# *Egg bungee jump* Teaching and learning plan

## Learning intentions

Students will be able to:

* identify that objects are made of materials;
* understand that materials have properties;
* identify the physical properties of some common materials;
* understand that the properties of a material can change if the material is changed;
* select materials for uses based on their properties;
* follow instructions to identify investigable questions about familiar contexts and predict likely outcomes from investigations;
* make accurate observations;
* record and represent observations;
* use tables to organise their observations;
* identify patterns from observations;
* draw conclusions based on evidence.

## Suggested time for this CLE

The time needed to complete the *Egg bungee jump* CLE will depend on the depth of the prior knowledge of students and the time taken to complete the two investigations—*Selecting materials* and *Engineering challenge*—as well as follow up with any further extension activities. Allow 2–4 hours.

[**Planning ahead and equipment list**](http://assist.asta.edu.au/sites/assist.asta.edu.au/files/Planning_and_equipment_list_Yr4_Egg_Bungee_Jump.docx)

## Safety considerations

When you and your class are completing your Risk Assessment, consider the following safety points and add any other relevant ones to the list.

* Safety glasses should be used since rubber bands are involved and they could snap and flick into the eye.
* Consider any egg allergies.

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## Introduction

This CLE focuses on and links to the Year 4 Australian Curriculum: Science. Students will identify the material/s that make up an object. They will distinguish between an object and the material of which it is made. They discuss the properties of the material/s and develop vocabulary.

### Equipment needed

Per group:

* ball of wool
* plastic sandwich bag containing small samples each of wool, pipe cleaner, curling ribbon, string, cotton thread, pop stick, rubber band, balloon.
* student worksheet [Properties matrix](http://assist.asta.edu.au/sites/assist.asta.edu.au/files/Student_worksheet_Properties_matrix.docx)

### What to do

1. Divide the class into groups of 3 or 4 students.
2. Introduce the concept of physical properties of materials by showing the students the ball of wool. Let them pass this around their groups and as they explore the wool, ask the students to tell you **something they observe** about the wool. Explain to the students that an observation is something they can find out about the material using their senses, e.g., what does the material feel like, look like, sound like or smell like?
3. List all the **observations** on a white board. Answers may include:

blue, furry, strong, stiff—not elastic, bendy, soft, scratchy, long, thin.

Explain that observations like these about the material are **called properties. (**Physical properties are those properties of a material that can be measured or observed without changing the nature of the material.)

1. Introduce some **collective terms** to group these properties. Explain the **difference between stretching and being elastic**. (*A material is described as elastic, if it has the ability to return almost to its original shape after it has been stretched or squashed by a force.*) You could demonstrate this difference by stretching a curling ribbon and compare it to when you stretch a piece of elastic or a rubber band*.*

|  |  |
| --- | --- |
| Observation | **Physical property** |
| Blue | **Colour** |
| Furry | **Texture** |
| Strong | **Strength** |
| A bit stretchy—not elastic | **Elasticity** |
| Bendy | **Flexibility** |
| Soft | **Hardness/Malleability** |
| Scratchy | **Texture** |
| Long | **Shape** |
| Thin | **Shape** |

1. Hand out a plastic sandwich bag of materials to each group.
2. Ask the students to explore the materials and discuss their **physical properties**. Have them refer to the list created on the white board for ideas.
3. Handout the [Properties matrix worksheet](http://assist.asta.edu.au/sites/assist.asta.edu.au/files/Student_worksheet_Properties_matrix.docx) and ask the students to fill this in using ticks and crosses or words or pictures. Let the students represent their observations in their own way.

## Core

### Investigation 1: Selecting materials

Students will discuss the properties of the material/s and consider how these properties relate to the use of a material using the example of a bungee cord.

### Equipment needed

Per group:

* plastic sandwich bag containing small samples each of wool, pipe cleaner, curling ribbon, string, cotton thread, pop stick, rubber band, balloon.
* student worksheet [Properties matrix](http://assist.asta.edu.au/sites/assist.asta.edu.au/files/Student_worksheet_Properties_matrix.docx) (distributed in previous activity)

### What to do

1. Show the video of Wile E. Coyote trying to catch the Road Runner using a bungee cord. ‘Wile E. Coyote and Road Runner – Coyote Falls’, *YouTube* (3:00 min) <https://youtu.be/IleZWq45jDg>
2. Show the whole video through once, then rewind and stop the video when Wile E. is about to catch the roadrunner but stops just short. Ask the students: What properties does a bungee cord need? Why?

Discuss this as a class. Possible answers may include: strength, elasticity, flexibility.

1. Ask the students to go back to their properties matrix and look at the properties of the materials they explored. Which material, or combinations of materials do they think would have these properties?
2. Ask the students to colour in the squares on the properties matrix that relate to the selected bungee cord properties.
3. Looking at their coloured-in matrix, ask the students to select the materials that they would use to build a bungee cord.
4. Ask the students to draw and label what their bungee cord might look like.

