+ minutes

Key Concepts:
Force, friction, surface area, balance

Things you can use

Find several items from each category. Don't limit yourself to the items on this list. Use whatever you have on hand. Be creative!

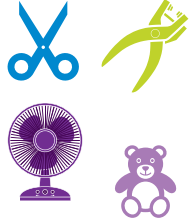| Wind catchers	Structural pieces	Round items
• Fabric • Recycled paper or cardstock • Cardboard scraps • Foam sheets	• Straws • Craft sticks • Chopsticks • Bamboo skewers	• Cardboard tubes • CDs • Bottle caps • Plastic lids • Paper plates
Bases	**Fasteners**	**Other**
• Fruit baskets • Paper cups • To-go food containers	• Twist ties • String • Rubber bands • Hair ties	• Scissors • Hole punch • Fan or hair dryer • Gift (e.g. small plushie or toy, cork, game piece, etc.)

Tip: Try building without tape or glue so you can change your designs faster and reuse materials.

Instructions

Story or scenario

Thinking about the story can help you explore whimsical design ideas, build empathy, and focus your building goals. In Cupcake Delivery, you are sending a cupcake or something similarly delicate across town to a friend.

• Imagine you could build the ultimate gift delivery vehicle. How would you make it look fun and exciting?

• How do you want the person getting the gift to feel when they receive the gift?

– How would you feel if you received a gift that was damaged?

– How will your design keep the gift safe and secure during its travels?

Create

1. Once you've gathered your materials and set up your testing area, it's time to build! Let your imagination run wild. Try out as many different designs as you can think of.

2. As you start creating your vehicle, you may want to ask yourself:

   • What kind of devices use wind for power?

   • What parts are important to those devices? How do they use wind to move?

3. Think about a time you might have had food or something fragile delivered to you. How were the items packaged so they didn't spill or break?

Real-world Inspiration

Set up your testing area

1. Find a spot that has a smooth surface and measure out the desired length of your testing area.

   - We recommend a length of 6-8 ft (1.83-2.44 m) long — this could be a table, your driveway, or even a piece of cardboard.

2. Place a fan on one end of your track and a finish line at the other.

   - If you do not have a standing fan, try using a hair dryer on the cool setting for your wind power. You could even try waving a piece of cardboard or a file folder.
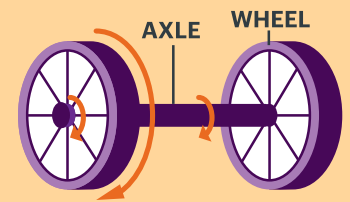
Test

1. As you test your device, make observations on its performance. Some questions you could ask yourself include:

   - Why do you think your design is ...
     - tilting?
     - falling forward?
     - getting stuck?
     - not moving?
   - What do you think would happen if you adjusted the surface area, angle, or sides of your design?
   - What happened to your gift during the ride? Would someone be excited to get it?

2. Is your device having trouble moving forward? If so, there may be too much friction, the force that slows the movement between the bottom of your device and the surface of the track.

   - Try adjusting the friction by adding a new material where the device makes contact with the track. Test different materials to see which ones move more smoothly along the track.

3. Don't worry if your first attempts don't work as you imagined! Use your observations to think of possible improvements to your design.

   - Does your device lean to one side?
   - Could it be adjusted to capture more wind?

Explore More

- **Adjust the Speed:** Without changing the setting on the fan, how might you make your device travel faster? Slower?
- **Rocky Road:** Test your vehicle across different terrains like hardwood, carpet, or tile. What changes would you need to make to your design in order for it to travel across different surfaces?
- **Challenge Cards:** Successfully completed the challenge and ready for more? Try designing with a new criteria from one of our **challenge cards**.

Share Your Results! Keep us posted about your design challenges on social media with **#TheTechatHome.**

Tip: Wheels can be surprisingly challenging when designing wind-powered vehicles! You might try building a vehicle that slides rather than rolls. Experiment with friction between the vehicle and the surface on which it is traveling in order to adjust the ride.

AXLE   WHEEL

If you'd like to try building a design with wheels, try creating an axle by connecting two round items to a long structural item at either end. The axle will need to be attached in a way so that it rotates freely, allowing the wheels to turn.

The Tech Interactive at Home

thetech.org/athome

One Modification

Change one part of your design and see how it performs. (*Example*: add or get rid of wheels.)

Travel Faster

Try to get your device to reach its destination more quickly.

Larger Delivery

Increase the size or weight of the cargo being transported.

Dependable Design

Make your device more reliable. (How many successful test runs can you do in a row?)
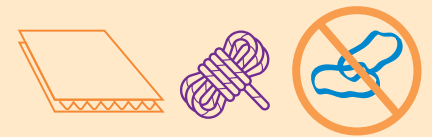
Innovator's Choice

Choose a new way to improve your device and challenge your engineering skills.

Materials Limit

Build with fewer materials. (*Example*: Build with only 2 different kinds of materials, or no rubber bands.)
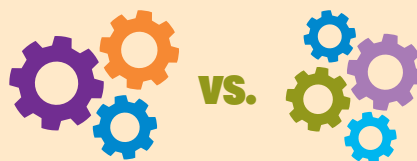
Rapid Redesign

How quickly can you revise your design? Set a timer for 5 minutes. (If you are on a team, make sure you are all involved and collaborating.)

Alternate Dimension

Create a second, totally different design to test. Compare the performance of each prototype.

VS.

Extreme Conditions

Increase the wind speed or change the surface. How well does your device deliver in a "storm" or bumpier terrain?