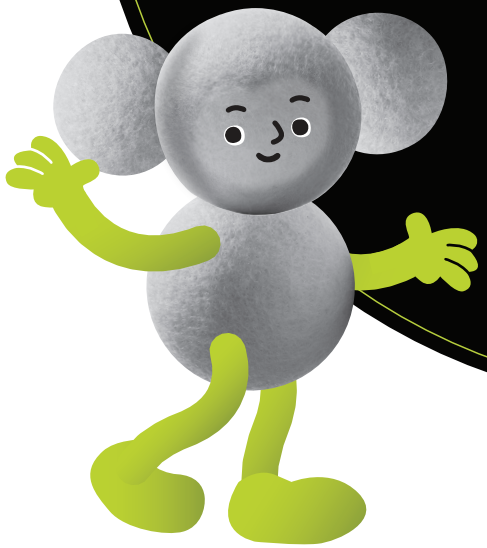
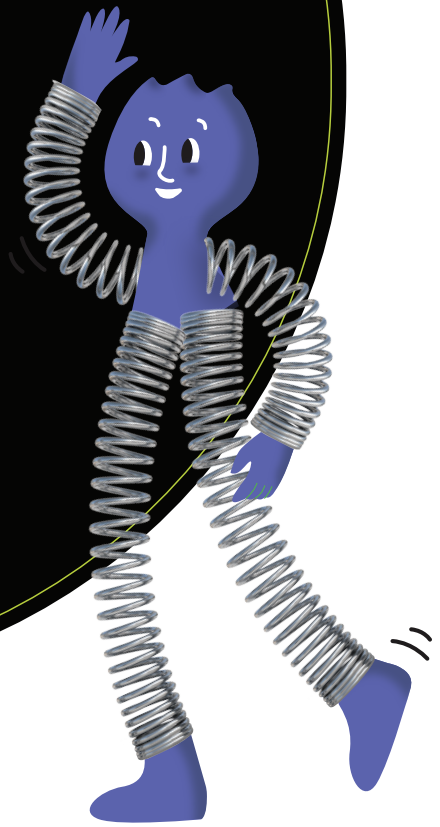
Teacher Guide

TINKER TOWN

imagine design create





MUSEUMS VICTORIA

CREATIVE VICTORIA

How To Use This Guide

This resource is created to help facilitate the design process as your class builds their very own *Tinkertown*!

•The guide includes pre-visit, *Tinkertown* visit, and post-visit activities that correlate to a step of the design process. Please reference the page, *Tinkertown* Design Process, to see how the design process is organized within the *Tinkertown* experience.

•Through engineering design and research activities students will decide what resources a town needs and how to build them.

•During your school excursion to *Tinkertown* your students will prototype and test designs and collect inspiration.

•Back at school each student will build one town resource (car, house, bridge, playground, etc.) The class will then combine their resources to build a mini *Tinkertown*!

•You can use the entire resource as a unit or choose the activities that are most appropriate for your students.

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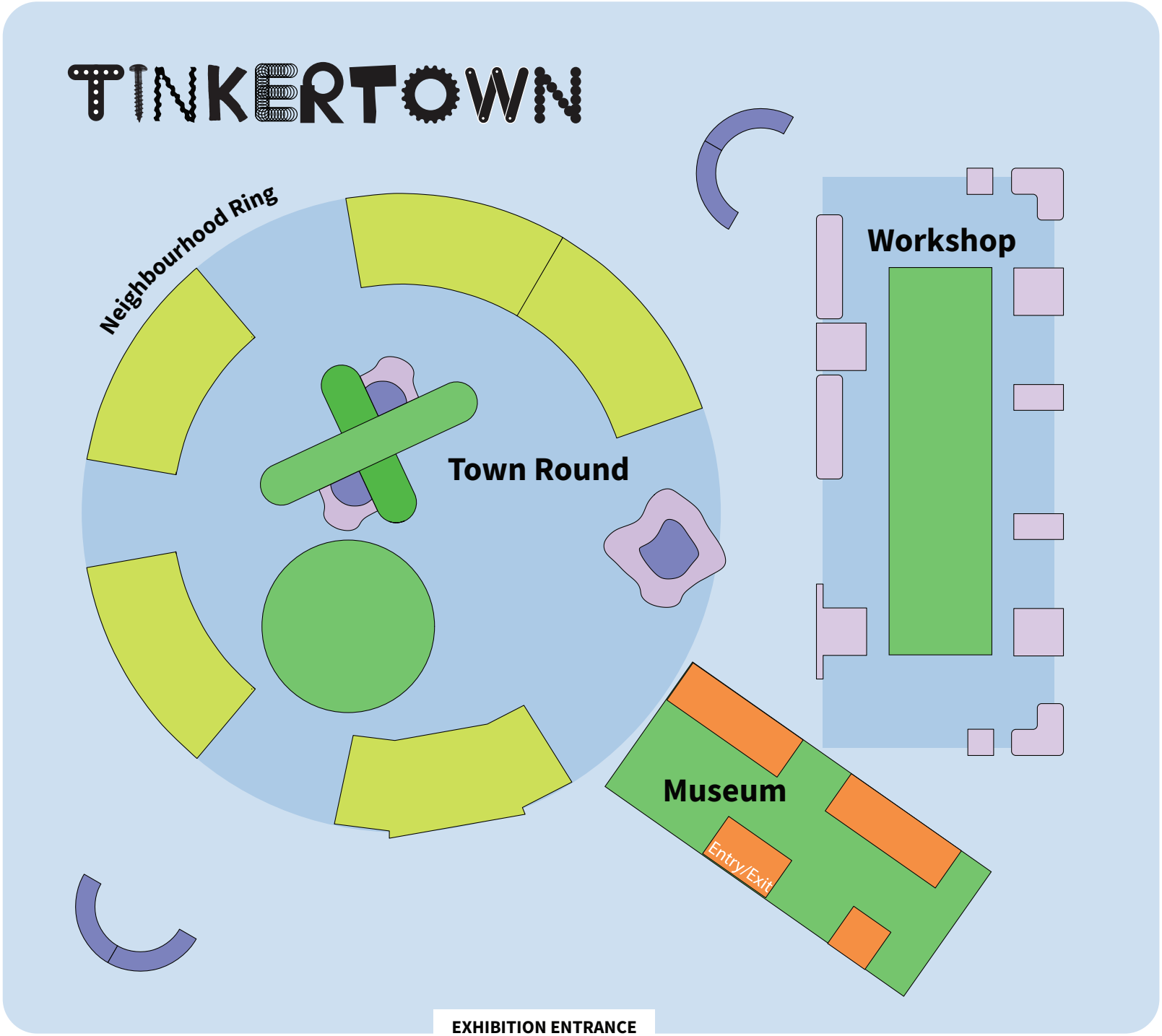


What is tinkering?

