

1.2 Why do things slow down?

Moving things often slow down by themselves. This happens even when we don't want it to.

- What happens to a bicycle if you stop pedalling?
 - What must you do to keep the bicycle going at the same speed (or, in other words, to stop it from slowing down)?

Things slow down because there is a force acting on them. This force acts in the opposite direction to the way they are moving. We call this force a friction force.

Sliding friction

When two things slide over each other, there is a friction force between them.

This friction force can be large or small. The diagrams show why.

- Copy and complete the sentences.

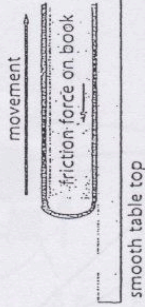
The friction force on a moving object always acts in the opposite _____ to the way the object is moving.

So it makes the object _____ down.

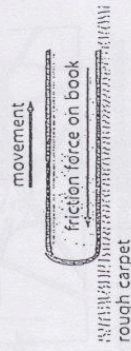
There is less friction if the object is sliding over a _____ surface.



A bicycle will slow down by itself unless you keep pedalling.



If you give a book a push, it will slide across a table. A table top is smooth. There is only a small friction force. The book slides a long way before it stops.



But a book won't slide very far across a carpet. A carpet isn't very smooth. There is a large friction force. The book doesn't slide very far before it stops.

Friction with the air

In tennis, the ball is moving through the air most of the time. But this doesn't mean there isn't any friction.

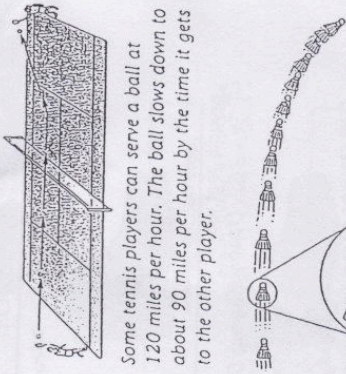
There is a friction force between the ball and the air. This friction force is called air resistance or drag.

- Look at the diagram. Then copy and complete the sentences.

A tennis ball _____ down as it travels through the air.

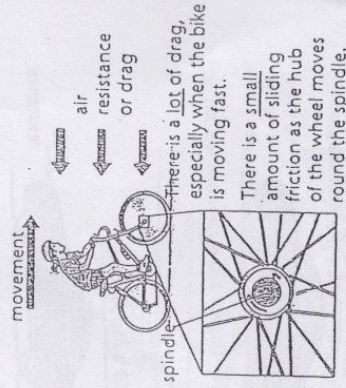
This is because of air _____ or _____.

- A shuttlecock slows down a lot faster than a tennis ball. Explain why.



Some tennis players can serve a ball at 120 miles per hour. The ball slows down to about 90 miles per hour by the time it gets to the other player.

There is a lot of drag on the feathers of a badminton shuttlecock, so it slows down quickly.



Why a bicycle slows down

If you stop pedalling, a bicycle slows down. This is because of friction. The diagram shows where this friction occurs.

- Write down the two friction forces that slow down a bicycle.
 - Which of these two forces slows down the bicycle more?

WHAT YOU SHOULD KNOW (Copy and complete using the key words)

Why do things slow down?

Moving things slow down because of _____ forces.

Friction forces act in the _____ direction to the way an object is moving.

There is friction between things which _____ over each other.

There is also friction when things move through the air. This is called air resistance.

1 The table shows the time taken by five athletes to run a 100 m race.

Athlete	Time in seconds (s)	Position
Jo	11.8	
Pat	10.0	
Chris	10.5	
Nita	11.4	
George	12.0	

a Complete the last column to show the order in which the athletes finished the race.

b What was Pat's average speed?

c Was Pat's top speed more than, less than or equal to your answer to **b**?
.....

d Why would a hand-held stopwatch not give accurate enough times for this race?
.....
.....

2 Draw lines to match each force with its correct meaning.

Force

- weight •
- thrust •
- friction •
- air resistance •

Meaning

- the force due to a moving object displacing air molecules
- a force that opposes motion
- the force on an object due to gravity
- a forward pushing force

3 Complete the following sentences. Choose from the words below to fill the gaps.

balanced

constant

downwards

air resistance

gravity

stationary

upwards

weight

If all the forces acting on an object are balanced, the object is either
..... or moving at a speed.

