

Teacher Handout | SPOOL RACER

Dear Teacher

We have a really interesting STEM challenge for you to try. We would like you and your class to make a Spool Racer. These instructions are to guide you rather than tell you exactly what to do – we want you and the class to create your own unique designs!

We hope you have fun making these spool racers. We would really like to see your designs if you had time to send us a photo of your designs that would be great. Could you please send the pictures to us via email craftmaker@mic.ul.ie or tag the CRAFT Maker Space, Research Ireland and Curious Minds across our many social media channels.

Lets get imagining, designing and creating!

Science Content Included in this Activity:

Energy Storage and Energy Conversion

Rubber bands are very good at storing energy. When you twist the rubber band with the pencil, you stretch the band and wind it up. This winding and stretching creates and stores **potential energy**. The more you twist, the greater the amount of potential energy you create. When you put the spool down on a surface, the band unwinds, releasing the energy i.e. converting the potential energy into **kinetic energy** and the spool racer speeds away from you.

Energy conversion: The change of energy from one form to another.

Kinetic energy: The energy of moving objects. Anything in motion has kinetic energy. The faster an object moves, the more kinetic energy it has.

Potential energy: Energy that is stored and can be used when needed.

The Class Challenge

Design and build the fastest Spool Racer in your teams, using only the materials supplied to you.

The Engineering Design teams will be required to brainstorm, imagine and draw their possible designs, build their prototypes, test them, modify where necessary, and re-test their spool racers before facing off in a final race competition between the Engineering Design teams.

Questioning

Why do you think we use a rubber band in the design?

What do you think the washers will add to the design?

How will we ensure that we make the fastest spool racer possible?

I wonder how can we steer the spool racer?

Identify Criteria & Constraints

Engineers look at challenges through the lens of criteria (what does my device have to do?) and constraints (what are the limitations I face in making, testing, and using the device?). Discuss what the criteria and constraints of this challenge are.

The Spool Racer must

- Race as fast as possible
- Race as far as possible
- Race in a straight line as much as possible
- Be designed using only the materials provided

How to Make Your Spool Racer

1. Gather all your materials

- 1 Thread spool
- 1 Lollipop stick
- 2 Washers
- 1 Pencil
- 1 Thick Rubber Band

You will also need: Scissors, Adhesive tape



2. Image

Using the materials provided, ask the Engineering Design teams to imagine and sketch their designs.

3. Plan and Design

Gather all materials and plan how your design will be constructed.

4. Create

It is time to build the spool racer.

Watch the Curious Minds video from the CRAFT Maker Space at Mary Immaculate College.

Part 1:

Push the rubber band through the centre of the spool using a pencil.

Break the lollipop stick so that it is no greater than the diameter of the spool. Insert this piece of lollipop stick into the band at one end of the spool and pull the rubber band taut so that the lollipop stick lays flat on one end of the spool. This prevents the band from

falling back out of the spool. Fix in place using some tape.

Part 2:

At the opposite end of the spool, thread the rubber band through the two washers and push the washers down so that they are sitting on the spool. Insert the pencil into the rubber band next to the washer and twirl the pencil. This will twist the rubber band.



5. Test and Evaluate

Once the rubber band is wound up, put the spool racer down on its side on a smooth surface and let it go.

- Evaluate if, and how the design could be modified or improved.
- Remember your set criteria (race as fast and as far as possible, in a straight line and only using the materials provided).

6. Modify (if required)

Think about:

- Why are the washers so important to the design?
- Would the length of the pencil affect the design?
- Is the length of the rubber band affecting your design?

The teams can also add any other decorations to the spool at this point before the final race competition.

7. Race your Spool Racers



Extension Activities

Think about:

- Try testing different spool sizes. Which size rolls fastest? Which size rolls the farthest?
- Try testing rubber bands of different lengths and widths.
- Try testing pencils of different lengths.

The CRAFT Maker Space at Mary Immaculate College Limerick

The CRAFT (Creative Arts / Future Technologies) Maker Space at Mary Immaculate College (MIC) is a dynamic STEAM engagement centre that delivers inclusive, hands-on educational experiences to children, families, educators, and communities across the Mid-West Region of Ireland and beyond.

Through workshops, camps, CPD courses, and public events—delivered both on-campus and in schools, libraries, and community spaces, CRAFT promotes equity of access and builds capacity among educators. Activities include engineering challenges, coding, robotics, 3D printing, and much, much, more.

To find out more and to avail of our STEAM workshops for your school click on our website at: <https://stemcraft.mic.ul.ie/>