Tinkering is unstructured time to mess with things in an experimental way through hands-on play with thoughtfulness and self-defined purpose, iterating and adapting on the fly.

Curriculum Links and Learning Experiences

In *Tinkertown*, students will experience:
• engineering • design challenges • building inventions • open-ended or guided tinkering
• communication • coding and creation • patterns and puzzles • masses of magnetic cushions

Science: Chemistry

F–2 VC2S2U04

Objects can be made of one or more different materials; these materials have observable properties.

F–2 VC2S2U05

Materials can be combined in a variety of ways for particular purposes; the properties of objects and mixtures can differ from the properties of the materials from which they are made.

F–2 VC2S2U06

Materials can be changed physically by different actions without changing their material composition, including by bending, twisting, stretching, crushing, squashing and breaking into smaller pieces.

3–4 VC2S4U05

The properties of natural and made materials, including fibres, metals, glass and plastics, influence their use and re-use.

Design And Technologies

F–6 Creating Design Solutions

Investigating and defining, generating and designing, producing and implementing, evaluating, planning and managing.

Technologies and Society

F–2 VC2TDE2S01

How familiar products, services and environments are designed and produced by people to meet personal or local community needs and sustainability.

3–4 VC2TDE4S01

The role of people in design and technologies occupations and factors including sustainability that impact on the design of solutions to meet community needs.

5–6 VC2TDE6S01

How people in design and technologies occupations consider competing ethical factors including sustainability in the design of products, services and environments.

Science: Physics

F-2 VC2S2U10

The way objects move depends on a variety of factors including their size, shape and material.

3-4 VC2S4U10

Forces, including frictional, gravitational, electrostatic and magnetic, can be exerted by one object on another through direct contact or from a distance and affect the motion (speed and direction) of objects.

Mathematics: Space

1 VC2M1SP01

Make, compare and classify familiar shapes; recognise familiar shapes and objects in the environment, identifying the similarities and differences between them.

2 VC2M2SP01

Recognise, compare and classify shapes, referencing the number of sides and using spatial terms such as ‘opposite’, ‘parallel’, ‘curved’ and ‘straight’.

3 VC2M3SP02

Interpret and create two-dimensional representations of familiar environments, locating key landmarks and objects relative to each other.

The *Tinkertown* Design Process

Pre–Visit

1. **Identify**—What resources does a town need?
2. **Research**—How do we design and build the right resources for our town?
3. **Design**—How can we be innovative and creative?

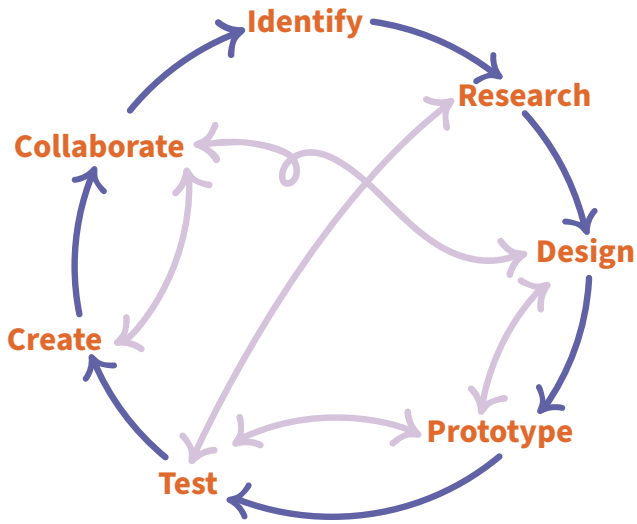
Tinkertown

4. **Prototype and test**—Does our design function for its intended purpose?

Post–Visit

5. **Create**—Build your resource!
6. **Collaborate**—Put your resources together to build your to**wn!**

The design process is represented linearly but in reality, it is a spectacularly messy process. And that's okay, we love making a mess! Your design process may look more like this...



Pre-Visit: Identify

Step1: Identify-What does a town need?

You are a town planner in charge of designing a new town! First, decide as a class, where will your new town be built? Next, create a list of everything your town needs. Houses, roads, bridge, playground, parks, transportation, what else?

Question Prompts:

How does the location and ecosystem of your town impact the community needs?

What do you need to be healthy and safe? What about your family, community, friends?

What does a town need to provide happiness and a high quality of life? Is it accessible for all people?

What type of infrastructure does a town need?

Step 2: Tangram Town

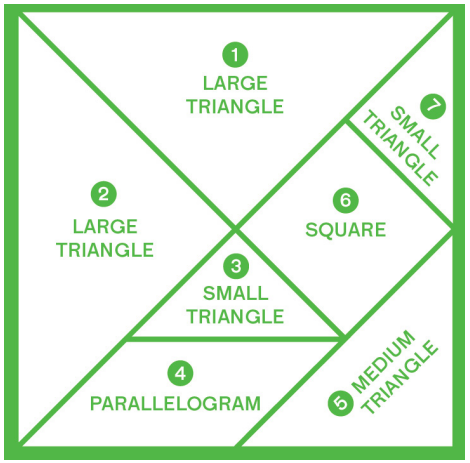
- Cut out the 7 shapes from the tangram print out
- Using only the 7 pieces, create 1 town resource from your list
- Shapes have to be touching and can not overlap
- Work together as a group to map your town
- Using the background print out, glue your town resources together

Does your town have everything it needs?

