



## Friction

### Topic Summary

During this topic pupils will learn that forces can be measured and compared and that friction is a force which opposes motion and exists between objects moving across solid surfaces. They will also learn about the opposing forces of air resistance and water resistance.

Pupils will be asked to:

- decide what evidence to collect in planning and carrying out a fair test;
- make measurements using a forcemeter;
- look for patterns in results and interpret and suggest explanations for these.

Pupils will relate knowledge and understanding of frictional forces to everyday contexts and recognise scientific explanations for familiar phenomena related to friction.

### 5–14 Guidelines Attainment Targets

Level C

- give some examples of friction
- explain friction in simple terms
- describe air resistance in terms of friction

Level D

- give examples of streamlining and explain how this lowers resistance

### Resources for further work

Forcemeters, metre ruler, circle template, paper clips, paper, scissors, sticky notes.

### Glossary / Vocabulary

<b>air resistance</b>	The force that air exerts on a moving object, slowing it down.
<b>force</b>	An influence that may cause an object to change speed or direction. A force is a push or a pull.
<b>forcemeter</b>	An instrument used to measure the size of a force in newtons.
<b>friction</b>	The resisting force that occurs when surfaces slide over each other and slows down their movement.
<b>newton</b>	The unit used to measure the size of a force. It is abbreviated to N.
<b>size</b>	How big something is.
<b>surface area</b>	The area of the outer part, or surface, of an object.
<b>water resistance</b>	The force that water exerts on a moving object, slowing it down.

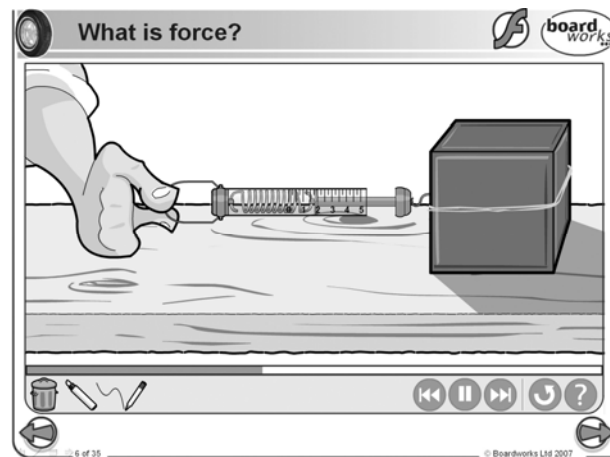


## 1. What is force?

### Chapter Summary

Pupils will learn:

- to use a forcemeter carefully to measure forces;
  - that 'newton' is the unit of force.
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- Review children's previous learning and gauge their understanding about forces by asking questions. Ask pupils to identify the direction in which the forces are acting in each illustration, e.g. pushing the pram, pulling during the tug-of-war game and the change of direction for the golf ball. Discuss the effect of forces in relation to their size.
  - Explain to pupils that a forcemeter measures a force between the smallest and the largest newton markings on the scale. Discuss with the pupils why we use different-sized forcemeter scales to measure the force of different objects. As the teddy bear is relatively light, we can measure the force on a 5 N or a 10 N scale. Forcemeters are also available with scales of 25 N or 50 N. Explain that larger forces are measured by forcemeters with a stronger spring inside them. The scale on the forcemeter shows the size of the force it can measure. Ask pupils: "What if you were using a forcemeter with a scale of 10 N and the forcemeter result was 10 N?" The object could have a force of 10 newtons or a larger forcemeter might be required to accurately measure the force.



Notes



## 2. Friction

### Chapter Summary

Pupils will learn:

- that there is a force between an object and a surface which may prevent the object moving;
  - to decide what evidence to collect;
  - to predict what they think will happen and to plan a fair test;
  - to make and record careful measurements and present them in a bar chart;
  - to relate the results to the prediction;
  - to explain conclusions in terms of the roughness or smoothness of the surfaces;
  - that the force between two moving surfaces is called friction;
  - that friction can be useful.
- 
- Ask: "Is this a fair test?" Pupils should give reasons for their answers.
  - Ask pupils to interpret the bar graph and the results for the different surfaces. Then ask them to discuss possible conclusions in pairs before voting as a class which conclusion they think is correct.

**Friction**

Sometimes, friction can be really useful. Friction between our shoes and the floor stops us from slipping.  
What's happening in the animation?

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Notes



### 3. Water resistance

#### Chapter Summary

Pupils will learn:

- that water resistance slows an object moving through water;
  - to explain what evidence is to be collected and decide whether the test is fair;
  - to identify trends in results and draw conclusions explaining these in terms of the force between the object and the water.
- Pupils discuss the different theories in pairs. Ask: "Which theory do you think is the most/least likely?" and "How could you test each theory?"

**Water resistance**

**Boy**

Water resistance ✓ **large water resistance**

Surface area ✓ **large surface area**

**Fish**

Water resistance

Surface area ✓ **small surface area**

**small water resistance**

Plenary

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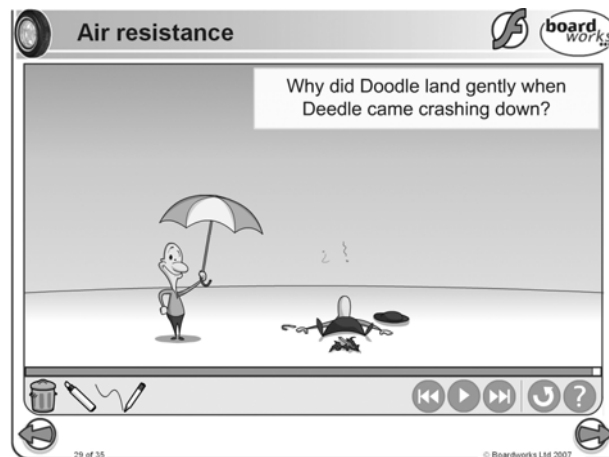


#### 4. Air resistance

##### Chapter Summary

Pupils will learn:

- that air resistance is a force that slows objects moving through air;
  - to plan a fair test saying what they will change, what they will keep the same and what they will measure;
  - to make measurements of time;
  - to identify a pattern in the results and explain it in terms of air resistance.
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- After pupils have planned a fair test and conducted the experiment trials, ask them to identify a pattern in the results and to explain it in terms of air resistance.



Notes



### 5. Review

- Ask pupils to rub their hands together. The heat generated is caused by friction.

#### Extension task/homework

- Pupils list things that need a non-slip surface (e.g. pavements) and things that need to be slippery (e.g. roller coaster rails). Who can make the longest list?
- Review work on friction by asking pupils to write and illustrate a story to show how friction is important to them. Read and talk about the stories with the pupils.

**Friction**

As the duck swims around the pond, water resistance against the part of the duck in the water slows it down. On the part of the duck above the water, air resistance also slows it down.

Review

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