KS4 & 5

Theme: **Carnival Science**

Amusement parks and local fairs are a big part of summer memory-making for many families, at least in non-pandemic times. Standing in long lines at amusement parks may be out this summer, but we've got fun science activities you can line up for a whole week's worth of carnival-inspired STEM!

Could you set up a fun outdoor amusement-park-style event using some of the activities listed here? Yes! From amusement park games to roller-coaster-inspired builds and even some fun with mirrors, this week's Summer of STEM roundup gives you a number of exciting ways to explore carnival-themed science. With each of these ideas, you can design or build something awesome that can be used as part of a homemade amusement park! (Don't forget to design some fun tickets, too!)

We all hope you enjoy the different tasks. Have fun and remember to share those photos at: office@bwf.education or on the Woodside twitter page.

Please see a few of our ideas below:

	Task		
	Design own fun tickets for the amusement park	Paper, colouring pencils	
	Make a cereal box marble run	Activity sheet below	
	Penny racers and screaming balloons	Activity sheet below	

	Simple catapult	Activity sheet below	
	Word search	attached	
	Make own carnival costume	Activity sheet below	
	Design and build your own roller coaster	Activity sheet below	
Have you ever heard anyone say the chance of something happening is "50-50"? In this activity, you will do some calculations and then test if your calculations hold true for reality!	What are the chances - a probability STEM activity	https://www.sciencebuddies.org/stem-activities/probability?from=Blog	
In this science activity, you will get to investigate balance using marshmallows, skewers, and toothpicks. Sticky, yummy balancing fun!	Circus-Trick Science: How to Balance Anything	https://www.sciencebuddies.org/stem-activities/balance-marshmallows?from=Blog	
	Build a Paper Rollercoaster	https://www.sciencebuddies.org/stem-activities/paper-roller-coaster?from=Blog#summary	

	Build a Popsicle Stick Catapult	https://www.sciencebuddies.org/stem-activities/popsicle-stick-catapult?from=Blog	
	Build a Marble Roller Coaster	https://www.sciencebuddies.org/stem-activities/marble-roller-coaster?from=Blog	
	How to Make Cotton Candy Without a Machine	https://www.youtube.com/watch?v=D-bG59cITaY	
	Homemade ice cream	https://www.bbc.co.uk/food/recipes/how_to_make_ice_cream_97157	

Design and Build Your Own Rollercoaster

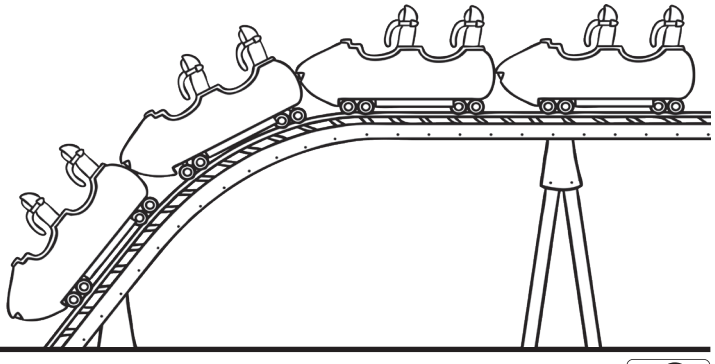
Test Stages

Complete the table below with the materials you are testing and notes on how they perform in the test.

Material	What was it good at?	What was it bad at?

Complete the table to show which materials you will use for the different features.

Feature	Best material	Notes/things to think about
360° loop		
45º drop		
High section at 1.5m or above		



