# STEM Stage 1 learning sequence: magnificent vehicles

**Driving question**

How can a most magnificent vehicle deliver a small, special parcel to our neighbours?

**Learning sequence description**

Students will:

* design a solution to an authentic problem: How can a most magnificent vehicle carry a special parcel to my neighbours?
* identify the characteristics of different vehicles including their materials and their movement
* investigate light and sound energy and how they are can be used for a specific purpose
* explore the effects of these characteristics on how vehicles are designed and their purpose
* apply their knowledge of 2D shapes and 3D objects, measurement and position within their design solution
* identify the needs of their neighbours as member of their community and will demonstrate inclusive and respectful behaviours
* explore kinships as an important part of Aboriginal and Torres Strait Islanders cultures.

## Syllabus outcomes and content

### Science and technology

**ST1-2DP-T** – uses materials, tools and equipment to develop solutions for a need or opportunity

* design and develop a product that uses one or more forms of energy to create change
* select appropriate materials, components, tools, equipment and techniques and apply safe procedures to produce designed solutions

**ST1-6MW-S –** identifies that materials can be changed or combined

* investigate how materials can be changed by bending, twisting and stretching

**ST1-7MW-T –** describes how the properties of materials determine their use

* design and evaluate a product, demonstrating understanding of the suitability of materials for a purpose

**ST1-9PW-ST** – investigates how forces and energy are used in products

* explore how forces are used to create movement in products

### Mathematics

**MA1‑1WM –** describes mathematical situations and methods using everyday and some mathematical language, actions, materials, diagrams and symbols

* record length comparisons informally using drawings, numerals and words, and by referring to the uniform informal unit used

**MA1-3WM –** supports conclusions by explaining or demonstrating how answers were obtained

* explain the relationship between the size of a unit and the number of units needed,

**MA- 9MG** – measures, records, compares and estimates lengths and distances using uniform informal units, metres and centimetres

* compare and order several shapes and objects based on length, using appropriate uniform informal units
* estimate linear dimensions and the lengths of curves by referring to the number and type of uniform informal unit used and check by measuring

**MA1-14MG –** sorts, describes, represents and recognises familiar three-dimensional objects, including cones, cubes, cylinders, spheres and prisms

* identify and name familiar three-dimensional objects, including cones, cubes, cylinders, spheres and prisms, from a collection of everyday objects
* represent three-dimensional objects by making simple models or by drawing or painting

**MA1-15MG –** manipulates, sorts, represents, describes and explores two-dimensional shapes, including quadrilaterals, pentagons, hexagons and octagons

* make representations of two-dimensional shapes in different orientations using concrete materials

**MA1-16MG –** represents and describes the positions of objects in everyday situations and on maps

* describe the positions of objects in models, photographs and drawings
* make simple models from memory, photographs, drawings or descriptions
* draw a sketch of a simple model
* use drawings to represent the positions of objects along a path

### English

**EN1-10C** – thinks imaginatively and creatively about familiar topics, ideas and texts when responding to and composing texts

* identify creative language features in imaginative texts that enhance enjoyment

### PDHPE

**PD1-3** – recognises and describes the qualities that enhance inclusive and respectful relationships

* demonstrate an understanding of what it means to be inclusive and respectful to others

**PD1-10** – describes and practises interpersonal skills to promote inclusion to make themselves and others feel they belong

* explore kinship as an important part of Aboriginal and Torres Strait Islander cultures

[Science and technology K-6](https://educationstandards.nsw.edu.au/wps/portal/nesa/k-10/learning-areas/science)  © 2017 NSW Education Standards Authority (NESA) for and on behalf of the Crown in right of the State of New South Wales.

