



Safety bicycle with pneumatic tyres



The walking machine

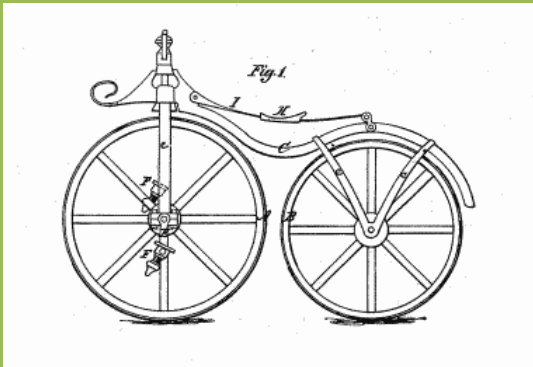


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Modern bicycle



Quadracycle



Velocipede or boneshaker



Safety bicycle with hard tyres



High wheel bicycle

Activity 1.2 The hour record



The hour record is a competition for cyclists through the decades. The challenge is to cycle as far as you can in one hour. Success in this sport depends on the cyclist's fitness and on the quality of the bike.

To do

- a** In pairs use the data in the table to plot a graph of the one-hour record between 1876 and 2005.

Date	Record holder	Distance (km) travelled in one hour
1876	Frank Dodds	26.5
1893	Henri Desgrange	35.3
1905	Lucien Petit-Breton	41.1
1912	Oscar Egg	42.1
1933	Jan Van Hout	44.6
1942	Fausto Coppi	45.8
1956	Ercole Baldini	46.4
1967	Ferdi Bracke	48.0
1972	Eddy Merckx	49.4
1984	Francesco Moser	51.1
1993	Chris Boardman	52.3
1994	Tony Rominger	55.3
1996	Chris Boardman	56.4
2000	Chris Boardman	49.4
2005	Ondřej Sosenka	49.7

- b** Agree on the type of graph you are going to draw before you start. Which set of data will be the x axis and which will be the y axis? Decide on a scale that will use as much of the graph paper as possible.
- c** Carefully plot all the points in pencil checking each other's work after every five points.
- d** When you have plotted all your points, decide how you will join them. Talk to another group before you make your decision.
- e** Write down:
- three pieces of information you can get from your graph
 - three questions you can ask another group about the information shown in your graph.

Activity 2.1 Get a grip!



You are going to carry out an investigation into the grip of a variety of sports shoes.

To do

- a Attach the force meter to the shoe.
- b Put weights in the shoe so each shoe being tested has the same mass (for example 1 kg).
- c For each one, pull the shoe until it moves at a steady speed.
- d Measure the force on the force meter.
- e Design a table and record your results.
- f Repeat with a different shoe.

You will need

- scissors
- force meter
- string
- a selection of sport shoes
- laboratory weights
- metre rule

To discuss

- 1 Which factors did you keep the same each time to compare the different shoes?
- 2 Could you compare your results with those of another group? Explain your answer.

To do

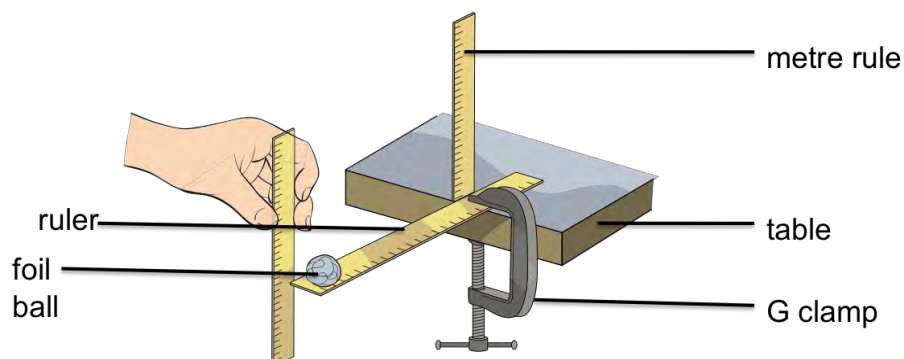
- a Use the table below to summarise your findings from your shoe grip investigation.