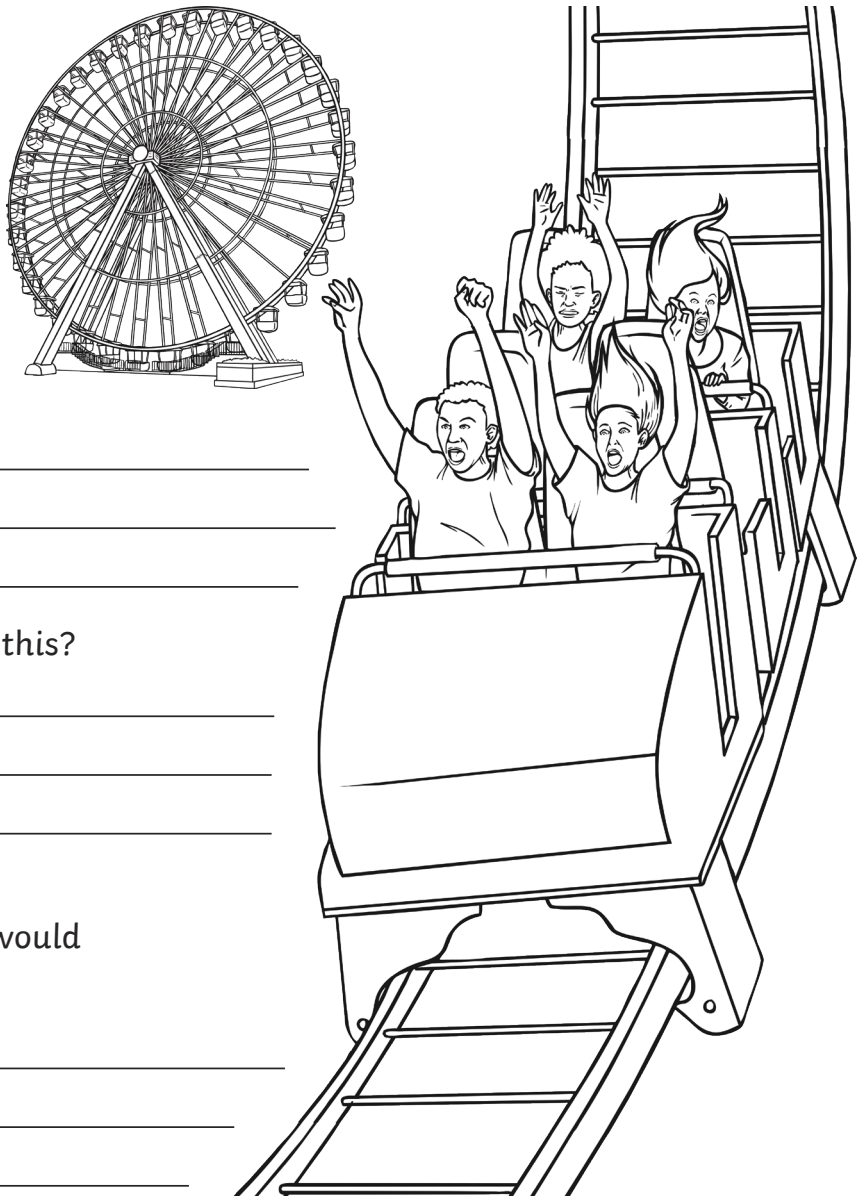
Design

Use this space to design your rollercoaster.
You will need to include labels for each part and notes of measurements as well as materials.

Evaluation

Tick the features you included:

- ☐ 45° drop
- ☐ 360° loop
- ☐ High section at 1.5m or above
- ☐ Full length at least 2m



What worked well and why?

_____

_____

_____

What didn't quite work and why was this?

_____

_____

_____

If you were to build this again what would you change?

_____

_____

_____

What did you like from other people's designs?

_____

_____

Do you think you would like to be a rollercoaster designer and why?

_____

_____

_____

Making a Cereal Box Marble Run

Ever wondered what to do with those empty cereal boxes?

Follow these simple instructions to make a cereal box marble run.

You will need:

- 2 cardboard cereal boxes
- glue
- sticky tape
- scissors
- marbles

1. Start off with your empty cereal box. Tape the lid shut and then cut off the front panel (take care, scissors are sharp!). Make sure you leave a little ledge at the bottom. This will stop the marbles rolling out everywhere when they reach the end of the run.

2. Then take the detached front panel and cut it into three strips. Bend them at the ends and cut a notch on one side for the marble to run through.

3. Next, take a little extra cardboard from another cereal box and fold the end of it and tape it onto the bottom. The folded end makes the marble run tilt back a little bit so the marble goes down the holes and doesn't fall out of the box.

