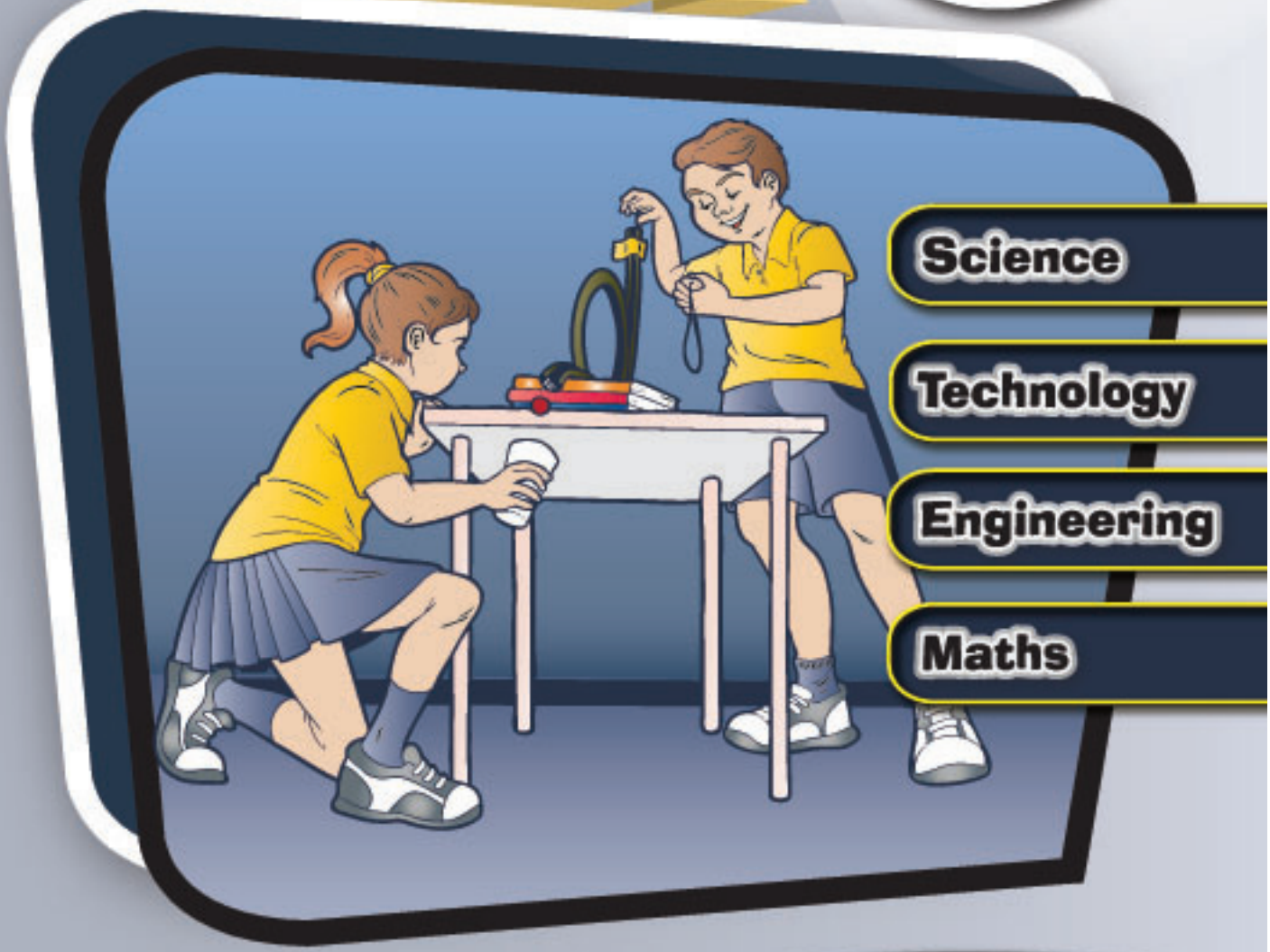
Ready-Ed Publications

PRIMARY LEVELS
Year 4 - Year 5

PHOTOCOPY MASTERS

STEM

Book 1



Science

Technology

Engineering

Maths

By Leonie Westenberg

Teachers' Notes

This book provides classroom teachers with the means to approach both the targets of inquiry-based mathematics learning and the introduction of coding, alongside science inquiry skills and content, use of engineering processes, and design and digital technologies. The activity sheets also emphasise literacy skills.