[Mathematics K-10](https://educationstandards.nsw.edu.au/wps/portal/nesa/k-10/learning-areas/mathematics/mathematics-k-10) © 2012 Copyright Board of Studies NSW for and on behalf of the Crown in right of the State of New South Wales

[English K-10](https://educationstandards.nsw.edu.au/wps/portal/nesa/k-10/learning-areas/english-year-10) © 2012 Copyright Board of Studies, Teaching and Educational Standards NSW for and on behalf of the Crown in right of the State of New South Wales.

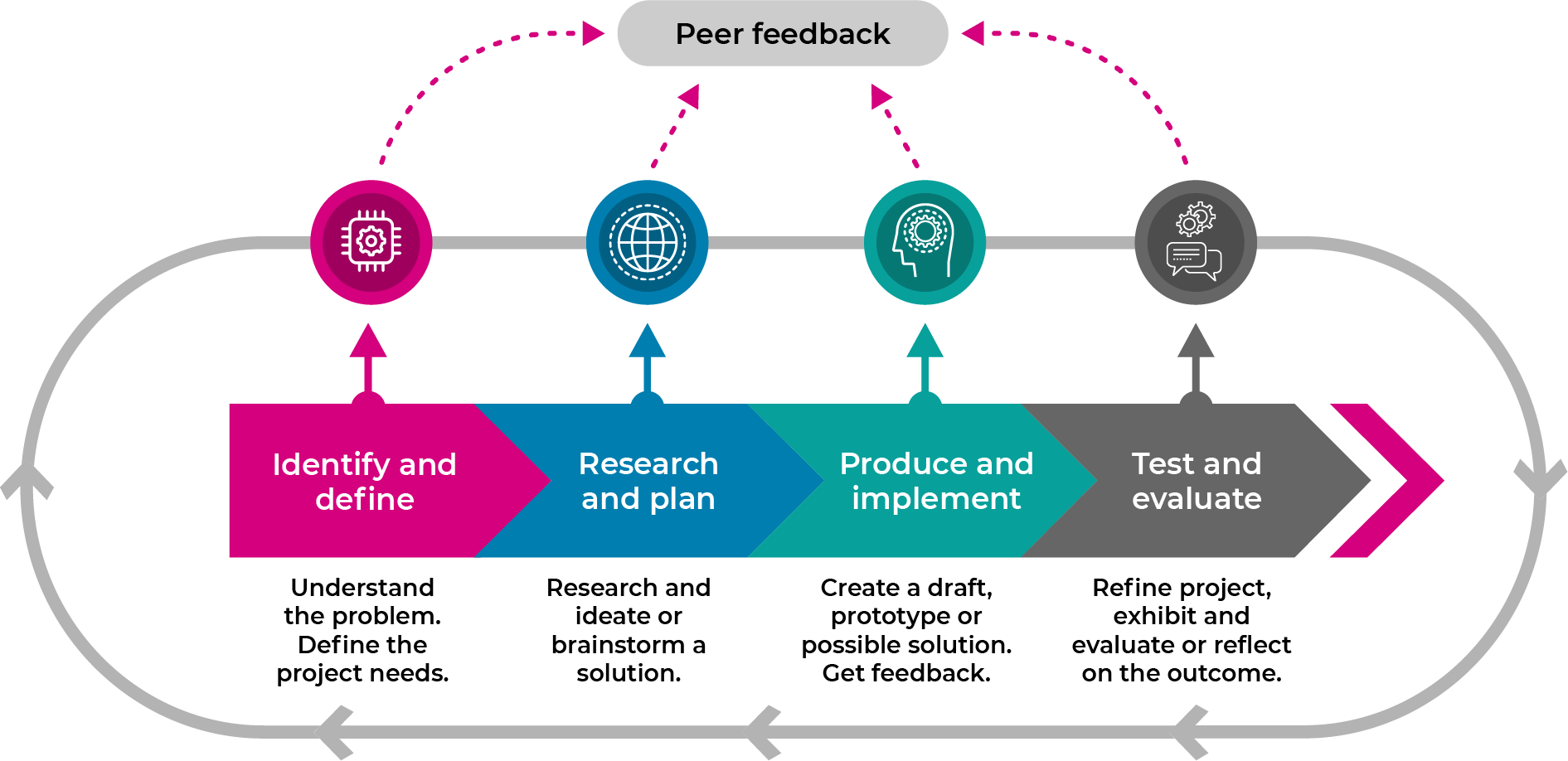
[PDHPE K-10](https://educationstandards.nsw.edu.au/wps/portal/nesa/k-10/learning-areas/pdhpe/pdhpe-k-10-2018) © 2018 NSW Education Standards Authority (NESA) for and on behalf of the Crown in right of the State of New South Wales.

