

WORKSHOP EXTENSION ACTIVITY

Built by The Home Depot Kids Workshop



SLED & REINDEER

Ages 5-12

MAKE. CREATE. EXPLORE.

#KidsWorkshopExplore





Santa has to land on a lot of different rooftops. What is yours like?

'Twas the Night Before...

In order for Santa to deliver gifts around the world, imagine all the different rooftops on which his sled must land! Below, sketch or list some of the different types of buildings that his sled might encounter:

Of the buildings you brainstormed above, which one(s) do you think might be the trickiest to land on? Why?

If you listed any buildings with a slanted roof, you're probably right! Any roof with an incline means that the sled will have to be extra careful not to slide off. But did you also consider what material the roof is made of? Different materials will have different kinds of friction. When an object wants to move in one direction, friction is the force that acts in the opposite



Use [#KidsWorkshopExplore](https://www.instagram.com/kidsworkshopexplore) to post a picture of your upgraded sled as it rests easily on a non-slip rooftop.

What advice would you give Santa after your experiment?

direction and slows or even stops the object from moving. In other words, how much Santa's sled slips will be largely due to how much (or how little) friction exists between his sled and the roof.

A little confused? The next activity should clear this up!

You'll need...

- Sled and Reindeer
- Foam board
- Aluminum foil
- Fine grit sanding sheets
- Medium grit sanding sheets
- 80 grit coarse sanding sheets
- Masking tape
- Scissors
- Stopwatch
- Blocks or books
(to prop the "roof")

Santa's Helper

To help avoid landing malfunctions, let's test what kind of rooftops Santa and his reindeer should be on alert for when delivering presents! Follow the directions below to get started:

1. To begin, place the foam board flat on the floor with your sled on top of it. While a flat roof is clearly the easiest roof to land on, most roofs aren't flat—so slowly raise one side of the foam board to make an incline. When the sled starts to slide, stop moving the foam board. Prop books or blocks under the foam board to keep it at this height.
2. Now get out your stopwatch! Put the sled back at the very top of the foam board and time how long it takes for the sled to slide to the bottom. Thank goodness the reindeer can fly because this is how long it would take for Santa's sled to slide off the roof! Record your findings in the chart below.
3. Now experiment with other roof types by covering the foam board with each of the materials listed, one at a time. Use masking tape to secure the edges of each



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material to the underside of the board and then place the roof back at its incline.

- Place the sled on the roof, restart the stopwatch and see if the sled slides! Below, record if the sled moved and (if so) how long it took to reach the bottom!

Roof material	Roof texture <i>(Smooth, rough, extremely rough, bumpy, etc.)</i>	Did the sled move? <i>(Yes/No)</i>	How long did it take the sled to get to the bottom? <i>(seconds)</i>
Plain foam board			
<i>(Other types of materials:)</i>			

Landing Recommendations

Review your results. If you were to advise Santa on landing his sled, what kind of roofs should he approach the most cautiously? What kind of roofs should be easy to land on?



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These results are all because of friction! When a sled lands on an incline, it is pulled downward by gravity and begins to slide. Roof surfaces that are rougher have more friction, which resists movement and helps keep the sled on the roof! Roof surfaces that are smoother, on the other hand, have less friction. When there is less resistance to movement, gravity can more easily pull the sled off the roof!

Sled Upgrade

As you learned, friction is the force between two surfaces that are touching each other. With this in mind, what else could you change to increase friction and help the sled stay in one place?

The sled's runners!

The blades along the bottom of the sleigh are the only part of the sled that actually touch the roof... so to have the most friction, these need an upgrade! Use the materials from the roof testing as well as any information you learned from this experiment to redesign the sled's runners.

Then test out your new and improved sled on top of the roof that you decided was best to land on. Make it your goal to create runners that don't slide at all. The reindeer will be grateful to focus their energy on flying between roofs, and not just trying to stay on top of them!



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