Section 1: How Roller-Coasters Work includes activities that enhance students' knowledge in the physical sciences with inquiries that facilitate problem solving skills and the production of text, diagrams, and designs. Students predict, question, analyse and evaluate results to design experiments and test hypotheses concerning energy, gravity and friction. The activity sheets encourage collaborative work with partners or in small groups, facilitating deep learning and knowledge. Photocopiable sheets provide guided progressive questions to develop skills in mathematical problem solving, digital technologies, and design capabilities, within an interdisciplinary approach that also incorporates Arts and English (known as STEAM). Students are asked to present their work in a variety of forms, using technology, literacy and numeracy skills, and art and design. Communication literacies are encouraged through reports, persuasive speech, video presentations and blogging or vlogging.

Section 2: Design And Make Your Own Roller-Coaster focuses on group work in design technologies. Students are guided through the process of applying scientific, mathematical and technological skills to create a model of a roller-coaster. While this section furthers independent work in small groups, formative assessment tasks are provided to allow for peer and teacher evaluation throughout the learning project. A summative assessment task during the project has provision for self, peer and teacher feedback.

Section 3: Virtual Roller-Coasters And Coding introduces students to programming and coding. Students make use of online technologies to design and advertise roller-coaster and amusement park rides. Activity sheets present an introduction to computer programming and ASCII. These inquiry-based activity pages introduce students to traditional, contemporary and emerging technologies.

Section 4: The History Of Amusement Parks encourages students to use skills in English and in Technologies to understand the intersection of technologies and innovation in the past, in the present, and in the future. Students are asked to research, prepare and present a speech. In addition, students explore emerging technologies and create animations of their own, building skills in innovative and critical thinking and in design and digital technologies.

- Elaborations: Discussing how models represent scientific ideas and constructing physical models to demonstrate an aspect of scientific understanding; Using labelled diagrams, including cross-sectional representations, to communicate ideas

Represent and communicate observations, ideas and findings using formal and informal representations

- Elaborations: Communicating with other students carrying out similar investigations to share experiences and improve investigation skills; Using simple explanations and arguments, reports or graphical representations to communicate ideas to other students

Science involves making predictions and describing patterns and relationships

- Elaborations: Exploring ways in which scientists gather evidence for their ideas and develop explanations; Considering how scientific practices such as sorting, classification and estimation are used

First Law Of Motion - Page 24

Suggested Answers

c. Friction. Roller-coasters use friction to slow down the ride. Brakes apply friction as roller-coasters reach the landing-pad at the end of the ride.
d. Seat belts and safety bars prevent people from falling out of a roller-coaster car. They provide friction and restraint.

Curriculum Focus

MATHS

Construct suitable data displays, with and without the use of digital technologies, from given or collected data. Include tables, column graphs and picture graphs where one picture can represent many data values

- Elaborations: Exploring ways of presenting data and showing the results of investigations; Investigating data displays using many-to-one correspondence

SCIENCE

Forces can be exerted by one object on another through direct contact or from a distance

- Elaborations: Observing qualitatively how speed is affected by the size of a force; Comparing and contrasting the effect of friction on different surfaces; Investigating the effect of forces on the behaviour of an object

With guidance, plan and conduct scientific investigations to find answers to questions, considering the safe use of appropriate materials and equipment

- Elaborations: Exploring different ways to conduct investigations and connecting these to the types of questions asked with teacher guidance; Working in groups, with teacher guidance, to plan ways to investigate questions

Consider the elements of fair tests and use formal measurements and digital technologies as 8 teachers' notes appropriate, to make and record observations accurately

Elaborations: Making and recording measurements using familiar formal units and appropriate abbreviations; Recognising the elements of a fair test and using these when planning the steps and processes of an investigation

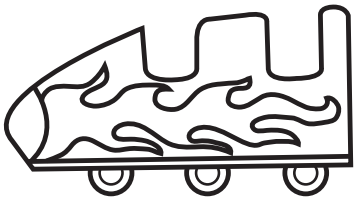
Compare results with predictions, suggesting possible reasons for findings

- Elaborations: Discussing how well predictions matched results from an investigation and proposing reasons for findings; Comparing, in small groups, proposed reasons for findings and explaining their reasoning

Potential And Kinetic Energy 1

ACTIVITY

Have you ever thought about how amusement park rides actually move? Or do you just climb aboard and enjoy the ride? Let's consider movement in a bit more detail.