4. Finally, tape the strips into the box and cut a little hole at the top to drop the marble through. Then go and find some marbles!

Design a Rollercoaster Teacher Guidance

This is a great STEM and teamwork activity for KS2 children.

Preparation

- The design sheets for drawing would be useful on A3 paper. These can be stapled together into a booklet at the end.
- Prepare the children by watching some videos of rollercoasters and looking at photographs.
- All materials need to be big enough for a marble (around 10mm+ diameter) to run down easily (22mm diameter is perfect).
- Forward planning needs to be done for collection of materials as well as length of time allocated to the activity and the storing or materials during the making.

You will need:

- Design sheets for the children
- Sticky tape and metre rulers (for propping up parts and securing)
- One marble for each group to test the rollercoaster
- A range of materials, including cardboard tubes, plain cardboard, boxes and plastic tubes (a 2m long piece of plumbing pipe can be purchased quite cheaply from DIY stores)
- Plumbing pipe to be cut in half by an adult if needed
- Flexible tubing for the 360° loop
- Small pieces of these materials for use during the testing stages

Organisation

- Mixed ability groups of between two and five
- You may want to spend a whole day doing this activity or split it over a week.

Tip and tricks

- Send a letter home for materials beforehand as there may be families with plenty of tubing going spare.
- If budget allows, each team could be given a 2m length of plumbing pipe which can be sawn easily with junior hacksaws for design and corners. (Check your school's policy and risk assessment before considering the use of junior hacksaws.)
- Use sticky tape and metre rulers to support parts of the rollercoaster.
- A covered tube will stop the marble from falling out of the loop or other parts.
- The 45° drop should be used to get enough speed to finish the run and complete the 360° loop. Note how this is done with a big drop at the start of most rollercoasters.
- Make it real by giving the rollercoasters a name and even making an advertisement for them on video or paper.
- Use this is a cross-curricular and writing/presenting activity.

Simple catapult

In this activity a simple catapult is constructed from a plastic spoon, wine cork, and rubber band. Any small object that can fit in a spoon can be used to launch. Simple physics through Newton's Laws of Motion are observed. Engineering is incorporated by constructing the catapult, and mathematics is touched by doing a simple calculation of distance of launched item.

Materials
Corks
Plastic Spoons
Rubber bands
Jelly Beans
Measuring Tape
Display Board for Recording Students Distances
Marker

Instructions
1, Start by wrapping spoon mid- handle in rubber band, then attaching to wine cork in crossed manner, as can be seen below.

2. Then place jelly bean on spoon, and launch by pressing down on bottom of handle

3. Record distance.

https://catherineodson.com/2015/01/23/putting-the-cat-in-catapult/

Theme Park

f a r i l o g f l u m e t a
m n o i t a p i c i t n a m
h e l t e r s k e l t e r u
i c l c e a s m s t e a l e
d r e m f l c d e k r d e s
n t r g o u d o d g e m s t
u i c g y f q f a r g i u t
o c o e q u n u q u i s o i
r i a m u s e m e n t s r c
g t s h i j k l m u o i a p
r t t t s c r e a m i o c a
i r e s d o d j u m s n o n
a q r u v q u e s a e c g l
f u a t t r a c t i o n s f

admission
amusements
anticipation
attractions
carousel
dodgems
fairground
helter skelter
log flume
queuing
rollercoaster
scream

My Carnival Costume

This Carnival I will dress up as a _____.

This is what my costume looks like:

Write why you have chosen this costume:

_____

_____

_____

_____

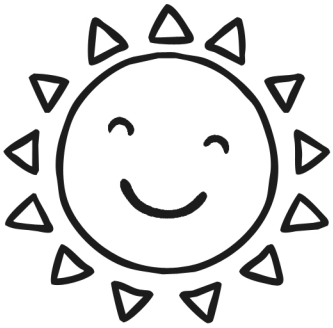
_____

_____

_____

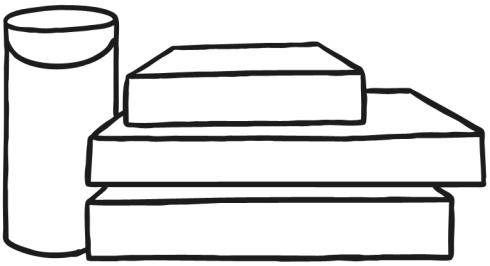
_____

Summer Activities Challenge



How many different types of activities can you do over the summer holidays?

