Forces and Energy

Post-visit Activity

This lesson has been designed as a post-visit activity after the 'Forces and Energy' workshop, for schools that are part of the Discover Primary Science programme.

Lesson Overview

Pupils carry out an investigation to determine which type of shoe has the best grip. This will reinforce or introduce the terms friction; force; Newton and weight.

Learning Outcomes

- Pupils will understand that forces can be either pushes or pulls and begin to recognise specific forces, such as friction.
- They will understand that forces are needed to make things move.
- They will understand the difference between balanced forces and unbalanced forces.
- They will have carried out a fair test.

Curriculum links

SOCIAL ENVIRONMENTAL AND SCIENTIFIC EDUCATION (SESE)
SCIENCE
WORKING SCIENTIFICALLY
Through completing the strand units of the science curriculum the child should be enabled to:
Questioning

- ask questions that will identify problems to be solved
- ask questions that will help in drawing conclusions and interpreting information

Predicting

- offer suggestions (hypotheses) based on a number of observations and data available about the likely results of the investigations
- make inferences based on suggestions and observations
- propose ideas or simple theories that may be tested by experimentation

Investigating and experimenting

- collect information and data from a variety of sources, including observations in the environment, classroom observations and experiments, photographs, books, maps, CD-ROM and computer database
- design, plan and carry out simple experiments, having regard to one or two variables and their control and the need to sequence tasks and tests
- realise that an experiment is unfair if relevant variables are not controlled
- appreciate the importance of repeating tests and experiments

Estimating and measuring

- use appropriate simple instruments and techniques to collect and record data on length, weight, mass, capacity, time and temperature thermometers, rulers, scales, stop-watches, measuring jugs record sheets, spring balances and forcemeters
- estimate and use appropriate standard units of measurement
- decide what should be measured and the degree of accuracy required

SOCIAL ENVIRONMENTAL AND SCIENTIFIC EDUCATION (SESE)
SCIENCE
STRAND UNIT: FORCES
The child should be enabled to:

- identify and explore how objects and materials may be moved
- explore the effect of friction on movement and how it may be used to slow or stop
  moving objects
- explore how friction can generate heat rubbing hands
- come to appreciate that gravity is a force
- become aware that objects have weight because of the pull of gravity

MATHEMATICS
Integrating and connecting
Through completing the strand units of the mathematics curriculum the child should be enabled to:

- recognise and apply mathematical ideas and processes in other areas of the curriculum

MATHEMATICS
STRAND UNIT: WEIGHT
The child should be enabled to:

- estimate, compare, measure and record the weight of a wide variety of objects using appropriate metric units (kg, g) and selecting suitable instruments of measurement
- rename units of weight in kg and g
- rename units of weight using decimal or fraction form
- solve and complete practical tasks and problems involving the addition, subtraction, multiplication and simple division of units of weight (kg and g).

MATHEMATICS
STRAND: DATA
The child should be enabled to:

- collect, organise and represent data using pictograms, single and multiple bar charts and simple pie charts
- compile and use simple data sets
- explore and calculate averages of simple data sets
- use data sets to solve problems

LEARNING STYLES INVOLVED
Visual/Spatial, logical/mathematical, kinesthetic, interpersonal.

THINKING SKILLS INVOLVED
Managing Information, Thinking, Problem Solving and Decision Making, Being Creative, Working with Others

Lesson Plan

WHAT YOU NEED
Ask the pupils to bring in different types of shoes they think have good grip.
For this investigation you will need:

- shoes
- scales
- weights
- a table
- string / rope
- a forcemeter or a bag and weights

SET UP
Set the table at the front of the room with plenty of room around it. Clear the table and make sure it's clean. Also set out one shoe of each type, the weights, the scales, the forcemeter or bag, and the rope or string.

INTRODUCTION
Start by reinforcing the learning from the workshop about forces:
Forces are just pushes and pulls in a particular direction. If two forces are balanced, it means the forces are the same size but are acting in opposite directions.
If two balanced forces are acting on an object, that object will not change its motion. If it is still, it will stay still. If it is moving, it will continue moving, in the same direction and at the same speed. Unbalanced forces can make objects start to move, speed up, slow down, or change direction.