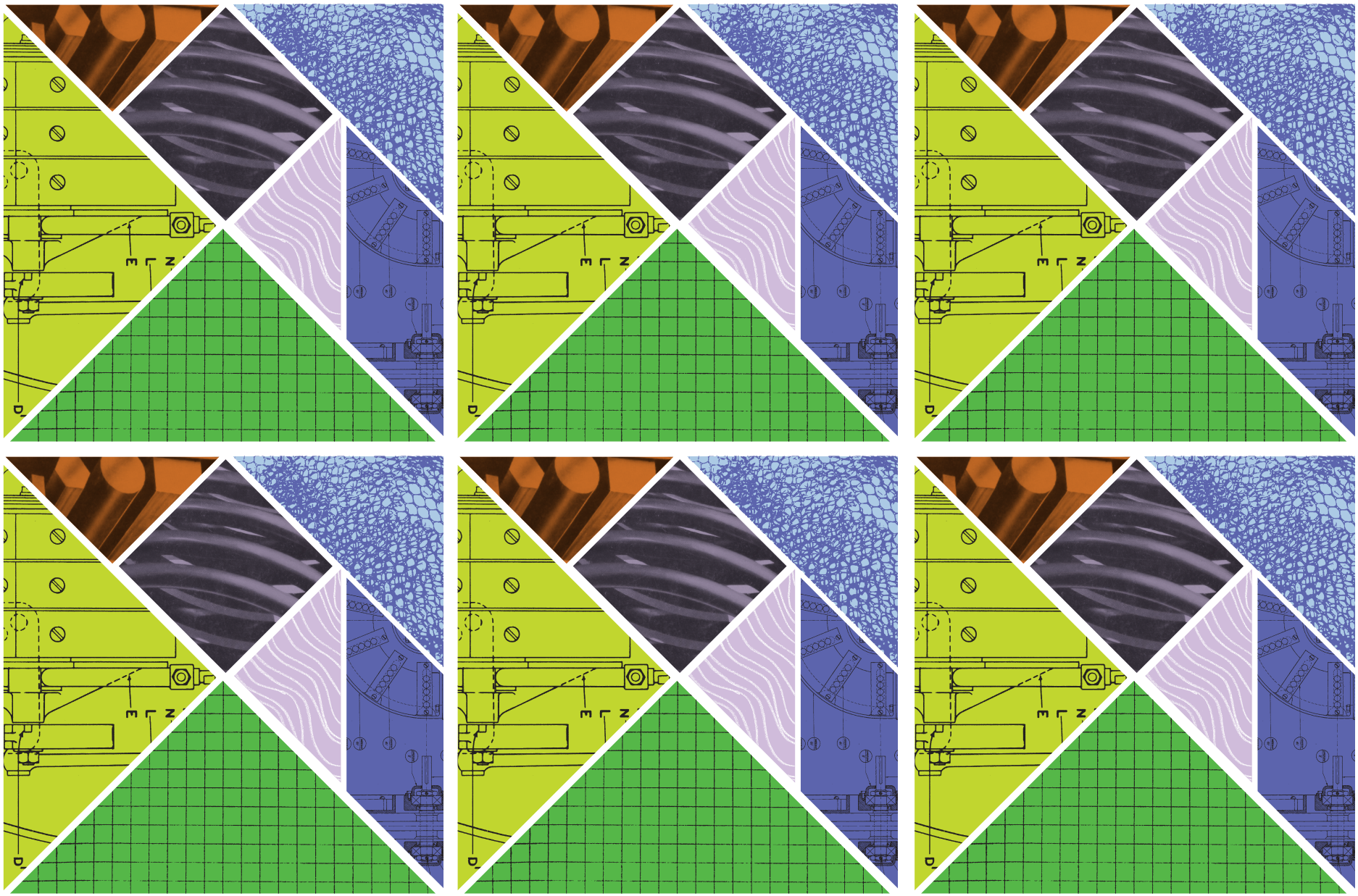
A tangram is a puzzle that consists of 7 different geometric shapes that you arrange and rearrange to create thousands of pictures and scenes.

Further investigation:
A town needs to be for everyone, let's interview our town members to find out what they need and want!