The force of acting on an object gives
it weight. This force acts

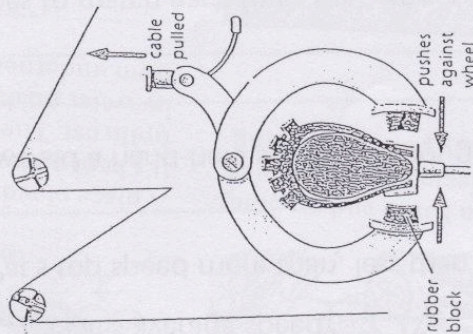
If an object is falling through the air, a force called
..... acts in the direction on it.

1.4 Making good use of friction

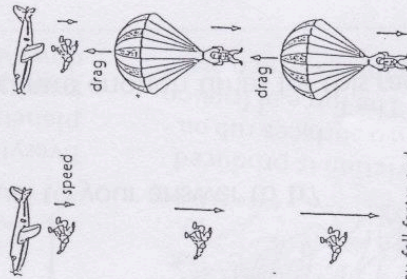
Friction is often a nuisance. So we usually want to reduce it.
But friction can also be very helpful. Then we want to increase it.

Slowing down

- To slow down a car or a bicycle, we use the brakes.
 - The diagram shows how the brakes on a bicycle work.
- 1 Write down the following sentences in the right order. The first one is in the correct place.
 - ▣ You squeeze the brake lever to pull the cable.
 - ▣ There is a force of friction between the rubber blocks and the wheel.
 - ▣ The wheel slows down.
 - ▣ The rubber blocks press against the wheel.



How bicycle brakes work.



You fall faster and faster. You will be killed or injured when you hit the ground.
A parachute slows you down so you can land safely.

Using drag to slow things down

Brakes use sliding friction to slow things down. You can also use air resistance to slow things down. The diagram shows how air resistance slows down a parachutist.

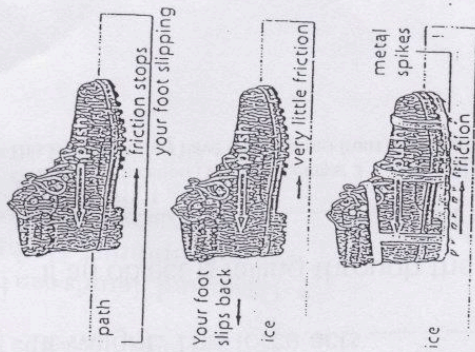
- 2 (a) Why do people use a parachute when they jump out of a plane?
- (b) How does the parachute work?

Walking on ice

The friction force is sometimes big enough to stop two surfaces from sliding across each other.

You use a friction force like this when you walk. That is why it is difficult to walk on ice.

- 3 Look at the diagrams. What happens if you try to walk on slippery ice?



- 4 How do the crampons work?

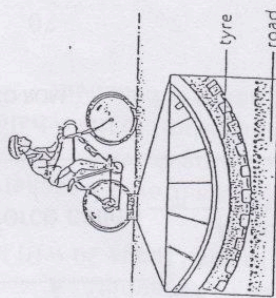
Getting a grip

Tyres must grip the road. If they don't grip hard enough, the car or bicycle will skid.

- 5 Look at the diagram. Then copy and complete the sentences.

To make tyres grip, there must be a lot of _____ between the tyres and the road.

To make the friction forces big, we make tyres from _____ and make road surfaces _____.



There is a lot of friction between a rubber tyre and a rough road surface.

WHAT YOU SHOULD KNOW (Copy and complete using the key words)

Making good use of friction

Between tyres and the road there must be a lot of _____ if there isn't, the tyre might _____.

You slow down cars and bicycles by using the _____. These use _____ friction to slow the wheels down.

A parachute uses _____ to slow the parachutist down.

7.1 How to make things move

We often want to start things moving. The diagrams show some examples.

1 Copy and complete the table.

	What you do to start it moving
golf ball	hits the ball
drawer	pull
buggy	push

Pushing things, pulling things and hitting things are all ways of starting things moving. They move because you make a force act on them.

