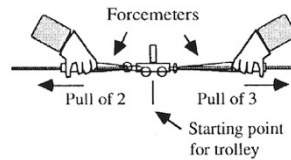


11. The Pullers hook their forcemeters onto either end of the car or trolley and rest their arms on the table.

For each turn, the Pullers choose a force from the Force Diagram on the chart. This is the force each Puller uses.



The Starter holds the car or trolley steady at the starting point. The Pullers pull steadily with their chosen force, not moving their arms. The Starter lets go. The Judges watch carefully to see which way the car or trolley moves. Each person uses the chart to record the direction in which the car or trolley moves.

Turn	Force diagram	Direction car moved
1		
2		
3		
4		
5		
6		

Take it in turns to be the Starter, a Puller and a Judge. Choose some forces of your own for turns 5 & 6.

12. In your group, decide on a rule for predicting the direction in which the car or trolley will move. Write it here.

13. Write down what you have learned about force and how to measure it.

Lesson 5: Measuring Forces

Name: _____




Making and using a forcemeter to measure pushes and pulls


Making your own forcemeter

- Everyone is going to make their own forcemeter.


You will need:

1 piece of wooden dowel 

1 poster pin 

hook , masking tape

1 piece of plastic tube about 7 cm long 

A piece of elastic as long as the dowel 

You will also need scissors, a pencil and some masses.

- Stretch the elastic. Use masking tape to stick both ends of the elastic to one end of the tube as shown here.



This step is very important so make sure you have stuck the elastic firmly to the tube. It is no use winding lots and lots of masking tape onto the tube – the important thing is to stick the first layer firmly to the tube.

- Use your poster pin to make a small hole in the middle of one end of the piece of dowel – this hole will help you guide the hook into the dowel in the next step.

- Slide the tube onto the dowel so that the elastic sits on the end with the hole.

Screw the hook into the end of the dowel through the elastic, making sure there is the same length of elastic on either side.



Your forcemeter now needs to be *calibrated*. This means working out where to put the markings (like on a ruler).

Calibrating your forcemeter

- Hold your forcemeter upright as shown in the picture on the next page. Hang 500 grams on the hook of your forcemeter.

Draw a line on the dowel exactly where the top of the tube now reaches. Label this line 5. This means 5 Newtons. Newtons are the units used for force.

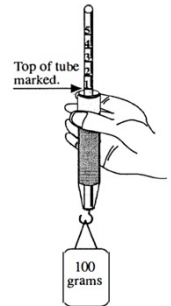
- Take 100 grams off the hook of your forcemeter, so that you now have 400 grams on the hook.

Draw a line on the dowel exactly where the top of the tube now reaches. Label this line 4.

- Repeat this process, each time taking off another 100 grams and labelling the lines.

Stop when you have lines marked and labelled for 500 grams, 400 grams, 300 grams, 200 grams, 100 grams, and 0 grams, as shown in the picture.

You now have a calibrated forcemeter ready to measure some forces.



Using your forcemeter

- Work in pairs to try using your forcemeter. If you hold the plastic tube, your forcemeter can measure how hard you pull on the hooked end, or how hard you push with the other end.

Gently push your partner with a force of 1 Newton.

Now try 2 Newtons. Can you feel the difference?

Get your partner to push you.

Find some more things to push or pull with your forcemeter.

- With your partner, find three things in the room that need between 1 and 5 Newtons to make them move.

Record your results in the table below.

The first row has been filled in to show you how to do it.

What you pushed or pulled	Push or pull	Force needed (N)
Book	Push	2N

Two forces pulling in opposite directions

- Work in groups. One person will be the Starter. Two people will be the Pullers. The other people will be the Judges.