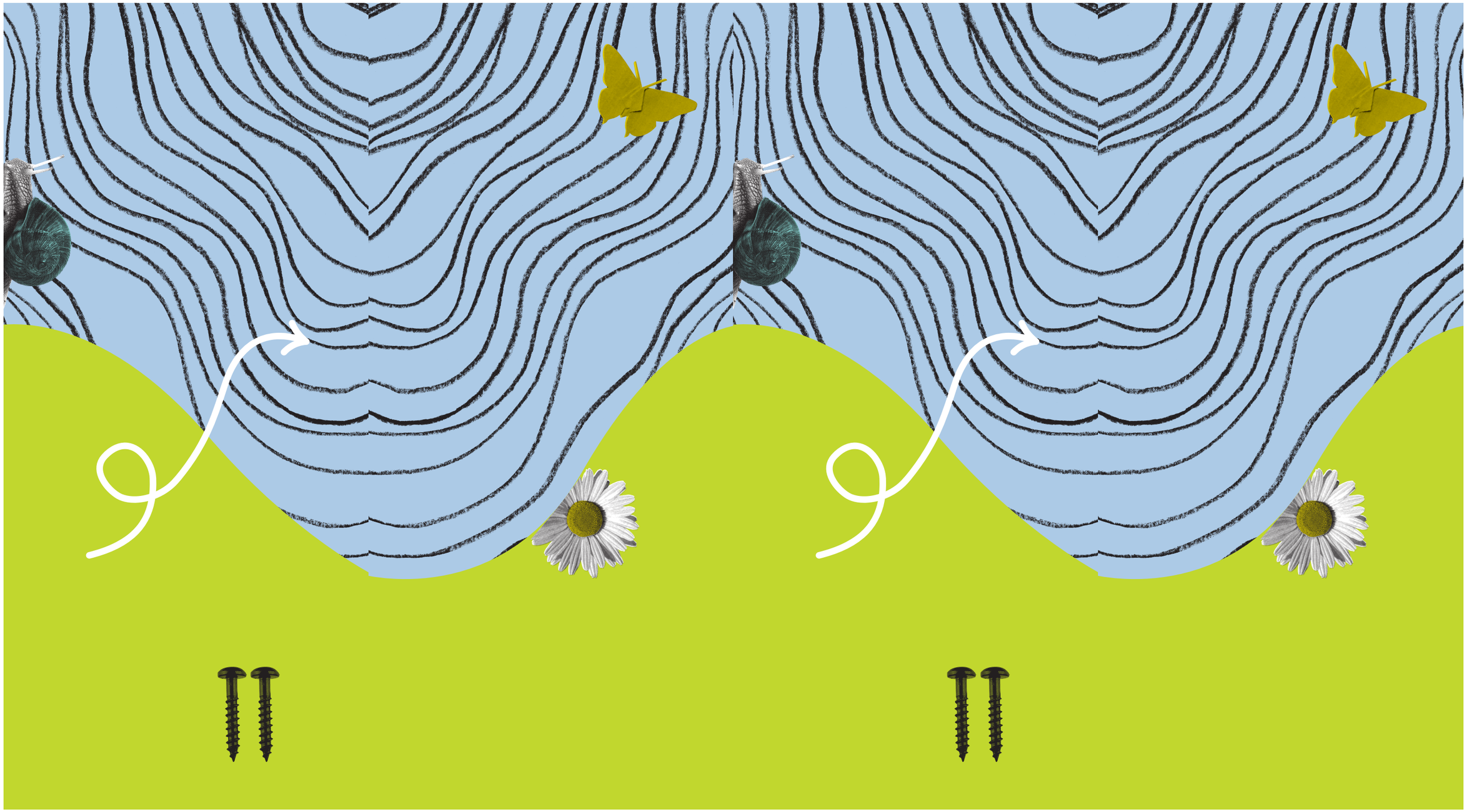
Check out the Tangram puzzle wall at Tinkertown!



Print these pages for the tangram collage on A4 paper. Cut out each shape.



Print out this background page on A3 paper. Then glue your shapes onto the page to make a town.



Pre-visit: Research

Activity 1: Shape Strength Test

Shapes are used to add strength in structures. As town planners, engineers, and tinkerers, it is important to know which shapes are the strongest. Let's test them!

Materials: jubes, toothpicks, books. Use playdough or clay as a jubes alternative.

1. Students work in groups to create 4 cubes and 4 triangular pyramids with gum drops and toothpicks
2. Spread all the built cubes out so a book can be balanced on them and the weight is equally distributed against all 4 cubes
3. Don't forget to make a hypothesis and record your data in the table!
4. Carefully stack books one at time on top of the cubes

   How many books can the cubes hold before collapsing?
5. Do this again but with the triangular pyramids
6. Make a hypothesis and record your data in the table

Have you ever noticed shapes within a building? What shapes do you see inside of the Eiffel tower structure?

Pre-Visit: Research
Shape Strength Test

I predict _____ will the strongest shape.

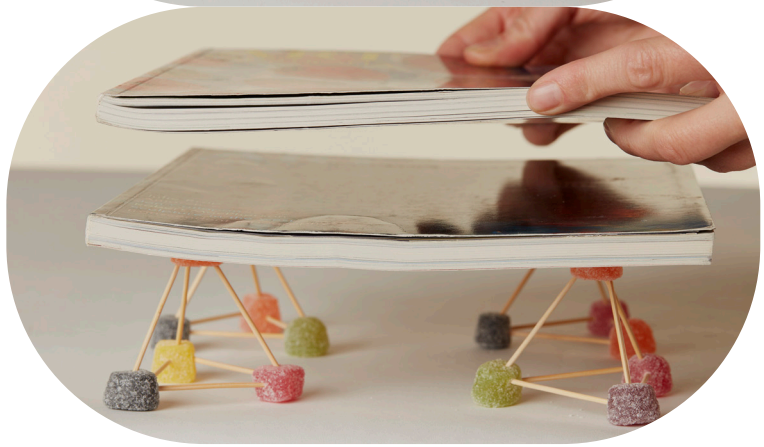
How many books can 4 triangular pyramids hold?

Hypothesis	Result

How many books can 4 cubes hold?

Hypothesis	Result

What shape would you use to build the roof of a house?



Pre-visit: Research

Activity 2: Properties of Materials

Would you build a car out of cement? Would you build a slide with carpet?

Knowing the properties of our building materials is so important for a tinkerer! So, before we get building, let's do some testing research.

Gather a variety of materials to test various properties.

You will also need: Sharpended #2 pencils, a spray bottle, a plastic tray, magnets

Material suggestions are listed below but you use any classroom materials!

- **Metal:** Steel bolts, aluminum foil or cans,
- **Fabric:** Cotton or synthetic scraps or old clothes
- **Plastic:** Plastic folders, stretch-wrap
- **Pulp products:** Cardboard, paper towels
- **Wood:** Pine or cedar scraps , balsawood
- **Water Resistant Material:** Water resistant material, raincoat
- **Rubber:** Rubber bands, bicycle tyre tube
- **Foam:** Swimming noodle, sponge, foam mat

Did you know?

Dried mushrooms can be used as padding protection in helmets.

Banana fibers can be used to make ropes and clothes.

Plastic bottles filled with sand or mud and stacked together can provide insulation to a building.

What should we consider when choosing a material to build with?

Material properties, cost, availability, sustainability. Can you think of anything else?

