Jiwi’s machines are very clever indeed but can also be described as very simple. They involve a succession of Simple Machines linked together to achieve some amazing things. TOAST POP is a great way to investigate a few Simple Machines.

The Inclined Plane – a flat surface with one end higher than the other.

The Inclined Plane or Ramp is a type of simple machine that can be used in two ways. It can be used to lift objects up using less effort (in the way that the Egyptians built the pyramids) or to reduce and control the force at which something falls. This is the way in which Jiwi uses inclined planes.
ACTIVITY 1: EXPLORE THE INCLINED PLANE
(5 – 10 minutes)

A graphic illustration of the Inclined Plane can be done by getting 3 children to demonstrate the following: prepare a short inclined plane with a height of approximately 1 metre and a longer, less sloped (less steep) inclined plane from the same height.

Have one child hold an egg 1 metre above the floor, and one child hold an egg at the top of each inclined plane. (You may need a small edge to stop the egg rolling off the inclined plane.)

Let go of the eggs. Now inspect them for damage. It should be obvious that the longer the inclined plane, the less force is applied to an egg. Inclined planes are a great way of controlling a falling force. In the Toast Pop clip, we see this as the pool ball happily rolls along the wooden channel and then along the top of the toast!

ACTIVITY 2: CREATE MARBLE RUNS WITH INCLINED PLANES
(30 minutes to 1 hour + sharing time)

BIG SCIENCE IDEA: The slope of the inclined plane allows the marble to gain energy as it rolls.

Have children construct their own marble or toy car runs using boxes and paper towel tubes cut in half to create inclined planes. This could be a large marble run, using cardboard from a refrigerator or washing machine box, or a smaller machine, using materials such as a shoe box lid, with ice cream sticks on the edge. You will need lots of tape.

Get each child or group to demonstrate their marble run. Which made the marble go fastest? Slowest? Why? Alternatively – create a large marble run together using cardboard tubes from wrapping paper / paper towel rolls and paper cups pinned to a classroom display wall. The Inclined Plane is visited again and extended in Episode 4: Recipe for Disaster.

The Lever – a rigid bar used to gain force, gain speed or change direction. The Lever is a type of simple machine that pivots about a fulcrum or pivot point, usually to increase the force in one direction. Watch the Toast Pop clip again, paying particular attention to the hammers. What role do they play in keeping the pool ball rolling along the inclined plane? Can you see them swing? Can you see them pivot around the nail? The hammers are held back by pencils, then swing into action, gaining force as they pivot around the nail and apply more force to the “pop” switch on the toaster. Because the hammer is hanging downwards and held back by the pencil, the hammer has gravitational potential energy (stored energy). As it pivots around the nail and swings downwards that potential energy transforms into kinetic (moving) energy. All of this energy is then transferred to the toaster when it hits the “pop” button. The concept of potential energy and kinetic energy is explored in more depth in the Newton’s Cradle support page.

Levers are visited again and extended in EPISODE 3: CHANGING THE LIGHTBULB.
**ACTIVITY 3:**
**COMBINE THE KNOWLEDGE OF INCLINED PLANES AND LEVERS TO BUILD A PINBALL MACHINE.**
(1.5 to 3 hours)

**Big Science Idea:** A lever pivots on a fulcrum.

Use shoe box lids (or larger) as follows:

1. Make a launch lever by folding a piece of cardboard in half and attaching it with a fastener so that it pivots as per the diagram. You may need to experiment with the placement of the lever to get the marble firing up to the top.

2. Tape several straws or ice cream sticks up the length of the box lid to guide the marble upwards.

3. Tape a thin cardboard curve around the top corner.

4. Now use a series of ice cream sticks, straws, paper cups (for tunnels), tin foil or any other materials to create tracks for the marble to work its way down.

**JIWI WONDERS**

- Does the marble roll as you expect? Why? Why not?
- How could this be improved?
- What makes you think it would improve?
- What else would you like to try?
- How are your designs changing each time?

**INVESTIGATING IN SCIENCE**

Children can carry out science investigations using a variety of approaches. These activities lend themselves well to exploring, making things, pattern seeking and developing systems.
MATERIALS

<table>
<thead>
<tr>
<th>Activity 1</th>
<th>Activity 2</th>
<th>Activity 2</th>
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<tbody>
<tr>
<td>2 ramps of different lengths</td>
<td>Cardboard</td>
<td>Box lid</td>
</tr>
<tr>
<td>3 eggs</td>
<td>Boxes</td>
<td>Cardboard</td>
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<tr>
<td></td>
<td>Paper towel tubes</td>
<td>Split pin</td>
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<td></td>
<td>Sellotape / Masking tape</td>
<td>Straws</td>
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<td>Ice cream sticks</td>
<td>Ice cream sticks</td>
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NZ CURRICULUM PLANNING SUMMARY

<table>
<thead>
<tr>
<th>Contextual Achievement Objective: Physical World; Explore and investigate physical phenomena in everyday situations.</th>
<th>Nature of Science Achievement Objective: Investigating in Science; Carry out science investigations using a variety of approaches (pattern seeking).</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Big Science Idea:</strong> The slope of the inclined plane allows the marble to gain energy as it rolls. A lever pivots on a fulcrum.</td>
<td><strong>Big Nature of Science Idea:</strong> Scientists are curious. Scientists seek patterns when they investigate.</td>
</tr>
<tr>
<td><strong>Weblinks:</strong> <a href="http://scienceonline.tki.org.nz/Teaching-science/Teaching-Strategies/Types-of-investigation">http://scienceonline.tki.org.nz/Teaching-science/Teaching-Strategies/Types-of-investigation</a></td>
<td><strong>Capability focus:</strong> In science, we try to make meaning from our observations.</td>
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