### Resource considerations

This lesson sequence allows for continuity of student learning and could be adapted to fit in with your existing teaching and learning program. Students will be supported to meet outcomes from a number of key learning areas. Most tasks have a duration of approximately 30 minutes and could be used in conjunction with your existing frameworks. The tasks provide options for students with and without technology. They can be used with any online platform. Suggestions about how your school will plan students’ learning from home and ways to communicate with students can be found through the [Learning at home](https://education.nsw.gov.au/teaching-and-learning/learning-from-home) space on our website. Assessment strategies linked to the success criteria are included to ensure evidence of learning is monitored and collected.

### Teacher notes

This learning sequence models an integrated approach to learning where the student solves an authentic problem by employing [design thinking skills.](https://schoolsequella.det.nsw.edu.au/file/ba43743b-baca-4dd2-9689-2da09ad2ffc7/1/design-thinking-across-the-curriculum.zip/index.html" \l "/)



When initially introducing the model to learners, the flow is sequential; that is from Identify and define to Research and plan to Produce and implement to Test and evaluate. As students and teachers become more familiar with the approach, regular and rapid movement backwards and forwards between the stages is to be expected and encouraged. In practice, students may move from Test back to Identify and define or Research and plan; they may then jump forward to Produce and implement. The fluid movement between the stages frequently results in a more comprehensive outcome.

# Resources

STEM Stage 1 magnificent vehicles student workbook

The Most Magnificent Thing book (author by Ashley Spires) and/or video

[Design thinking poster](file:///C:\Users\hlaverick\Downloads\Design%20thinking%20model%20A3%20(PDF%20119.86%20KB))

# Learning experiences

## Activity 1

Students are learning to:

* recognise the way that different texts create different personal response
* respond to texts through discussion
* understand the author’s and illustrator’s message

### 1.1 (approx. 30 mins)

#### English: shared reading

As an introduction to STEM and designing, read the book ‘The Most Magnificent Thing’ by Ashley Spires. This is available as The Most Magnificent Thing video or you may have a copy of the book ‘The Most Magnificent Thing’ by Ashley Spires, published by Kids Can Press in your school library. Another alternative is you may be able to find a reading of this book on a digital sharing platform, such as YouTube.

The students are learning to think critically when listening to a story. They need to know that people bring different experiences, thoughts and ideas to a story, and this can change how we understand it. They are learning to look at a story and think about the author and illustrator’s message. This lesson will help students use new vocabulary.

At the end of the video, talk about aspects of the story. Ask questions and prompt responses to extend the students beyond the basic, obvious facts. For example:

* I wonder how the girl imagined and created all her different ideas.
* Do you think the people in the street knew how magnificent the inventions were? Why did they take her inventions?
* Tell me about the dog and girl’s relationship using the illustrations to support your thoughts.
* Have you ever felt so mad that you could explode? Tell me about it
* Talk about how the girl’s feelings changed she went for a walk with her dog after she had exploded. Have you ever had to walk away from a problem? Did this help you?
* Tell me about how the girl may have felt after she had success with her final invention.

### 1.2 (approx. 30 mins)

#### English: character development

Discuss how people look and feel, and the words we use to describe appearance and feelings. There is a difference between how a character feels, acts and looks.