List Your Materials

Property: Which material(s)….	Test	Hypothesis	Result	What could you make with this material?
is the strongest? Strength – The ability for a material to handle force or stress without breaking.	Two students hold each side of the material. Place weights in the middle. Keep adding weights (e.g. books, bean bags) to see which material can hold the weight without breaking.			
is the most flexible? Flexibility – The ability for a material to stretch and change shape and return back to its original shape.	Try to bend each material back to itself and then straighten it out again. Notice which materials return to its original shape once released.			
is the hardest? Hardness – The ability to resist permanent scratches or dents.	Hold a sharpened pencil with 2 fingers and push into the material. The hardest materials won't be indented by the pencil.			
is the most water resistant? Waterproof – A material that stops water from passing through it.	Place each material in a plastic tray and spray it 5 times with the spray bottle. Pick up the material, did the water soak through? Can you feel moisture on the other side? Do you think the amount of water makes a difference?			
is able to be magnetised? Magnetic – A material or substance that is attracted to a magnet.	Using a magnet test your materials to see which ones are attracted to it. Is all metal magnetic?			

Pre-visit: Research

Activity 3: Wheels and Axles

What are some modes of transportation that your town has?

A wheel and axle is a simple machine. It consists of a rod, known as an axle, that runs through a hole in the wheel. These parts rotate together to move or lift loads.

Let's tinker with wheels and axles so we can build transportation for our town.

Materials:

• Plastic bottle caps

► Prep- drill holes through the middle of the caps with a power drill or you can use a nail and hammer

• Wooden skewers (pencils or recycled toys work as well)

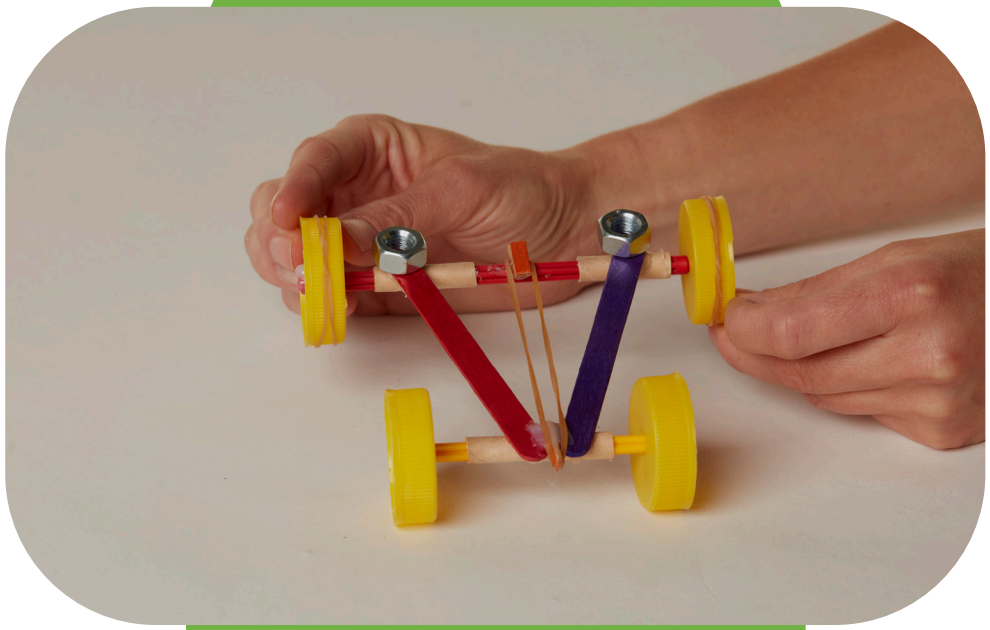
► Tip–make sure they are the same size as the wheel hole. They should have a snug fit

• Straws

• Popsicle sticks

• Hot glue

Extension materials: Rubber bands and weights

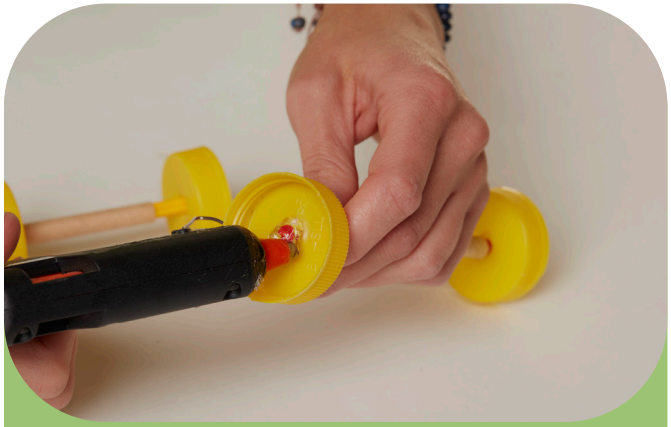


The wheel and axle were created over 5000 years ago. Some archeologists hypothesize that the first wheels and axles were invented for pottery wheels rather than transportation!

Pre-visit: Bottle Cap Car

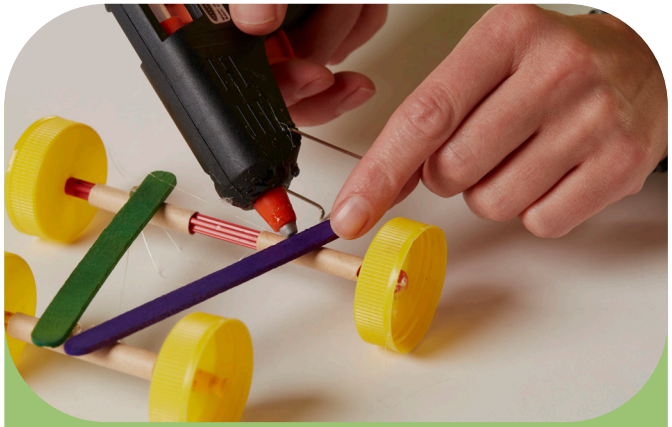
Materials: Hot glue, popsicle sticks, straws, axles (skewers, pencils, toys), 4 pre-drilled bottle caps Extension: Rubber bands, weights (bolts)

Cut the straw into 3 pieces. 2 pieces for the rear axle and 1 for the front. Push your axle into the center hole in the bottle cap. Do this for all 4 wheels.

