

Do Try This at Home

From the **Institute of Physics**

Snowball Slingshot

This winter one-off should be s-now trouble at all! Make your very own snowball launcher and put it to the test to uncover the science to sending snowballs soaring through the sky.

Before you start:

These experiments have not been specifically safety tested for home use but we believe them to be safe if the instructions are followed. Adult supervision or direction is recommended as appropriate. All experiments are carried out at your own risk.

What you'll need:

- Plastic bottle with tapered neck (we used a squash bottle)
- Marker pen
- Tape
- Balloon
- Scissors
- Some "snowballs" to send flying: cotton wool balls, or scrunched tin foil work perfectly

Optional

- Paper
- Colouring pencils/felt tips
- Any other decorations to make your launcher as jazzy as possible.

A note for Grown-Ups:

Before you can start to play, you are going to you need make your Snowball slingshot. Make sure you supervise this experiment very carefully. We are using sharp scissors as a stabbing tool so you will need to do some steps with (or for) your family depending on their ages and how sensible they are

What to do:

1. Draw a circle around the neck of your bottle in marker pen
2. Cut along the line you have drawn. To get started you have to stab a hole in the bottle first using the pointy end of your scissors, an adult should definitely do this part.
3. We are only using the top of the bottle here, you can use the bottom part to play ping pong pick up! If you have made any sharp or jagged edges with your scissors, cover them up with sticky tape so that your slingshot is safe to hold and use.
4. Take off the cap and stretch the balloon over the mouth of the bottle. If your balloon bunches up when you do this, gently pull it, so that it is even all the way round.



Now is the time to test your launcher. We recommend launching rolled up bits of tin foil or cotton wool balls so your home remains unscathed. And it should go without saying - don't fire them at each other!

5. Put your snowball into the bottle, hold onto the neck with one hand and pull the balloon back with the other. Then take aim and release the balloon to shoot snow through the sky.
6. Challenge your friends and family to see who can shoot the furthest and who has got the best aim – we created targets on the floor, you can use bowls or boxes and place them wherever you like:
 - a. An easy target scores 10 points
 - b. Medium target, 20 points
 - c. Difficult, 40 points

The competitor with the most points after 5 launches is the winner and you don't have to play nice!

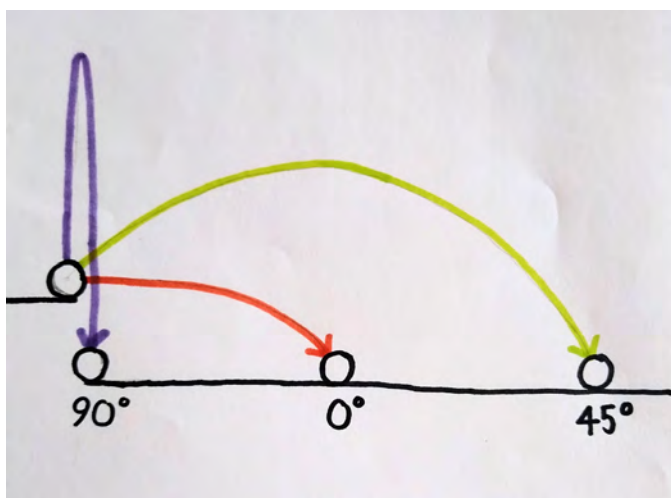
What to talk about

- What happens to the distance when we change the angle we launch the ball at?
- What do you think makes a good slingshot?

What's going on?

Pulling the balloon back stretches it out of shape. When you let go, the balloon snaps back into its original shape, flicking into the snowball. This flicking force is what launches the snowball and sends it flying.

But to win a game of snowball slingshot you need to know best way to hold the tube. The secret is the direction, or angle, that you are pointing it. This is because from the moment the snowball leaves the slingshot, the force of gravity controls the journey it takes. An object is called a projectile if, once it has been launched the only force acting on it is gravity. So why does the angle that you fire your snowball make such a difference?



If you point straight upwards and launch, the snowball starts off quickly but the downwards pull of gravity causes the ball to travel slower and slower until it stops going upwards and starts to fall. The snowball speeds up as it falls back down and lands exactly where it started. Launching straight up like this keeps the snowball in the air for the longest time possible, but it hasn't gone forwards at all, which won't get you any points.

At the other extreme; when you point straight ahead and launch, we are pointing in the right direction. But because we aren't firing upwards at all, the snowball doesn't stay in the air very long so it doesn't go very far.

When you tilt the tube diagonally upwards and then launch, it's a compromise between the two and the snowball takes a lovely curved path up and back down to the floor. To get the maximum distance and the most points you should launch diagonally upwards at 45° . This angle is exactly between straight up and straight forwards and is the perfect balance between the two. Knowing the physics behind snowball (or any projectile) launching should give you the secret to winning a game of snowball slingshot, it is up to you whether you decide to tell your family and friends!

What next?

There are loads of interesting things still left to investigate together. Can you improve the design of the slingshot at all?

Think about:

- The shape and size of your projectile
- Can you swap the balloon for a different material to launch your projectile?
- The size, length and material of your tube

How will you know for sure that you have made the design better?

Did you know?

If you launch a projectile fast enough it will never hit the ground! It ends up constantly falling around the earth, and is called a satellite.