1. Read the information about potential and kinetic energy.

> Potential energy is stored energy, like the energy in the elastic when you pull back on an elastic band. Kinetic energy is moving energy, like the energy that moves the band forward when you let go of the elastic.

2. In pairs use an elastic band to demonstrate potential and kinetic energy.

3. Can you think of any other everyday objects that you can use to demonstrate these two different energy types? Brainstorm your ideas in groups and jot down your thoughts below.

KINETIC ENERGY	POTENTIAL ENERGY
	

4. Mark and label the roller-coaster diagram below:

a. where you think the **greatest amount of potential energy** would be;

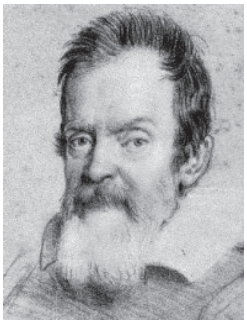
b. where you think this potential energy would be **converted into kinetic energy**.

Remember to use a ruler and a pencil to do this.

5. Pair-up. Compare and discuss your labelled diagrams. Use an eraser to make any changes.

Gravity 2

EXPERIMENT



A famous scientist, Galileo Galilei (1564-1642), found that objects fall at the same speed. The objects fall because of the influence of gravity. The downward fall is called deceleration. Galileo discovered the law of free fall by dropping different sized balls from the top of the leaning tower of Pisa, in Italy.

Roller-coasters use gravity to make the cars 'free fall' down each hill and slope. You are going to copy Galileo's experiment by making a simple model of a roller-coaster.

You will need:

- a simple flexible track - consider a Hot Wheels plastic track or use a foam tube (foam insulation), cut in half
- several marbles
- books or blocks to help support the foam track
- tape to hold foam tube in place

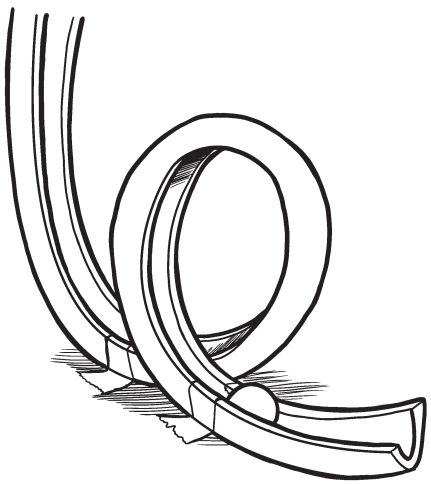
Steps

1. Look at the different 'tracks' below. Take turns creating the 'tracks' using your foam tube or Hot Wheels plastic track.
2. Experiment placing marbles at different starting points on each 'track'.
3. Note where your marble free falls, where it needs help to travel and where it stops. Think about why.

slopes **loops** **small dips and hills** **banked turns**

What did you notice?

The marble can take a __ __ path until it reaches the s__ __ __ height it st__ __ __ed from, if there was no fr__ __ __ __ __n. The marble begins to r__ __l d__ __n because of the force of g__ __ __ __ __ __. It stops when all the energy the g__ __ __ __ __ __ gave the m__ __ __ __e is u__ __d up. The marble acc__ __ __ __ __ __tes when the f__ __ __ __ __ act on it in the



Extra Activity

There are examples of free fall experiments and use of free fall in roller-coasters on YouTube. Search YouTube, find a video to share with the class or on your class blog.