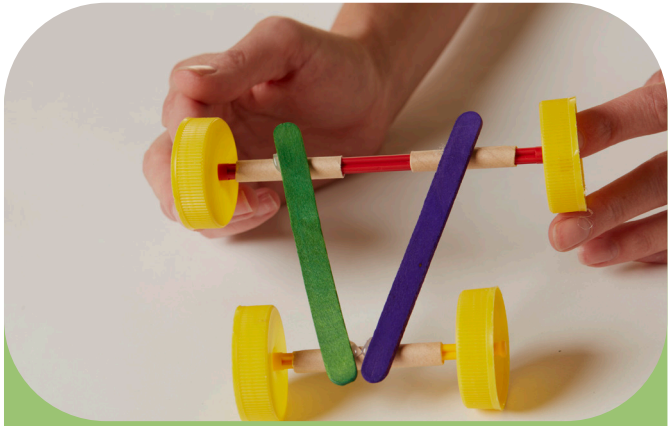


Glue the wheels to the axles.

Glue the popsicle sticks to the straws, making a triangle shape between the front and rear axle.



Make sure to keep space between the straws on the rear axle as shown.



Your car is ready to race! Experiment with the wheels and axles by pushing or pulling your car.

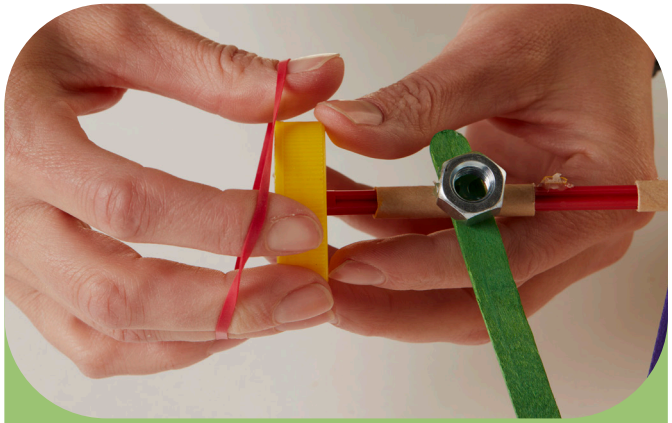
Extension: Add a force to your car! You'll need 3 rubber bands, 2 weights (bolts) and 1 popsicle stick.

Cut 2 small pieces from a popsicle stick. About 1.5 cm long and .5 cm wide.

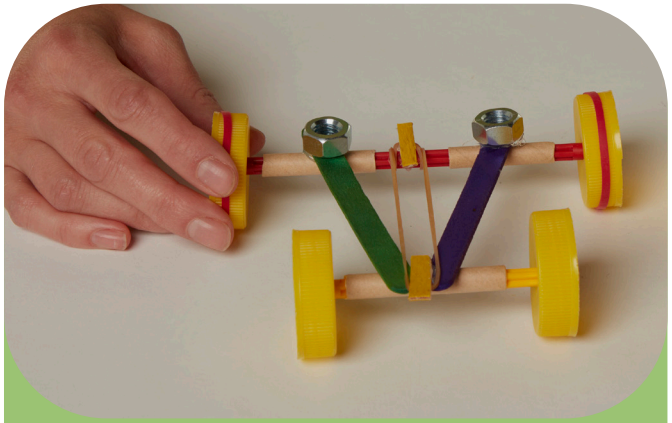
Glue 1 piece to the rear axle, directly between the 2 straws.

Glue the other piece to the front axle on the tip of the triangle.

Test out playing with weight and traction. Does adding weights above the rear axle make a difference?



Wheels have treads on the tyres. Does your car need traction? Try adding a rubber band to your wheels.



Hook the rubber band onto the front and rear axle attachment points. Twist the rear axle so that the rubber band winds around the axle, hold it in place and put the car on a flat, smooth surface and release!

Pre-visit: Design

Design your own *Tinkertown*

Design and sketch your prototype

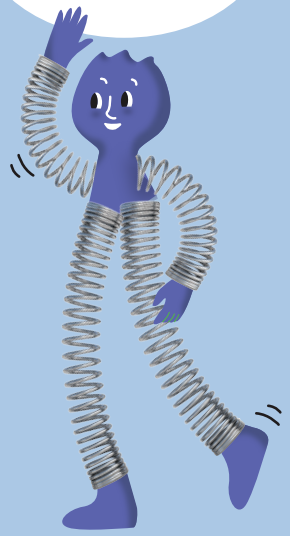
Your end-user is the person or people that you are building the resource for. How will your resource accommodate your end user?

_____

_____

_____

_____



What properties are required for your building materials?

_____

_____

Town planners consider the needs of the townspeople and the landscape of the town. Work with your class to plan your city. You will design and build one resource, but together, you will build an entire town!

As a town planner and engineer, what are you going to build for your town?

_____

_____

Does your build require simple machines?

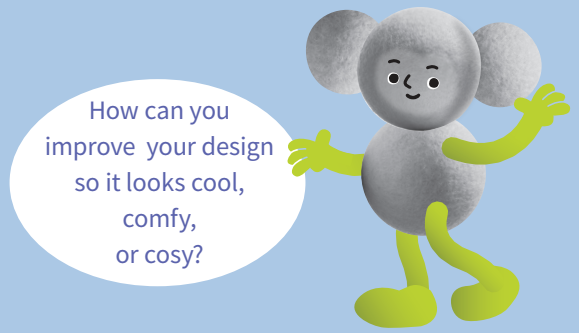
_____

_____

Does it involve shapes for strength?

_____

_____



Tinkertown Visit: Research
@ The Museum in *Tinkertown*

Check out our *Tinkertown* museum collection items! We can get inspiration and ideas for our own building projects by seeing what other people have created!

List 2 inventions that use a wheel and axle:

.....

.....

Find 1 object that uses triangles as structural support:

.....

.....

What are the necessary properties of the materials used for the flying machine?

.....

.....

Choose 1 invention. Can you name 3 of the materials the invention is built with?