Colour in the pictures of the activities you have taken part in.
Have fun and enjoy the summer activities challenge!



play a board game

go cycling

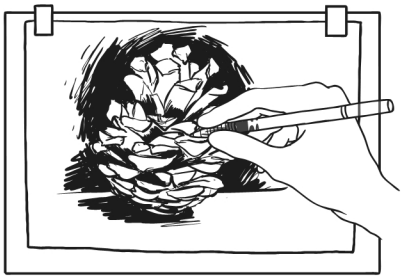
go swimming

build a sandcastle

go in a paddling pool

have a BBQ

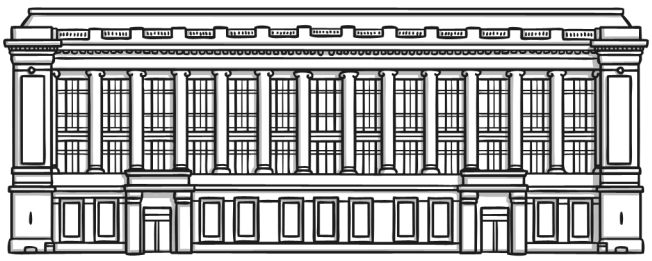
play in the park



learn a new skill

write a poem

build a den



visit a museum

read a great book

Carnival ride:

What you need:

Cardboard base 18cm circumference

Thin card 8cm circumference x2 top of the carnival ride

Thin card 3cm circumference x8 seats for the ride

Match sticks (no sulphate ends) 4cm length x8 arms for the seats

Batteries x2

Battery holder

Wires 16cm length x2

Fine string 7cm length x8

Motor

Ruler

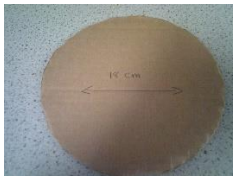
Pencil

Wire cutter

Hot glue gun

Instructions:

- Using thick card, measure 18cm circumference and cut out the base

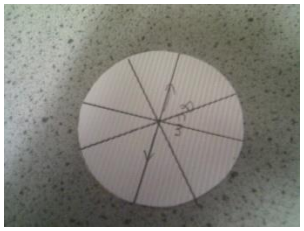


- Using thin card, measure 8cm circumference and cut out the top, twice

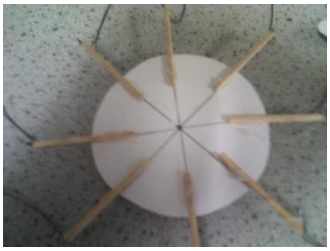
- Using the same thickness as the top, measure 3cm circumference and cut out for the seats, eight times

- Measure and cut 7cm length of cardboard tubing

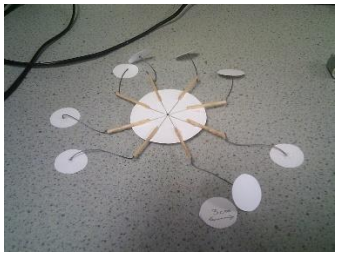
- Using a ruler and pencil, find the middle of the circle, draw across, continue all the way round the circle, as shown in the image (8 segments)



- Using the hot glue gun, glue the match sticks to each of the segment lines, as shown in the image

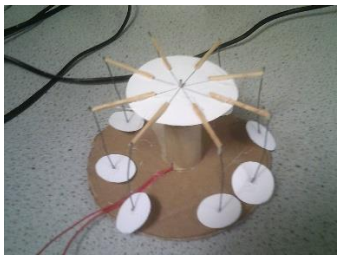


- Using the string, measure 7cm and cut, do this eight times. Heat the hot glue gun and glue the string to the end of the match sticks.
- In the middle of the seats, put a small amount of glue and attach the seats as shown in the image.