Rank the shoes in order from the ones with the most grip to the ones with the least.	
Suggest up to three features that give a shoe more grip. Use data from your investigation to justify your ideas.	
Explain why understanding about friction is important for a designer creating a new sports running shoe.	

Activity 3.1 Batting challenge



Your task is to modify some equipment provided to produce an improved bat and ball system. You will use a ruler to project a ball of foil exactly 1 metre into the air. This system will be judged on the control of its power.



You will need

(for each group)

- aluminium foil sheets, 10 x 10cm
- G-clamp
- metre rule
- Perspex ruler, 30cm (to be used as a catapult)

To do

- Set up the equipment as shown in the diagram. First practise with a piece of screwed up waste paper. You will be using aluminium foil for the real experiment.
- Make a list of all the things you could vary that would affect the power of the system, for example weight and width of foil ball, position of ball on rule. Decide which variables you will alter.
- You can only alter one variable at a time for each trial, for example ruler length or ball size.
- Design a table with two columns to record your results, for example:

Length of ruler	Height
10cm	
11cm	
12cm	

- Repeat this process with some other variables.
- When you have investigated three or more variables, try the system out with your chosen values, such as optimum length of ruler or size of ball.
- Write down your chosen values. This is now the specification for your equipment. You will use these values to compete with other groups.

Activity 4.1 Attributes analysis



Game Attributes	Pitch dimensions	Ball shape/ dimensions	Bat shape/ dimensions	Match length	Number of players	Scoring system	League system	Goal/hole/ distance/ time	Surface	Team size
Football										
Tennis										
Skittles										
Darts										
Golf										

Activity 4.1 Attributes analysis



Game Attributes	Pitch dimensions	Ball shape/ dimensions	Bat shape/ dimensions	Match length	Number of players	Scoring system	League system	Goal/hole/ distance/ time	Surface	Team size



Storyboard template

What is the audience for your video?

Image	Text



NF Sports Equipment plc Research and Development Exercise

NF Sports Equipment plc is an up-and-coming manufacturing company specialising in producing equipment and kit for unusual or innovative new sports and games. For example, most sports retailers now include NF lines of equipment for airball and trampoline fencing. To remain ahead of its competitors NF's research teams must continually investigate and develop potential new products.

Your task

You are to research a new piece of equipment and communicate your findings to the NF Sports Equipment board. If the board approve, you will get more funding for research and development to bring the product to market.



The process

In groups of six:

- Decide on a piece of equipment that will be used in a sport or game of your choice.
- Discuss and decide on a feature of the equipment to investigate. For example, which type of straw is best for blow football?
- Plan a simple research task to find out how the equipment can be improved.
- Plan a poster to present your findings to the NF Sports Equipment board.

Divide your group into two teams:

- **Team A Scientists** – These people select apparatus and plan and carry out the investigation. They will need to show what they have found out and provide evidence for it.
- **Team B Communications team** – These people present the research to the NF board in a concise and attractive format. This will be in the form a scientific research poster.

For the group to be successful everybody needs to be assigned clear roles. Good communication between teams will be essential.

Activity 5.1 Testing the kit – Collecting data



Name of piece of sport equipment you are going to investigate

.....

Enquiry question

.....

To do

- a Write down all the different ways your piece of equipment could vary. These are **variables**.
- b Decide which of these you are going to **change** systematically. This is your **independent variable**. Mark it with a **'***'.
- c Decide what you are going to measure to see the effect of changing the independent variable. This is called the **dependent variable**. Mark it with a **'#'**.
- d You will need to **control** all the other variables to keep them constant. Mark your list of these variables with a **'C'**. Use the table to explain how you will keep these variables constant.

Variable	Type of variable '*', '# or 'C'	How will you control the C variables?

e Make a list of the equipment you will need.

1.
2.
3.
4.
5.