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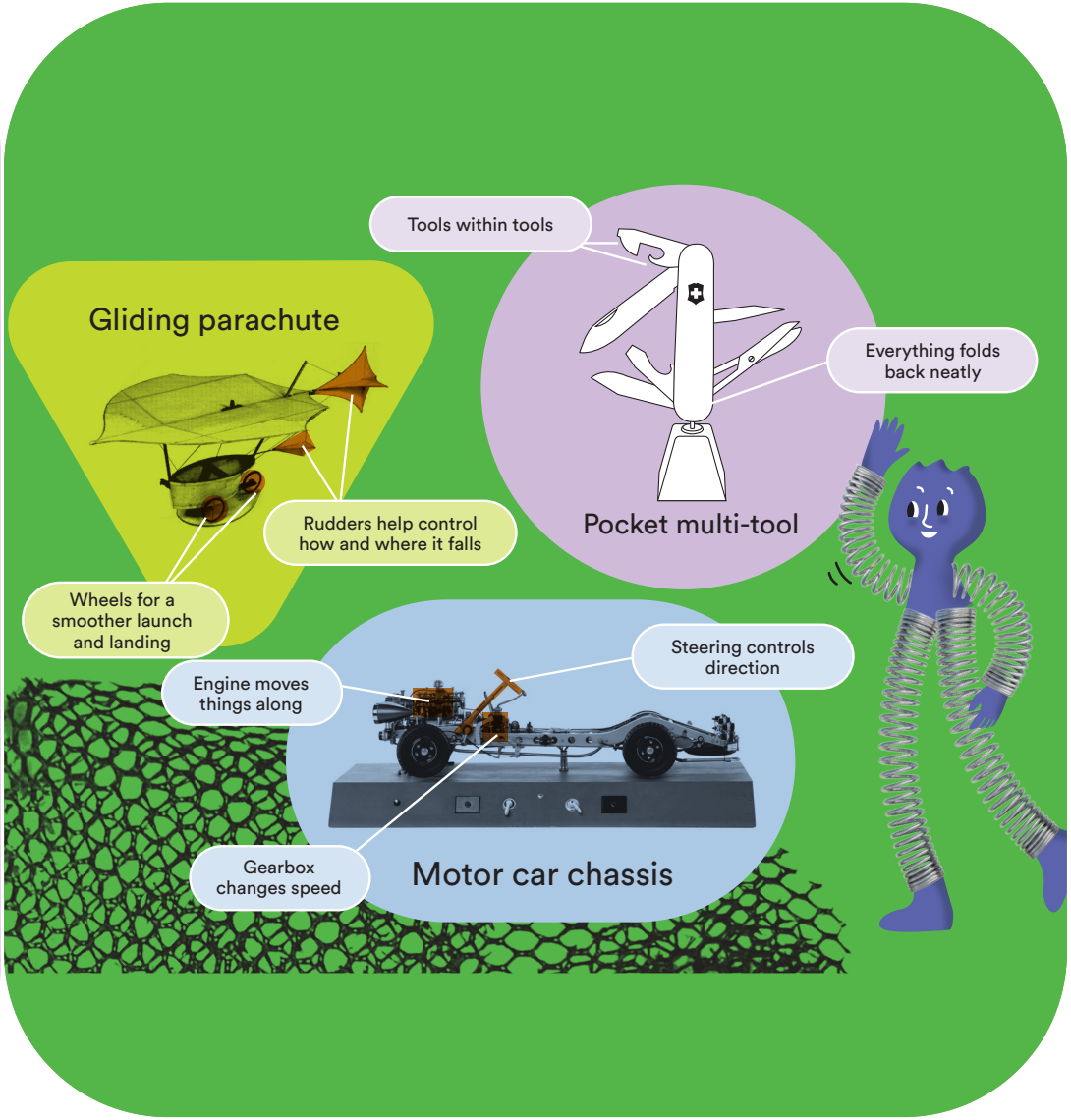


Tinkertown Visit: Prototype and Test
@ The Town Round

Building materials: magnetic cushions

Test with: shape and structural strength

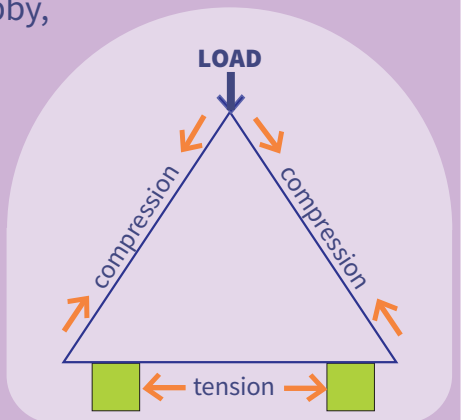
Town resource connection: homes and buildings

Character cubby challenges:

- Make a cubby that's cosy and curved
- Build a cubby that is tall, can Stretch fit in it?
- Test the strength of your cubby, is it safe?

Stretch yourself!

Prototype and test a roof for a house. Make a roof with 2 triangles. This is called an A-Frame. Test the strength of it. Does it hold? If not, try again with a new design!



Remember, errors are part of the design process! That's why it's nicknamed 'trial and error'.

If your design fails a test, try again!

Failures create the best creations if you stick with it!

Tinkertown Visit: Prototype And Test
@ The Neighbourhood Ring

Building materials: ball-ercoaster

Test with: simple machines

The ball-ercoaster uses a simple machine called an inclined plane, or a ramp, to move a ball.

