CD Racers are a classic STEM based build that incorporate the science behind potential and kinetic energy and a little creativity.

This build requires perseverance and determination, as it's surprisingly tricky. If one of the several elements isn’t quite right, the project won’t work.

It’s your job to work out where the problem lies, and how you will go about fixing it. Are you up for the challenge?
VOCABULARY

**Friction** - The resistive force between two surfaces that are sliding, or trying to slide across each other.

**Potential Energy** - Stored energy

**Kinetic Energy** - The energy an object possesses due to its motion.

**Acceleration** - The rate of change of velocity of an object with respect to time

**Force** - An interaction that, when unopposed, will change the motion of an object

**Mass** - A measure of how much matter is contained in a physical object

**Gravity** - A force that attracts an object toward an item having a great mass (such as the Earth)

**Velocity** - The measure of how fast an object moves in a particular direction

EACH TEAM WILL NEED

- **Elastic Band** 1
- **Cotton Reel** 1
- **CD** 2
- **Wooden Dowel** 1
- **White Tac** 1
- **Clothes Peg** 1
- **Washer** 1
WARM-UP ACTIVITIES

A

Discuss the following principles with your groups. Read the descriptions of each one carefully and consider what each means. Can you and your team mates think of any examples of each principle?

Newton's Laws of Motion

- Newton's First Law - An object either remains at rest, or continues to move at a constant velocity, unless acted upon by a force
- Newton's Second Law - Acceleration is gained when a force acts on an object containing mass. The bigger the mass of the object needed to be accelerated, the bigger the force required to do so
- Newton's Third Law - For every action there is an equal and opposite reaction

Energy

- Potential Energy - Stored Energy
- Kinetic Energy - The energy an object possesses due to its motion

B

Show your students an example of the CD Racer in action. Now give each team 10 minutes to answer the following questions.

- Where is the energy stored?
- What type of energy is stored?
- What part is made with high friction material?
- Why do you need high friction and low friction material to make the CD Racer move?

MAIN CHALLENGE

As a team, you are going to work together to build a CD Racer.

Firstly you will discuss and design your CD Racer before starting construction; don’t forget to think about and incorporate the scientific principles covered in the warm up activity.

Using the materials provided, the CD Racers must be stable enough to travel 3 meters and complete 3 successful journeys.

The success of this will be measured by how fast your CD Racer reaches the finish line.

Once completed and tested, there will be a class discussion about your findings.
BUILDING YOUR CD RACER

A
Place your white tac around the ends of your cotton reel. Be careful not to block the holes in the middle of your cotton reel, as this is where you’ll put your elastic band.

B
Attach a CD to each side of your cotton reel by pressing down onto the white tac. Give it a little shake to ensure it’s secured in place. Ensure that the CD’s are perfectly centred so the CD Racer will be stable. You should have something that looks like the image below.

C
Next take an elastic band and thread this through the middle of your cotton reel. The elastic band should be visible on either side of the cotton reel.

D
Take your peg and loop this through one end of your elastic band. Secure this to the CD using white tac. This high level of friction is needed to drive forward the CD Racer.
Place your washer over the elastic band loop on the other side of your CD Racer. Secure this to the CD with white tac.

Then take your wooden dowel and thread this through the elastic band, over the washer. This mechanism will provide a low friction surface allowing the CD Racer to turn.

TROUBLESHOOTING

- Rubber Band didn’t unwind - Try to wind the rubber band more tightly. It may just need more tension to rotate. If this doesn’t work try a shorter or thicker rubber band.

- CD’s spun but Racer didn’t move - Think about the friction between the surface and the CD’s and how you could increase this. Perhaps try a different surface.