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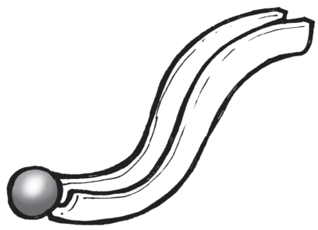


Teacher Notes

Introduction
Science and Maths in Motion

In order to teach science effectively, mathematics must be an integral part of that instruction. Science instruction involves measurements, calculations and graphing. Without these components, it is difficult to fully understand the scope of the content and scientific investigations carried out. Through no fault of the teachers, most teachers with a science degree have limited training in mathematics, especially primary and middle years teachers; as a result, science courses at those levels are taught with little to no integration of mathematics. This oversight leaves students at a disadvantage when they take higher-level science courses, and leaves the integration of mathematics up to those teachers.

The purpose of this book is to provide teachers with mathematical models to integrate with Motion and Forces content. It is designed to allow students practice with using mathematical models so they can develop a better understanding of the application of those models. The book is designed so that you can select and use those practice activities or investigations which best meet your students' individual needs or use them together as a complete guide to supplement or enhance your own science unit on motion and forces. However, it is recommended students be provided with additional practice of calculations other than what are contained in this book in order to deepen their understanding of the mathematics related to motion and forces.

The activities of this book engage students in active learning. It is organised in a manner that enables students to better understand the importance of the integration of maths with science. To teach any science class effectively, it is necessary to use a variety of teaching strategies such as individual assignments, group activities and hands-on activities. *Science and Maths in Motion* presents these strategies to implement in your classroom. This book would be a great resource for science or maths teachers, or it can be used as a collaborative tool where maths and science teachers engage in team teaching.

This book will enable students to learn the terminology associated with mathematical models and science content so they will be successful in subsequent, higher-level science and maths courses and state or national tests. With this instructional tool, you will enable your students to do the following:

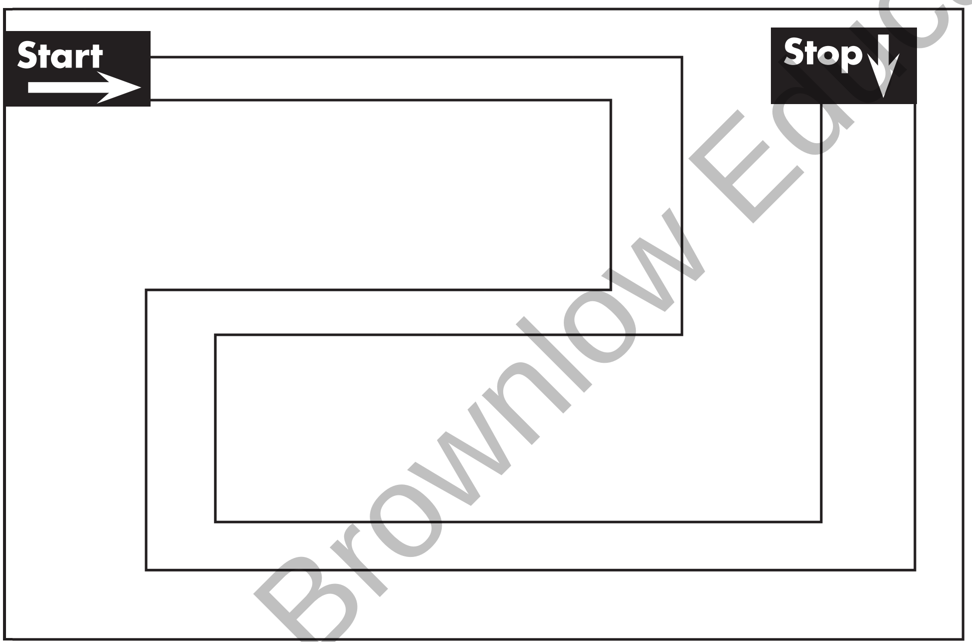
- solve problems using relevant equations
- apply mathematical models in scientific investigations
- use scientific equipment appropriately
- construct, understand and explain tables, charts and graphs
- understand the importance of maths and science integration

Student Activity Page

DISTANCE AND DISPLACEMENT

Distance is the length of a path between two points.
Displacement is the distance from the starting to the stopping point.