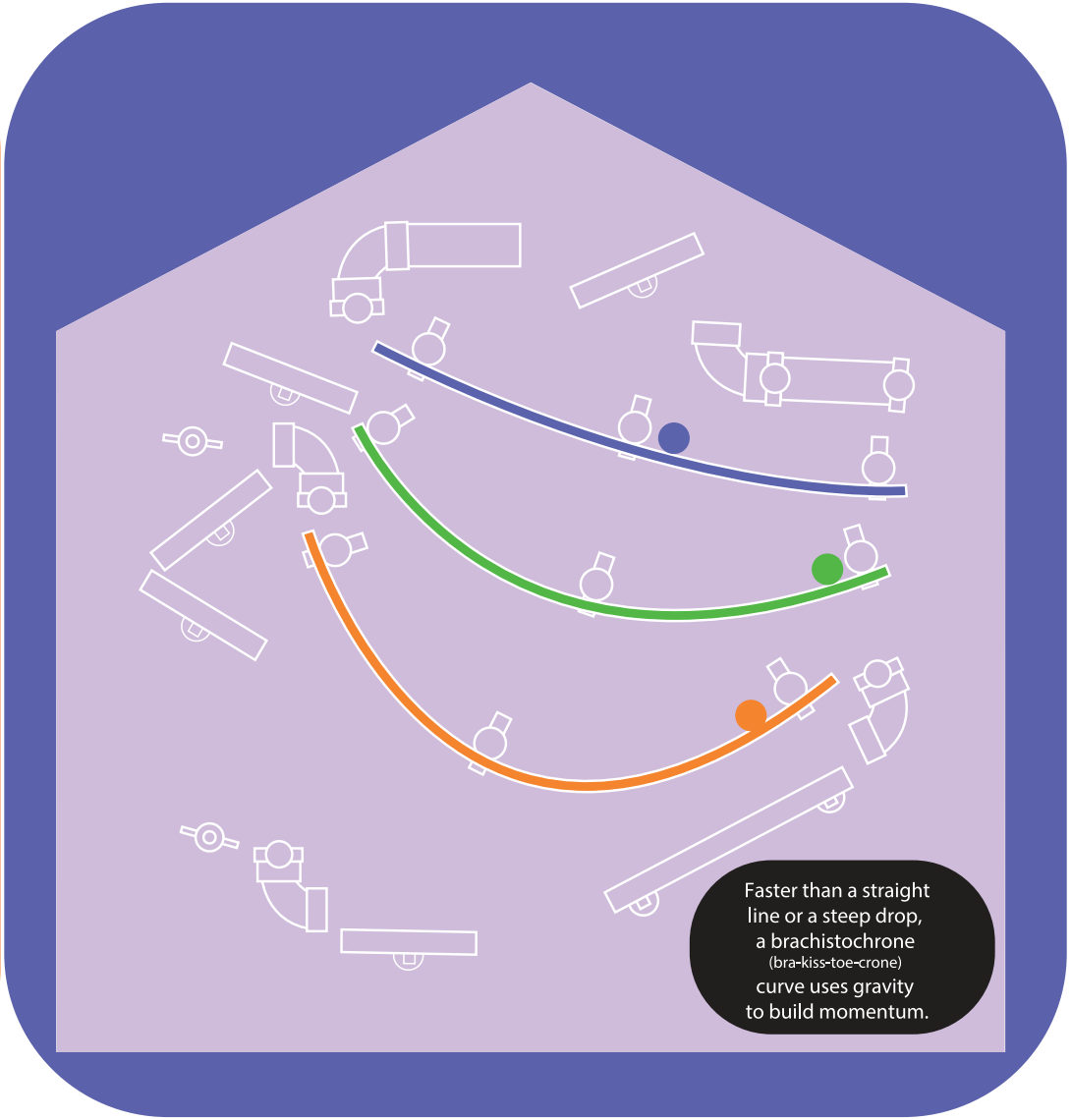
Town resource connection: Playground slides

Character challenges:

- Can you get the ball to the other side? Work with a friend to help the ball go through the gap
- Wouldn't it be fun it the ball goes upside down? Can you build a loop-de-loop?

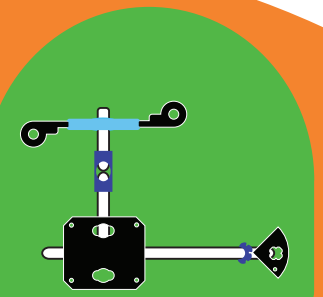
Stretch yourself!

Prototype and test a playground slide How steep should a playground slide be? Can you find the perfect slope? Could your slide have a loop-de-loop?



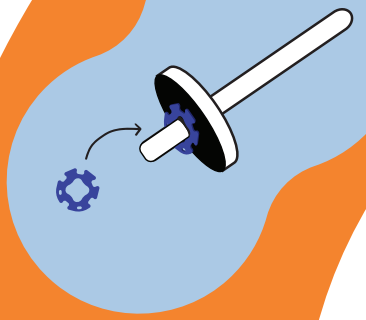
Tinkertown Visit: Prototype and Test
@ The Workshop

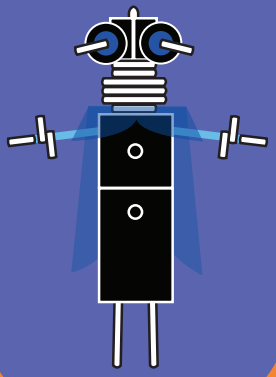
What can the pieces do?
Where do they fit?



Decide what to make then get building ...

Or start making and decide what you've created!





Building materials: Loose parts

Test with: Simple machines – wheels and axles

Town resource connection: Transportation

Character challenges:

- Can you build a: vehicle, flying contraction, robot, playground, bridge, marketplace
- Every town needs art as well as function! Can you build an art sculpture?

Stretch yourself!

Prototype and test a design for a mode of transportation. Can you invent a new mode of transportation for your town? It must have at least 1 wheel and axle. What are you transporting?

Post-Visit: Create, Collaborate and Share

Build your Bricolage Resource!

Step 1: Revisit your design. Has it changed since protoyping and testing in *Tinkertown*?

A bricolage is a something constructed from a diverse range of available materials

Step 2: Gather your materials.

Find materials that have the right properties for your resource. They can be recycled materials, repurposed, natural or human-made.

Remember to think about the properties of the materials. Are they right for your build?

Step 3: Check in with your town planning team! Does your town have everything that it needs?

Step 4: Build, test and re-build! This is an iterative process, meaning you may do it again and again to get your final product.

Step 5: Collaborate with your class and put your town together! It takes a village to build a town!

Step 6: Share your *Tinkertown* with family and friends.