How a character feels is on the inside can’t be seen. These are their **emotions**. How a character acts can be seen in their personality. These are their **traits.** How a character looks can only be seen on the outside. This is their **appearance**.

Discuss the observable features of the students’ friends and family members. Then share the emotions and personality traits that each may have.

In the story, The Most Magnificent Thing, there is a difference between how the girl in the story looks on the outside and how she feels on the inside. How do we know this? How do her feelings influence the way she reacts? What do you think are her personality traits? Discuss positivity at the beginning and the end of the story, and perseverance as things go wrong.

Discuss the feelings and emotions of the girl and the dog. How did the dog help the girl solve her problems?

Complete Activity 1.2 in the S1 student workbook: students discuss the image of the girl. On the left-hand side, we can see that she has lots of colours. On the right-hand side, her heart is the only colourful part. Why is this?

### 1.3 (approx. 30 mins)

#### STEM: Opportunity for monitoring student learning; formative assessment

##### All about designing

**What to look for:**

* understanding of difference between designing and making
* explanation of how to make things
* use of appropriate materials

Discuss with students things that they have designed or made. Encourage them through prompts such as:

* Have you made anything at home by yourself? Tell me about it. Accept all options Lego models, cake baking, card making/decorating
* How did you know what to make? from books, cards
* What did you make it out of? recyclable boxes and containers, cylinders from paper products, making box materials
* Where did you find the materials to make it? found objects, the shed, the kitchen, the garden
* What tools did you use to make it? encourage safety discussions concerning sharp implements including scissors
* How did you know how to make it?: instructions, recipes, my imagination

Relate to ‘The Most Magnificent Thing’ text: ‘She knows just how it will look. She knows just how it will work. All she has to do is make it, and she makes things all the time. Easy-peasy!’

In S1 student workbook, students complete Activity 1.3 by drawing a picture of something that they have made or designed. Write a description the thing and label with the materials they used. Ask students to draw or write about the tools that they used.

## Activity 2

Students are learning to:

* Identify the different forms of energy around us
* identify the effects and uses of forces
* Identify two-dimensional shapes, including quadrilaterals, pentagons, hexagons and octagons
* use imagination to represent aspects of an experience using drawings

### 2.1 (approx. 15 mins)

#### Science: forms of energy

Students move around the room to music using a movement of the teacher’s choice: include sliding, rolling, spinning, bouncing. When the music stops, last one/s moving are out. Discuss body movements as a form of energy.

Discuss other forms of energy that the students may know – sound, light, heat and electricity. Display these words on the STEM Word Wall.

### 2.2 (approx. 30 mins)

#### Science: force and motion

We change the speed objects move by adding altering the force of our push or pull motions.

Create a ‘race-a-ramp’ using found materials in the classroom or at home. Use a length of strong cardboard (or light timber if available) for a race ramp, elevate it slightly at one end using books or boxes. Gather different size and weight objects: some that will roll, and some that will slide – for example foam balls, tennis balls, marbles, wheels. rocks, blocks.

Ask students to predict the outcome when we adjust the force applied as they race objects down the ramp. If we increase the height of the ramp by adding extra books, what will happen to the object? What force is being applied? (the pull of gravity)

Ask students to predict which object will move the fastest using a **small** push. If we increase the push to the object, what will happen?

Students race their objects to test their predictions and repeat the test. Record with photos to add to the S1 STEM workbook, Activity 2.2.

### 2.3 (approx. 30 mins)

#### Mathematics: Illustrations that use 2D shapes

Collect reference shapes including quadrilaterals, pentagons, hexagons and octagons. Discuss/review the names of the shapes. On STEM word wall, teacher scribes the features of each shape as students identify such as an octagon has 8 sides that are the same (equal).

Draw students’ attention to the illustrations in the text, ‘The most magnificent thing’ by Ashley Spires, who is both the author and illustrator. In particular, look at the background drawings. What do you notice? There are a lot of 2D shapes especially in the buildings. Ask students to name and describe them. Teachers may choose to **print out the scene on Slide 10** where the girl and her assistant set up in an out of the way spot. Colour the 2D shapes that you can see.