### Expected results and explanations

When Wile E. is hanging by the bungee cord, the students should be very aware that he wants to stretch to catch the Road Runner but that he also doesn’t want the cord to break or stretch too far and hit the road. From these ideas, the students should select the properties of strength and flexibility for the bungee cord and also elasticity, as the coyote wants to bounce back up and not stay hanging. In this way, the students are relating a property of materials to their function or use in a bungee cord.

A sample of the coloured-in matrix could look like this:

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Colour | Strength | Elasticity | Shape | Texture | Flexibility |
| wool | blue | strong | a bit stretchy  not elastic | long and thin | furry | floppy |
| pipe cleaner | yellow | very strong | not stretchy  not elastic | long and thin | furry | bendy |
| curling ribbon | red | strong | stretchy  not elastic | long and thin | smooth | floppy |
| string | white | strong | not stretchy  not elastic | long and thin | scratchy | floppy |
| cotton thread | red | not strong | not stretchy  not elastic | long and thin | smooth | floppy |
| pop stick | brown | strong | not stretchy  not elastic | shorter and wider | smooth | not bendy |
| rubber band | brown | strong | stretchy  and elastic | thin and round | smooth | floppy |
| balloon | yellow | strong | stretchy  and elastic | flat and round | smooth | floppy |

From examining their matrix, students are able to select either, one material that best suits the criteria, or a combination of materials that will match the criteria.

### Investigation 2: Engineering challenge

### Equipment needed

Per student:

* student worksheet [Engineering design](http://assist.asta.edu.au/sites/assist.asta.edu.au/files/Student_worksheet_Engineering_design.docx)

Per group:

* 1 raw egg (plus some in reserve to account for breakages)
* 2 plastic sandwich bags or ziplock bags
* 2 wire bin-bag ties

Available per class:

* large bulldog clip (to use as launch pad)
* rulers, tape measures
* masking tape
* electric scales
* marbles or other weights
* quantities of all the sample materials for students to choose from, i.e. wool, pipe cleaners, curling ribbon, string, cotton thread, pop sticks, rubber bands, balloons.

***Notes***

1. Plastic sandwich bags work well to hold the egg.
2. The wire bin-bag tie should be tightly wound around the top of the plastic bag to avoid the bag slipping and the egg breaking.
3. The wire should be made into a loop for students to attach their bungee cord to.

### What to do

The students’ challenge is to design a bungee jump so that an egg stops within 5 cm of the floor when dropped from a height of 1.5 m. The egg should not hit the ground and break.

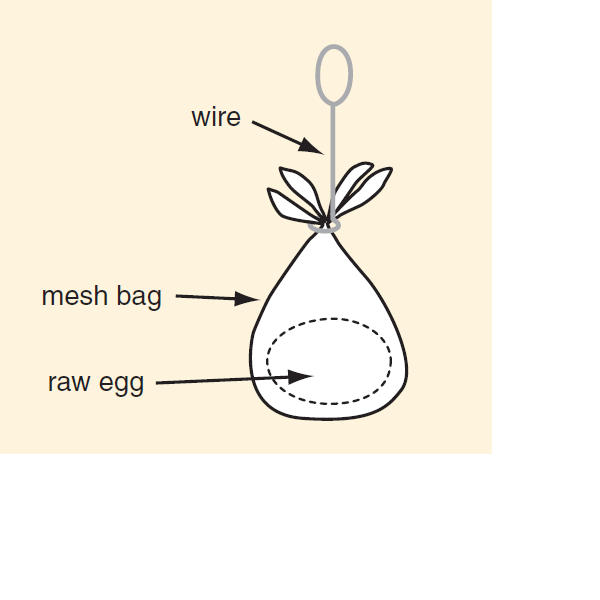
*Note to teachers:* You can adjust this height to work with what you have available in the classroom to use as the launch pad for the eggs. For example, you may decide to launch from the teachers’ desk, clamping the cord to the edge of the desk with a bulldog clip. In this case, the distance would be a lot shorter than 1.5 m.

1. Hand out the student worksheet [Engineering design](http://assist.asta.edu.au/sites/assist.asta.edu.au/files/Student_worksheet_Engineering_design.docx).

This worksheet uses an Engineering design process

* **Ask a question** about the goal.
* **Imagine a possible solution**.
* **Plan out a design** and draw your ideas.
* **Create and construct** a working model.
* **Test** that model.
* **Improve** and try to revise that model.

1. Demonstrate the equipment to be used to hold the egg (raw egg inside plastic sandwich bag, sealed and bin-bag tie twisted around the bag and into a loop).



plastic sandwich bag

1. **Explain the task to students**. If the egg stops too far above the floor, the bungee jump attraction won’t be exciting enough. Of course, if the egg hits the floor, the jump fails the safety test. Explain that they will get to build and test their bungee cord before the **final class challenge.**
2. Show the students the launch pad you will be using for the class challenge and demonstrate how you will launch the egg.
3. As a class, discuss **how they will measure** how close each egg gets to the floor.