Instructions: Using a ruler, measure the distance and displacement in the path below. Always include your units.



The distance of the path is ______________________.

The displacement of the path is ______________________.

Describe how you would measure the distance and displacement of a winding, curvy path if no tape measure was available. ____

____

____

____

Additional Activity: On a sheet of copy paper, draw a winding, curvy path/distance and measure the distance and displacement; or with a partner, walk a curvy path and measure the distance and displacement.

Student Practice Page

DISTANCE AND DISPLACEMENT CALCULATIONS

Complete the problems below. Show all your work and always include correct units.

1. Joel's mother asked him to go to the store to pick up some milk. He jumped on his bike and rode 250 metres before the bike's tire went flat. He then walked the remaining distance and called his mother to come to the store to pick him up. If Joel lives 287.5 metres from the store, what distance did he travel on foot? (Give your answer in centimetres.)

2. Carey watched possum in her front yard. The possum travelled 5 metres down the tree trunk to the ground. Next, it travelled 10 cm around the tree, and finally went 0.005 km back up the tree to where it started. What is the possum's displacement in metres?

3. Mary swam two laps in the pool. The length of the pool is 0.4 hm. What is the length of the pool in metres? What total distance in km did Mary travel to complete two laps? What is Mary's displacement in metres?

4. John rolled the marble down a ramp that was 100 cm long. The marble continued to roll on the floor in a straight path for another 5 cm before it hit the wall and bounced back 15 cm on the same path. What is the total distance in metres that the marble travelled? What is its displacement in cm after it bounced back?

5. Tyler's grandmother's house is 0.005 km from his house. What would be the best mode of transportation for Tyler to use to visit his grandmother? Explain how you arrived at your answer.

   In the space below, develop a word problem that includes both distance and displacement calculations.

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Teacher Notes

Speed Activity Lab

SLOW ROLLER

This lab is a competitive, fun activity that enables students to engage in inquiry as they design a model with very little guidance from you. The goal of the activity is to create a path for a marble to roll through in the slowest amount of time possible. This activity allows students to investigate factors that affect motion and speed and to calculate speed. Students should test both large and small marbles to see how mass affects speed; they should position their board at different inclines to see how gravity affects speed; and they should investigate to see if there are places where friction needs to be increased or decreased. The pegboards used in the activity have a rough and a smooth side. Some students take notice of this and intentionally use the rough side to slow down their marble. Other students make speed bumps out of toothpicks for their marbles to roll over to slow them down.

The main material needed for this activity is pegboard made of compressed wood. Cut board purchased at a home improvement store into 60 x 60 cm. squares. You typically see this pegboard material hanging on garage walls with tools attached. Other items needed are marbles (small and large), straws, toothpicks, masking tape, rubber bands, stopwatches, books for props, digital scales, or triple-beam balances. Students can tape the straws to create a path or rail for the marble to roll through or cut the straws to place into the holes of the pegboard. The best items to use inside the holes of the pegboard are broken toothpicks. Depending on the size of the holes in the board, two to three broken toothpicks generally fit tightly in the holes. Rubber bands are used to loop around the top of toothpicks or straws (toothpicks work better) to create a rail in the path for the marble to roll against. Students should be encouraged to use as much of the board's surface as possible in order to make their marble roll as long as possible.

Because this is an activity that is completed in one or two class periods, offer suggestions to groups that have no idea of how to get started. This activity works well with block classes where you have more time, but if you teach regular period classes, you may want to have the students construct the models one day and test them the following day. You will need to allow enough time to measure the time of each group's marble roll (three times) with a stopwatch and provide them with enough time to take their models apart. Set a timer so students will know how long they have to construct their slow rollers. Once the time is up, all construction must stop. Allow each group three tries as you are measuring the time so they can record their slowest time. You may also allow each group to make one small adjustment for any of the three tries.