Return students’ attention to the illustrations in the text, Now focus on the dog. Look at the dog on Slide 9, name the shapes of the ears, the eyes and nose/mouth. Go to Slide 14, sometimes the body of the dog looks like a …..shape? What shape name would be best here?

Students complete the activity in the S1 student workbook, Activity 2.3: cut out and move the shapes around to make the dog from the story. You can put smaller shape on top of bigger ones. Glue you dog into your workbook and label the shapes.

## Activity 3

Students are learning to:

* recognise familiar three-dimensional objects, including cones, cubes, cylinders, spheres and prisms
* respond to a text through improvisation
* recognise action verbs

### 3.1 (approx. 30 mins)

#### Mathematics: Using 3D objects

Collect reference shapes including cones, cubes, cylinders, spheres and prisms. Discuss/review the names of the objects. On the STEM word wall, teacher scribes the features of each object as students identify them such as a cube has 6 equal faces that are all squares.

Return student’s attention to the illustrations in the text, The Most Magnificent Thing’. In particular, review the girl’s inventions. What can you tell about the shapes? Are they regular 3D objects? Why do you think the author has used such unusual shapes?

Identify 3D objects in the classroom or home. Draw or use playdough to model regular 3D objects. Take a photograph of your shape. Add it to the table in your S1 STEM workbook

### 3.2 (approx. 30 mins)

#### English: Revisit the text: improvisation

View again, or reread, ‘The Most Magnificent Thing’ and listen to the doing words (verbs). Just like the Science study of forces on movement, the girl and the dog are moving things and doing things using forces.

As you view or read the story, ask the students to respond to the text through role-play with a partner – taking turns to be the girl or the dog. Focus on the actions – predict the meaning of the verbs that may be difficult: tinker, wrench, tweak, fastens, pummel, nudge, pounce. Mention words that may have more than one meaning as a noun or a verb: jam, circle, fiddle, hammer.

Use the strategy of [frozen moments](https://app.education.nsw.gov.au/rap/resource/access/02f3d1ba-0509-400a-858a-d066546e4a62/1) to explore the feelings of the girl and the dog: At a signal given by teacher, students improvise movements in the text. Teacher assists with suggestions as required. Stop the action at random moments and ask the students to freeze. Select students to speak the thoughts of the moment in role to assist them to build belief in their roles and the situation. Refer also to Activity 1.2, the character’s feelings and appearance as well as personal traits.

### 3.3 (approx. 30 mins)

#### English: action verbs

Recall with the students the text ’The most magnificent thing’. There are many action verbs (doing words) associated with the girl and her dog. They tell the reader what these characters are doing to make their most magnificent thing. These verbs vary in intensity of meaning, for example: fix, straighten, hammer and pummel. Discuss these words and perform the actions associated with that intensity

Using the S1 Student workbook, ask students to sort and write the action verbs from the box into the T-chart to match what the girl and the dog did when they were making their invention.

## Activity 4

Students are learning to:

* interact positively with others
* consider the viewpoints of others in different situations

### 4.1 (15 mins)

#### STEM: design thinking

Introduce the students to design thinking. Show the design thinking model poster. Discuss the stages using the metalanguage of empathise, define, ideate, prototype, test and share. Ask the students to predict from the icons (and the words) what the stages mean.

Empathise has a heart icon and is at the centre – what do you think that means?

Define has the magnifying glass. What do you use that for? We will look closely at the question.

Ideate has the thinking cloud. Do you think we will be getting lots of ideas?

Prototype has a box icon with lines coming out. What do think will happen here?

Test has a bottle with lots of bubbles. Do you think we might be testing something?

Share has the people icon. What do you think that means? Draw the students’ attention to the arrows. Discuss briefly the reason.