2 Look at the diagrams again. Then copy and complete the sentences.

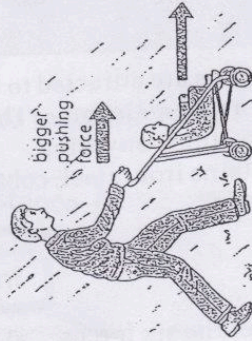
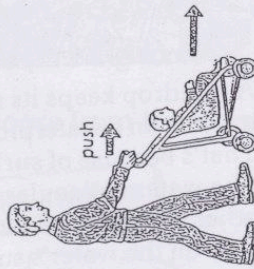
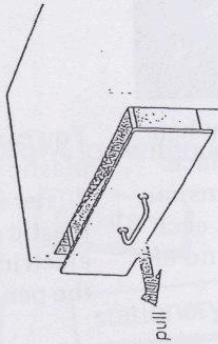
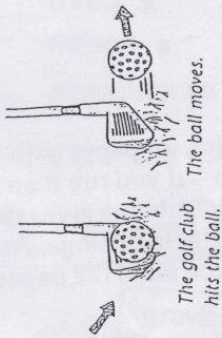
A force acting on an object makes it _____ as the object moves in the same _____ as the force.

3 Making things move faster

It suddenly starts raining. So the man wants to make the buggy move faster. The diagram shows how he can do this.

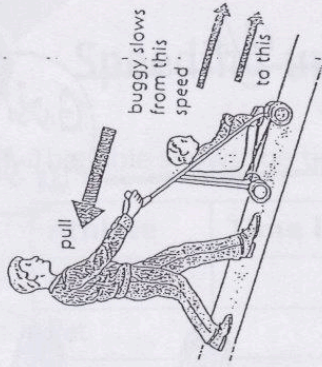
3 Copy and complete the sentences.

To make the buggy move faster, the man must push it with a bigger _____. This force must be in the same _____ as the buggy is moving.



4 Making things move slower

The man with the buggy now has to go downhill. The buggy starts to move too fast, so he needs to slow it down. The diagram shows how he can do this.



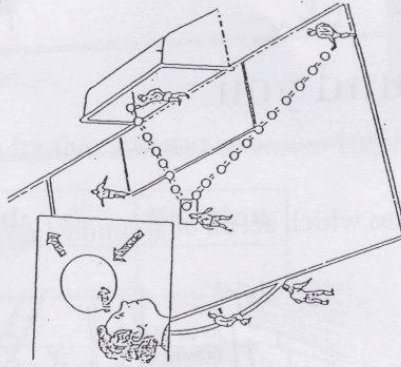
A force in the opposite direction slows the buggy down.

4 Copy and complete the sentences.

To make something slow down you need a _____ force. The force must be in the _____ direction to the way the thing is moving.

5 Making things change direction

A football is moving across the goal mouth. The attacker wants the ball to go into the goal. The diagram shows how he can do this.



5 Copy and complete the sentences.

To change the direction that the ball is moving, the attacker must make a _____ act on it. The attacker wants the ball to turn to the right. So he must head it with a force from the _____.

WHAT YOU SHOULD KNOW (Copy and complete using the key words)

How to make things move

To start something moving, to speed it up or to change its direction, you must make a _____ act on it. This force must be in the same _____ as you want the thing to move.

If you want to slow something down, the force must be in the _____ direction to the way it is moving.

1.2 Why do things slow down?

Moving things often slow down by themselves. This happens even when we don't want it to.

- What happens to a bicycle if you stop pedalling?
 - What must you do to keep the bicycle going at the same speed (or, in other words, to stop it from slowing down)?

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Sliding friction

When two things slide over each other, there is a friction force between them.

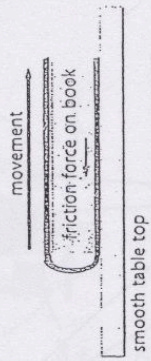
This friction force can be large or small. The diagrams show why.

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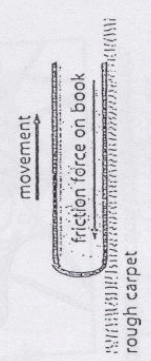
The friction force on a moving object always acts in the opposite _____ to the way the object is moving.
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Friction with the air

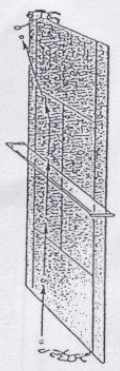
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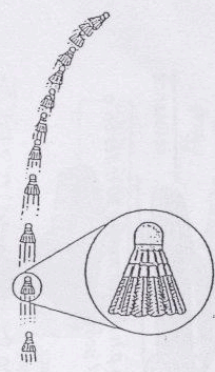
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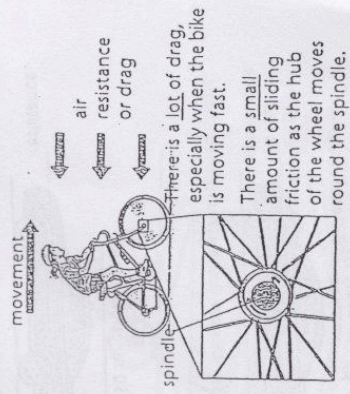