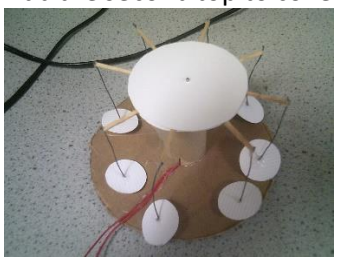


- Slide the wires through the tubing, then, using the glue attach the motor to the top of the tube.
- Stand the tubing upright and glue to the base as shown in the image

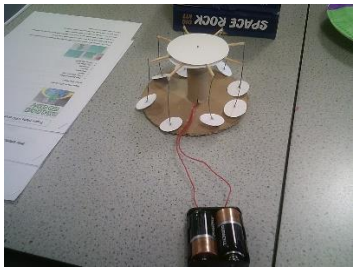
- Place the top onto the motor



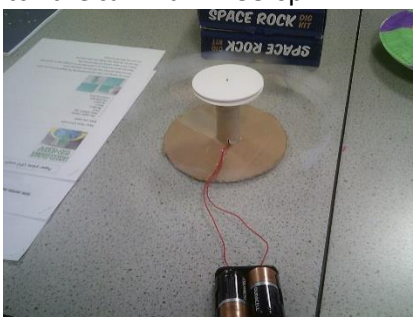
- Add the second top to cover all the matches



- Add the batteries to the battery holder, hold the wires to the terminal ends



- Watch the carnival wheel spin



Centripetal Force and Gyroscopic Stability: Penny Racers and Screaming Balloons

Penny Racers

- Place a penny inside a balloon, blow it up and tie it.
- Hold the balloon like a bowling ball and shake it gently in a circular motion
- The penny should soon begin to spin around on its edge in circles inside the balloon
- See how fast you can make the penny spin
- Stop moving the balloon and see how long the penny continues to spin inside

Screaming Balloons

- Place a hex nut inside a balloon, blow it up and tie it.
- Hold the balloon like a bowling ball and shake it gently in a circular motion
- The hex nut should soon also begin to spin around on its edge in circles inside the balloon, but this time it will make a loud screaming sound as it spins. The faster it goes, the louder and higher pitched the sound.

What's Happening: When you shake the balloon the penny or nut begins to bounce around and will soon find itself spinning along its edge simply due to random interactions, but once it does, because of the shape of the penny (or nut) the spinning motion produced is very stable and it will tend to keep spinning, especially if you continue to pump it at the right frequency (much like pushing someone on a swing). This is called gyroscopic stability, and it's what keeps a gyroscope pointing the same direction, a top spinning, or a rolling bicycle wheel from falling over. The round walls of the balloon also force the penny or nut to roll in a circle about the centre of the balloon. This is called centripetal force, and it will keep the penny rolling until friction eventually slows it down, but since the frictional force is very small and the penny is rolling very fast, it can keep going for a very long time. If it's spinning horizontally, as it slows it will roll in smaller and smaller diameter circles and move down the side of the balloon.

While the penny rolls around inside the balloon almost silently, the nut makes a screaming sound as it rolls. This is because the corners of the nut bounce as they hit the balloon and cause it to vibrate, or move back and forth very quickly. As the balloon vibrates, it in turn vibrates the air molecules nearby which creates sound waves. The faster the balloon vibrates, the faster the frequency of the sound waves and the higher the pitch will be. As the nut moves faster it

also has more momentum and makes the balloon move farther with each vibration, which pushes more air and makes the sound louder.

Variations: Try to make the penny spin in different directions. Try different shaking motions to start the penny spinning. Once it is spinning fast, turn your whole body and the penny should continue to roll more or less) in its original direction, just like a gyroscope. Try 2 pennies, or even 3 inside the same balloon. They might crash into each other at first, but you should find it quite easy to make all the pennies line up side-by-side and spin together. With a penny spinning fast, gently toss the balloon into the air and observe what happens as the centre of mass of the system changes.