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STEM Project

Chapter 7 Motion

Pages 155–178

Energy transformation toy

Think about the toys and games that you loved when you were young. Can you identify any that involved some type of energy transformation from one form of energy to another?

Many toys use energy transformation to make them interesting. Here are three examples.

- A wind-up car: elastic potential energy in a spring is transformed into kinetic energy.
- A talking doll: internal chemical energy in the battery is transformed into electrical and then sound energy.
- A marble race: gravitational potential energy is transformed into kinetic energy.

In this task, you will follow the engineering design process to create a toy that involves energy transformation. This task is best done with a partner.

Engineering design

The engineering design process has several variations, but in essence it follows five major steps:

- 1 Think** Consider the problem or objective from all angles, research it and brainstorm ideas.
- 2 Design** Develop a possible solution and design a prototype.
- 3 Create** Build the prototype.
- 4 Test** Evaluate the prototype to see if it meets the objective.
- 5 Improve** From the test results, identify how to make your design better.

You will use these five steps to help you design your toy.



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1 Think

Your objective is to make a toy that involves energy transformation.

Firstly, think about what you will need to know to tackle this task. Follow the questions in the table below to help guide your thinking. If you are unsure, do some research to find out the answers.

Add any additional questions of your own at the end.

Trait	Bead colour 1
What types of energy are there? (e.g. kinetic, electrical, gravitational potential)	
What mechanisms can you think of that transform energy? (e.g. spring, battery)	
What type of energy transformation occurs in these mechanisms?	
What toys already exist that use these mechanisms?	
What type of energy transformation will I choose for my toy?	
What mechanism will I use?	
How will I incorporate this mechanism into my toy?	



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Now that you have done some thinking and research, brainstorm some ideas for a toy, noting down the energy transformation that would be involved.

2 Design

Choose your best idea and develop it further. Write a description of your design showing its components and how it works, including a labelled diagram. Use the following questions to help you create your design.

- What type of energy transformation will be involved?
- How will it work? How will the parts fit together?
- What materials and tools will you need?
- What safety issues might be involved when building or using it?
- What will you call it?
- What will it look like?
- How can you make it look appealing to children?



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3 Create

Build a prototype of your toy. A prototype is a ‘first try’ to see whether your concept will work. Write down the steps you took to build your prototype below.

Steps:

4 Test

Check to see if your toy works. Write down your observations about how well it does what you intended it to do. If there are problems, note down how it turned out differently to what you intended. If you have access to a younger child, ask them to give you some feedback on your toy.

5 Improve

Based on your observations, how could you improve your design? Note down any ideas you have that could make it better. If you have time, modify your prototype to implement your improvement ideas.



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Discussion and reflection

What objects do you use in your daily life that transform energy? List as many as you can.

What objects do you use in your daily life that involve multiple forms of energy transformation (e.g. a torch transforms chemical energy in a battery into electrical energy and then into heat and light energy). List as many as you can.

Choose one object from your list. Do you think the engineers who designed this object did a good job? Can you think of a way to improve their design?

Identify and note down any similarities and differences you notice between the steps of the engineering design process and the steps of a scientific experiment.