Friction is a force between two surfaces that are sliding, or trying to slide across one another, for example when you try to push a toy car along the floor. Friction always works in the direction opposite from the direction the object is moving, or trying to move. It always slows a moving object down. The amount of friction depends on the materials from which the two surfaces are made. The rougher the surface, the more friction is produced. For example, you would have to push a book harder to get it moving on a carpet than you would on a wooden floor. This is because there is more friction between the carpet and the book than there is between the wood and the book. Friction also produces heat. For example, if you rub your hands together quickly, they get warmer.
Sometimes we want to reduce friction. For example, moving parts inside a car engine are lubricated with oil, to reduce friction between them. The oil holds the surfaces apart, and can flow between them. The reduced friction means there is less wear on

the metal, and less heat produced. But friction can be a useful force because it prevents our shoes slipping on the pavement when we walk and stops car tyres skidding on the road.

You are now going to test which shoes are best for preventing you from slipping when you walk. In other words, we're going to try and find the shoes with the most friction.

INVESTIGATION

Ask the pupils for their ideas for an investigation set-up, but lead them towards using the table to see how much force is needed to pull the different shoes across the surface. Look at the different shoes. Which one do they think will have the best grip? Why?

Ask the pupils to design a fair test to find out which shoe has the best grip by asking them leading questions:

- Should we use the same surface for each of the shoes?
- Is it ok that the shoes are made of different materials?
- Apart from the shoes, should the same equipment be used every time?
- Should the shoes be the same weight? How can we do this?
- How will we measure the results?
- How will we record and present them?

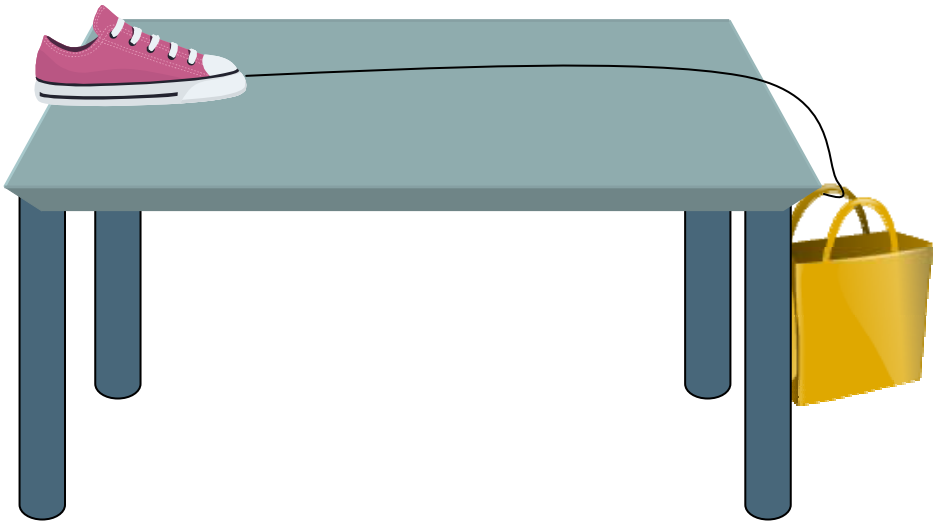
Explain that it is best to test how much force it takes to keep the shoe moving on the table, rather than to start it moving, as this takes more force. If using a bag, then keep adding small weights until the shoe keeps moving. Record the weight and then ask pupils to calculate how much force in Newtons this equals. You may want to remind them of the difference between mass and weight:
The mass of an object is how much matter it contains. It is measured in grams (g) or kilograms (kg) but is NOT a force. The weight of an object is the force caused by gravity pulling down on the mass of an object. It is measured in Newtons (N). Weight is measured using a forcemeter. The bigger the weight attached to the forcemeter, the more the spring inside the forcemeter stretches. 100 grams equals 1 Newton on earth.

Get the pupils to design a table to record their results. Make sure they put in clear headings and write down the unit in which they are measuring their results.

Example table:

Grip Investigation	
Shoe	**Force needed to pull the shoe across a table (N)**

Now set up the investigation:



Make sure each shoe weighs the same by adding weights inside. Place a shoe at one end of the table. Attach the rope or string to the shoe. Attach the forcemeter or bag (hanging over the edge of the other end of the table) to the other end of the rope or string. Pull the forcemeter or add weights until the shoe keeps moving across the table. Record the measurement.

Plenary

Talk to the pupils about the results. Which shoe was the best? Did they make the right prediction? Why do they think this shoe needs good grip? What is it normally used for? What other examples of useful friction can they think of?

Note

You could make your own weights for this investigation, using bags of sand or sugar of 50 grams and 100 grams.
A forcemeter can be bought from most educational suppliers for around €10.

If you wish to speak to a member of the Education Department directly please contact 028 9046 7836/7799