Make A Model Of Your Roller-Coaster 1 EXPERIMENT

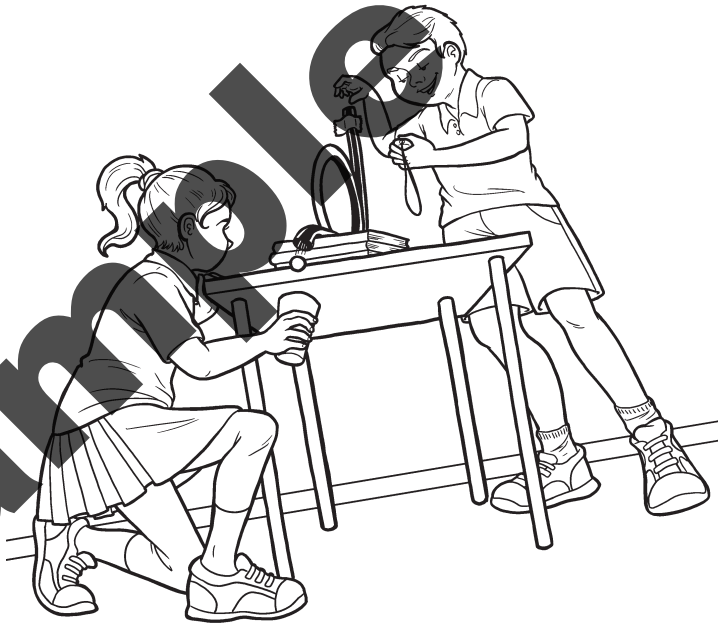
You have learned about the physics of roller-coasters. You have designed a roller-coaster in your small group with clear specifications. Now it is time to make a model of your roller-coaster!

What will you use to make your roller-coaster? Here are some ideas:

- Design Specification Sheet (P33)
- foam/plastic/cardboard tubing
- marbles
- paper or plastic cup
- roll of masking tape
- blocks
- cardboard
- matchboxes for cars
- books to rest the tubing on
- matchsticks

Steps

1. When engineers design structures and roller-coasters, they work within set limits or boundaries. These are called constraints. Some constraints include money considerations or availability of materials. The constraint for your project is your Design Specification Sheet (P33).
2. Use your Design Specification Sheet and start to construct a model of your roller-coaster.



Now answer these questions about the process of constructing your roller-coaster.

Questions

1. What changes did you make to your design/materials used as you built your model? Why did you make these changes?

_____

_____

2. How well did your group work together on this project? How could your group improve?

_____

_____

Step Right Up

ACTIVITY

In your small groups, you will create an ad for your roller-coaster model to encourage people to come and test out your ride. Use one of the apps below to do this:

Publisher	**Paint**	**Prezi**	**Picollage**	**Designpad**
Excel	**Word**	**Powerpoint**	**Animoto**	

1. Plan the images and text for your ad. Use the space below to brainstorm.

2. Now create your ad using your choice of technology.

3. Present the ad to the class. Talk about its features.

4. Ask the other groups for feedback .

Group	Feedback

Extra Activity

Upload your ad to the school or class online gallery or blog. Ask other classes for feedback -- which ride would they like to try? Why? Which ad 'sold' the ride to them? Why?

Program Writing 1

ACTIVITY

Designing amusement park rides and roller-coasters uses physics, engineering and mathematics.

As technology has improved, many rides use computer controls to add new movements. Computer technology has helped rides to move faster, and has made it easier to add adjustments to the speed of rides mid-ride.

Let's take a look at how you can use coding to plan the route of a ride.

Coding

Coding is a language that computers use. We can learn to think in symbols to understand coding. A computer program is a list full of instructions (called commands) that tell a computer what to do. Every time you use a computer - for example, press a key on a keyboard - there are commands that direct the computer to perform a task - for example, display the letter M on your laptop screen when you hit the M key on your keyboard.

Computers are good at following commands. But what happens when the person who programs the computer makes a mistake - leaves out a step in the list? The computer crashes and the programmer has to find the mistake (called bugs) and remove it (called debugging).

You are going to write a program on graph paper to understand coding.

You will need:

- graph paper
- ruler
- pencil
- eraser

Steps

1. Using your ruler draw a simple maze on your graph paper. Look at the example right. Use only horizontal lines ↔ or vertical lines ↕ for now (for your next try you can maybe add a diagonal line or curve! ↗ ↱).
2. Mark a START and FINISH point on your maze.
3. Pretend you are moving through your maze. Write instructions (a program) on how to go from the START to the FINISH of your maze, e.g. *Move up one square, move left two squares* OR you can use arrows as well as words ↑ 1 square; ← 2 squares.

EXAMPLE