

# Are enzymes the future of plastic recycling?

## Lesson plan

In this lesson, students will think about their relationship with plastic, recycling and how new enzyme technology is playing a part in changing the recycling system. They will discover how enzymes work, and observe some in action.

## Teaching sequence

30 minutes	<b>Part One: Recycling and plastic</b>
30 minutes	<b>Part Two: Enzyme experiment set up and initial observations</b>
20 minutes	<b>Part Three: Follow up</b>

### NSW Stage 2 outcomes:

- ST2-1WS-S Questions, plans and conducts scientific investigations, collects and summarises data and communicates using scientific representations
- ST2-7MW-T Investigates the suitability of natural and processed materials for a range of purposes

**Tip!** Set up the enzyme experiment earlier in the day, so students may observe the breakdown over the day.

**Tip!** To save time, you may choose to do this as a whole class demonstration.

# Part One

## Our relationship with plastic

### Step 1:

- As a class, brainstorm:

#### **What is Plastic?**

**Prompt:** You may use it everyday, but have you ever stopped to think about what most plastic is made from?

You may be familiar with the term “natural resources”. Some examples that may come to mind are sand, which we process into glass, or trees, which we use as timber, or process into paper. So, which natural resource do you think we process into most plastics?

*You may like to ask students to think pair share or collect all answers on the board/ SMART board.*

Could anyone in the class define exactly what plastic is, or which natural resource we use to make it?

- Show this short video to explain what plastic is, and a brief history of the material.

<https://youtu.be/6PgjA3HISmw>

1.12 to 4.32.

- Consolidate with a definition- one may be:

Plastic is a synthetic (man-made) material made from oil. It is malleable, durable and can be shaped into many forms.

- Refer students to the first question in their workbook

# Part One

## Recycling Re-cap and Plastic

- Part of our relationship with plastic includes recycling some plastic products. But can your students define what the term recycling actually means?

You can use this online quiz question:

<https://www.surveymonkey.com/r/RZZY92T>

Or read the clues

Recycling is:

1. Using something once then throwing it away
2. Using something, putting it in the correct place to be taken away, broken down and reprocessed into something else
3. Using something then reusing it for a new purpose
4. Using something then putting it in the compost bin to rot into soil

Ask students to raise\* you may like to get the students up and moving to corners of the room to signify their answer, e.g. "if you think the answer is A, move to the front right corner of the room"... etc.

It's B! A lot of people think that recycling is using the same object over and over, whereas recycling takes energy and resources.

- How do we currently recycle plastic? Is this the best method available? Watch:

<https://vimeo.com/883828661>

Ask students to share their opinions.

Highlight the use of enzymes in the Samsara Eco video.

- Refer students to questions 2 and 3 in their workbook

## Part Two

### Enzymes

- What are enzymes?

Prompt: Enzymes are used for all types of things. Think of baking, brewing, washing detergents, fermented products, pharmaceuticals, textiles and they even work hard inside our bodies to make it function. Basically enzymes are proteins that help speed up metabolism, or create chemical reactions.

<https://youtu.be/qgVFkRn8f10?si=zG-lfxJ1dAyMCab3>

<https://youtu.be/rIH1ym916Fo?si=BmwQlebmRv1rmSic>

- Refer students to page 2 in their workbook

When students reach Question 6, they will need to research the enzyme occurring in pineapple which has this affect on jelly, or collagen.

*Tip! You may want to research this as a class to save time.*

### Enzyme Experiment

In this experiment, students will observe the effects of enzymatic degradation, using pineapple and jelly. Pineapple contains an enzyme called bromelain, which will be the star of the show.

#### Equipment:

- Jelly
- Hot and cold water
- Beakers or cups
- Spoons
- Chopped fresh\* pineapple \*it must be fresh for the experiment to work.
- Chopped fresh strawberries, or other fruit\* excluding kiwi fruit, papaya, mango or guava. Suggest apple, pear or berries.

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### Preparation:

- Prepare jelly in a glass jug according to the instructions on the packet. When cool, pour into beakers or cups, to a height of 0.5cm to 1cm. Leave to set over night
- Each student group or demonstration will need three containers of jelly.
- Chop strawberries into slices or small pieces and cover until needed
- Chop pineapple into small pieces and cover until needed.

### Experiment set up:

- Each group to be set up with three containers of jelly, A, B, and C.
- Students note the condition of all three jelly samples on page 5 of their worksheet
- Teacher distribute (or students collect) enough chopped pineapple to cover the jelly surface on jelly container A,
- Repeat with strawberries for jelly container B,
- Jelly container C remains as the control.

Students note observations again, and write hypothesis.

Monitor the jellies and note observations every 20 minutes for the rest of the period, or if more convenient, set the timings to between other activities, or before and after lunch.

**Note: it takes at least 20 minutes to see some progress, and up to three hours to see most of the jelly dissolved in container A.**

- Student instructions are found on page 3 of their workbook
- Method Design and hypothesis on page 4
- Observations on page 5

## Part Three

### Follow Up

Final observations of jelly- discuss what students observed in each container.

Were their hypothesis correct?

Rewatch Sam Eco video (or other supplied). How do you think this technology will impact the future of plastic recycling?

- Refer students to page 6 of the workbook

This lesson was developed by Planet Ark with support of Samsara Eco