Return discussion to empathise. Discuss that we have a problem to solve. We are going to be using our heart when we think about giving to others. Here’s our problem to solve

**Driving question**

How can a most magnificent vehicle deliver a special parcel to our neighbours?

### 4.2 (approx. 20 mins)

#### STEM: identify and define the problem (empathise); PDHPE: Let’s talk about giving to others

Discuss with students the reasons we give: to say thank you, to help people in need, to recognise a special event like a birthday, or just to make someone feel good. Create a mindmap with the students – consider who do we give to, how do we give, when do we give, how often do we give.

Discuss the role of neighbours – who are they, why are they important, are they always next door

* + - * 1. An Aboriginal perspective of kinship

Important background information for teachers to share with students: In Aboriginal culture, kinship is more important than neighbours. Kinship is a term that is used to describe how people relate to one other in different cultures. In Aboriginal and Torres Strait Islander cultures, the concept of kinship is complex. Kinship determines how everyone relates to one another, as well as providing their roles, responsibilities and obligations regarding one another, the environment and ceremony. There are three primary foundations of kinship: **moiety** includes you and your environment; **totems** – each Aboriginal person has at least four Totems; their personal, family, clan and nation totem; and skin names - which work in a similar way to a surname, however an individual won't have the same skin name as their parent, nor would a husband and wife share the same skin name.

* + - * 1. Giving to others

Discuss current giving to charities, to bush [fire fighters](https://www.abc.net.au/btn/newsbreak/btn-newsbreak-20191115/11709752) (up to 1:42 mins) and to drought relief.

Discuss why it is important to give to others – respectful relationships, interact positively. Think about the girl in the book, ‘The most magnificent thing’ – review the slides and images. Did the girl in the story give to anyone? Who could she have given to? Use the drama strategy of [role play](https://app.education.nsw.gov.au/rap/resource/access/02f3d1ba-0509-400a-858a-d066546e4a62/1) with the girl giving to … the dog, the lady on the walk; to people from the street.

## Activity 5

Students are learning to:

* identify the problem and who is involved (the stakeholders)
* define and identify vehicles
* develop the skills of generating and communicating rapid ideas to solve a problem

### 5.1 (approx. 30 mins)

#### STEM (define/ideate): **Let’s talk about our question and create ideas**

**Driving question**

How can a most magnificent vehicle deliver a small, special parcel to our neighbours?

Display the driving question prominently on the STEM word wall. Help students understand the language of the driving question. By asking questions such as:

* What does it mean for something to be magnificent?
* What is a vehicle?
* What is a parcel?
* What does it mean to deliver a parcel?
* Where does the vehicle have to go to carry the parcel?
* What is a small, special parcel?
* Who are our neighbours?

#### All about vehicles and parcels

Brief focus on what a vehicle is and what a parcel is.

List ideas from the students and compile a student devised definition – a machine, usually with wheels and an engine that is used for transporting people or goods from one place to another; - a parcel is something wrapped in paper, usually so that it can be sent to someone.

Discuss images in S1 Student Workbook activity 5.1. Write a V under a vehicle or a P under a parcel and a cross under the images that do not belong

### 5.2 (approx. 30 mins)

#### PDHPE: Let’s make a small, special parcel

Share a memory of a time when you as a teacher (or parent) have received a special parcel. Share how it made you feel; did you keep it?

Discuss what may be included in special parcels – perhaps a surprise, a drawing, a note or something handmade. Create a shared list of possibilities. Prompt the students for unexpected acts of kindness.

Set the requirements of the parcel: define the size: no bigger than a tissue box (see following Mathematics activity); parcel must be wrapped

### 5.3

#### Mathematics: measure my parcel

Using informal units of measure, discuss the capacity of the parcel. Does the box need to be full? How will you estimate that your parcel will fit on the vehicle?