*Note to teachers*: Students may come up with ideas such as having observers at eye level, testing more than once, having a string at 5 cm above the floor for the egg to touch, holding a tape measure next to the jump, filming on iPads or phones and watching back in slow motion. This discussion will help the students think about how they are going to gather their own data from their test runs and use it to redesign their cord if needed.

1. Explain that each group needs to **measure a height of 1.5 m** to practice their jumps from. Before each jump, they should line up their egg and attached cord with this mark before launching.
2. Ask students to complete the **Ask, Imagine and Plan** sections of the student worksheet [Engineering design](http://assist.asta.edu.au/sites/assist.asta.edu.au/files/Student_worksheet_Engineering_design.docx), in collaboration with their group members.
3. Have the students collect the materials that they have selected to design their bungee cord.
4. Suggest to students that they may like to make a ‘test egg’ to practice with and save their raw egg for the class challenge. Allow the students to work out how they will construct this ‘test egg’. They may decide to use the weights and electric scales to keep the weight of their egg and the test egg the same. Use questioning to guide students into thinking about fair testing.

Allow time for the students to create and test their bungee cord. They will need time to test their designs, evaluate and improve and retest etc. (engineering design process).

1. Ask students to complete the **Create** section of the student worksheet [Engineering design](http://assist.asta.edu.au/sites/assist.asta.edu.au/files/Student_worksheet_Engineering_design.docx), in collaboration with their group members.
2. **Class challenge**: To conclude the investigation, gather all the groups together and test each design from the launch pad.
3. Evaluate each design constructively. Ask the students:

* What worked well with this design?
* What could you change to improve this design?

Students can use this feedback to complete the **Improve** sections of the student worksheet [Engineering design](http://assist.asta.edu.au/sites/assist.asta.edu.au/files/Student_worksheet_Engineering_design.docx), in collaboration with their group members.

### Expected results and explanations

Students will have different outcomes depending on the material or combination of materials they choose to make their bungee cord.

**Science** concepts:

* Students should link the physical properties of individual materials to the properties they need their bungee cord to have (use of materials). Students will most often use a combination of materials to construct their cord. Combining these materials produces an object with a specific purpose, which utilises the properties of the materials of which it is made. They may need help with securing the different materials together.
* The idea of fair testing can be explored as the teacher questions students about how they launch their egg and how they judge how far it stretched. In addition, those students that used a ‘test egg’ can be asked about how they constructed it and why.

**Technologies**:

* Students could be encouraged to film their jumps on tablets or phones and use a slow-motion function to measure how close the egg got to the ground. (Have the egg jump next to a measuring tape.)
* Students could record their design process using photographs.

**Engineering** Design:

* Most students will be able to construct a bungee cord that is durable and elastic (to some degree). The more able students will be able to design and redesign to allow the bungee cord to stretch to the desired distance.

**Mathematics** skills:

* Measurement of the jump height but more particularly the distance reached above the ground.
* Measuring the weight of the egg and then replicating this to make a ‘test egg’.

Bungee jumping is an extreme sport. People make bungee jumps off of bridges, from hot-air balloons, and from towers. Bungee jumpers attach themselves to these structures and vehicles using elastic cord called a *bungee*. The bungee helps to absorb a jump’s kinetic energy. Bungee cords are generally composed of one or more strands of elastic material, usually rubber, bound together by a fabric covering of cotton or nylon. This makes it more durable and adds strength to the cord to prevent over extension and snapping of the rubber.

## Conclusion

Post investigation follow up can be done via **class discussion,** or more formally through a teacher-designed student worksheet or assignment.

The open-ended nature of the activity encourages students to think about their experimental procedures and techniques. There are many possible variables that may affect the accuracy of the data students will collect, so this activity provides a rich source of post-experiment discussion on the sources of error that students encountered.

Some questions to consider after the investigation.

* What properties of your materials made them useful for a bungee cord?
* Were some materials more suited than others? Why?
* Can you think of other materials (other than those provided) that may be suitable for use as a bungee cord?
* Was your egg bungee jump successful?
* What would you change to make it better?
* What would happen if the length of the bungee cord were changed?
* What would happen if more weight were added to the test egg?
* What would happen if the bungee cord were only made out of string?
* How do you think bungee-jump developers test the length of a bungee cord for a human bungee jump?

### Assessment opportunities

This investigation provides an opportunity to assess student understanding of the concepts related to properties of materials.

The student worksheet, [Engineering design](http://assist.asta.edu.au/sites/assist.asta.edu.au/files/Student_worksheet_Engineering_design.docx) can be used as an assessment tool for assessing both understanding and the level of student achievement of the science inquiry skills, **Planning and conducting, Processing and analysing data and information.**