A Top tips

- Make sure it is possible to take the measurements you need using simple apparatus. For example, speed is difficult to measure, distance is easier.
- Make sure you have the correct apparatus for making your measurements.
- Make sure you have selected a realistic range for your independent variable.
- Be clear about the units you will use to measure your dependent and independent variables.
- Make sure you choose a range of values for your independent variable that will produce some measurable change in the dependent variable. It would be sensible to do a practice run before you collect detailed information.

B Recording and displaying data

You will record data in one of two ways:

1. Continuous variables

You may be able to change your independent variable systematically, for example:

Independent variable	Dependent variable values (units)
Temp of squash ball (°C)	Height of bounce of squash ball (cm)
10	3
20	6
30	9

In this case you can draw a line graph.



2. Discontinuous variables

It may be that you cannot change the independent variable systematically, for example:

Independent variable	Dependent variable values (units)
Surface	Height of bounce of squash ball (cm)
Wood	5
Lino	2
Concrete	9

In this case you will need to draw a bar chart.



As part of NF Sports Communications team, it is your responsibility to present information to different audiences in a concise and attractive format.

Here you will use a scientific research poster to present your group's findings to the NF Sports Equipment plc board.

See this example of a poster.

Content

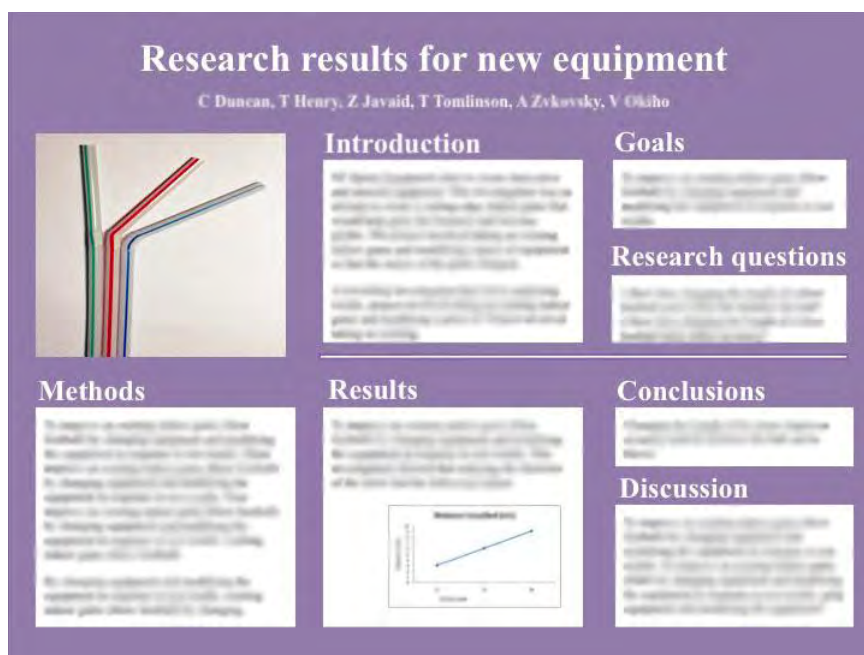
Collect information from your scientists, and present information under these headings:

- Introduction
- Goals
- Research questions
- Methods
- Results
- Conclusions
- Discussion

The discussion should suggest how your research might be used to develop or refine a piece of equipment.

Planning

- Start by deciding on the size of the poster and where it will be displayed.
- Decide on a heading for your poster.
- Sketch a rough layout showing the position and size of any pictures, tables and graphs. Information should flow from top to bottom or from right to left.
- Decide on a suitable font and font size to be read from 2m away.
- Keep the colour scheme simple.
- Decide who will be responsible for which parts of the poster.





Making the poster

- a** Make a final layout plan for your poster, providing space for the different sections.
- b** Collect information from the scientists as they work.
- c** Work together to process the scientists' information so that it fits the space allowed.
- d** Adjust your layout as necessary as you build up the poster.
- e** When your poster is completed, display it as part of the class exhibition.
- f** Use sticky notes to provide feedback on other groups' posters, including one thing that you like and one thing you think could be improved.