Students gather materials for their parcel which is to be no bigger than a tissue box. Use the language of capacity, container, full, empty, volume, measure, estimate

### 5.4 (approx. 20 mins)

#### STEM: Research and plan. Let’s ideate

In the S1 Student workbook Activity 5.4, students quickly draw 4 ‘crazy’ ideas for a most magnificent vehicle. Remind the students that it has to be MAGNIFICENT, and it has to move to carry the parcel. Encourage the students to be quick and draw fast, clever, new ideas. Remind the students that the ideas all need to be different. Ask the students to label the ideas.

## Activity 6

Students are learning to:

* Identify a range of materials for a purpose
* identify, plan and model a solution to a problem

### 6.2 (approx. 40 mins)

#### STEM: Prototype; opportunity for monitoring student learning – investigation and problem-solving

**What to look for:**

* selection of materials that approximate a real-life solution
* construction of a model that moves
* altering movement using pushing or pulling

Students make (engineer) their best idea that for the most magnificent machine to deliver their special parcel using materials found at home or school (a making box) such as cardboard boxes, paper, cylinders, tape, glue, pipe cleaners, materials, empty PET bottles, or any other resources that are available.

Remind students of **2D shapes** and **3D objects** Activity 3.2 and 3.3. Can these shapes be used in the design?

Remind students that the vehicle has to **move** to deliver the parcel – ask them how they will do this. Refer to Activity 2.1 and Activity 2.2 in the S1 student workbook. Or Action words

Remind students to choose their **materials** so that the vehicle will look MAGNIFICENT. Students may wish to decorate their parcel and their vehicle to add to its magnificence.

Students draw the solution (or paste in a photograph) in their S1 student workbook Activity 6.2.

## Activity 7

Students are learning to:

* give simple directions using a diagram or description
* review their actions in the design thinking process
* test and review the ideas of peers

### 7.1 (approx. 30 mins)

#### STEM: Test and evaluate; Mathematics: position

Discuss with the students the position of the neighbour and ask them to describe the position using everyday language, for example ‘my neighbour is next door to my house’. In the S1 Student workbook Activity 7.1, students draw a diagram to create a path from their house to their neighbour. Students should be encouraged to use the language of left, right, directions, turn, position, location, map, path.

Ask the students to test their solution by trying to deliver the parcel. Does the most magnificent vehicle deliver parcel? Does the prototype need adjusting?

### 7.2 (approx. 30 mins)

#### English: opportunity for monitoring student learning

**What to look for:**

* review of the design process
* verbs that describe the actions of making

Guide the students as they reflect on their design process from empathise to define, to ideate and prototype, and now to test and share.

Students think about the action verbs that would describe their activities as they completed their delivery system

In the S1 student workbook, students write the 5 best action verb words that describe how they made their magnificent thing. Students draw a picture of themselves doing these action verbs in the box next to the word.

### Activity 8

Students are learning to:

* share their design solution and reflect on their learning
* communicate their ideas clearly
* reflect on the success of their solution

### 8.1 (approx. 30 mins)

#### STEM: Opportunity for monitoring student learning – Share

**What to look for:**

* a solution which answers the question: How can a most magnificent vehicle carry a thank you message to someone special?
* student confidence to share the solution with others
* student acceptance of feedback

Organise a showcase display of the student’s work at school when students return. Alternatively, encourage students to plan their own STEM showcase at home. Students may be able to design invitations and set up a special STEM display spaces.

Encourage students to prepare for the day by bringing their vehicle to school with a copy of their Thank You message. Students will need to explain their design and how they used their learning from science and technology, engineering and mathematics to parents, students and teachers.

Take photos of the solution and print for students to paste into their S1 Student workbook Activity 8.1

### 8.2 (approx 15 mins)

#### Reflection

[2 stars and a wish](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/549)

**Reflection and evaluation**

These simple questions may help you reflect on your students’ learning and plan for next steps.

What worked well and why?

What didn’t work and why?

What might I do differently next time?

What are the next steps for student learning based on the evidence gathered?