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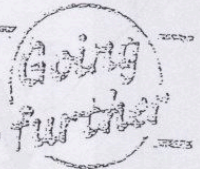
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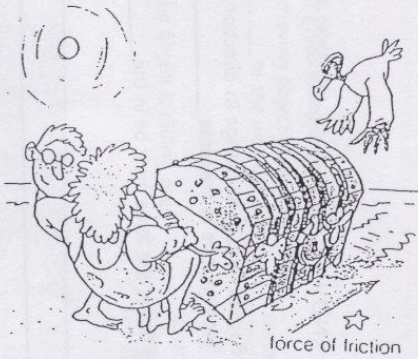
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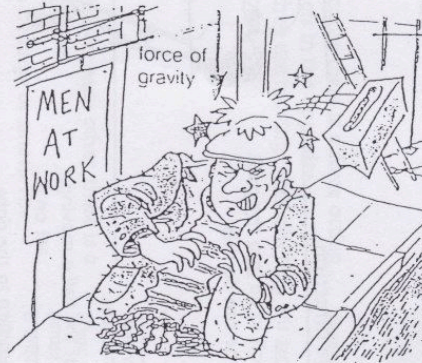
13.1 Forces around you



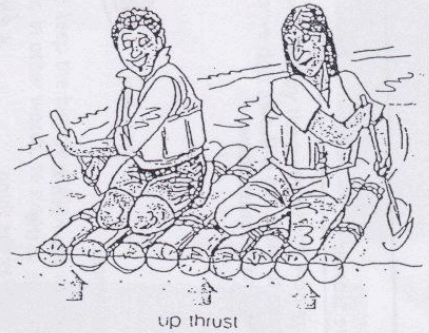
Here are some of the different forces which act on or around you.



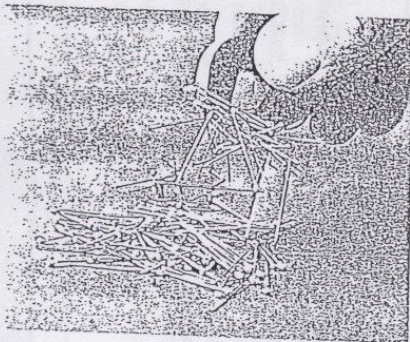
A force of friction is produced whenever two surfaces rub on each other. The force of friction slows down things which are moving.



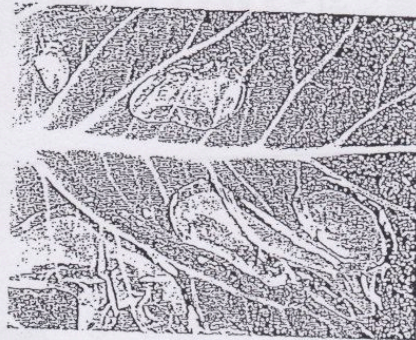
Everything on Earth, and on other planets, is affected by the force of gravity. Gravity pulls everything downwards.



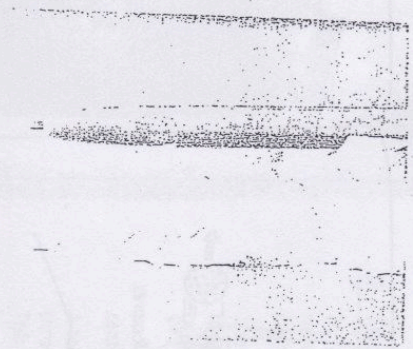
A piece of wood floats on water. It's kept up by a force called upthrust. The force is produced by water pushing on the wood from underneath.



The steel pins are attracted to the magnet by a magnetic force. The magnet can attract anything which contains iron, steel, cobalt, or nickel.



A raindrop keeps its shape when it lands on a waterproof surface. That's because of surface tension. The water molecules attract each other strongly and form a kind of skin on the water's surface.



You can pick up paper with your plastic pen – if you rub it on a duster first. Rubbing gives the plastic an electric charge. An electric force pulls the paper to the pen.

- 1 Which of the six forces: a) keeps a piece of wood floating b) keeps a raindrop in shape c) slows down things which are moving? ▲
- 2 Which of the six forces: a) picks up dust on a record b) keeps the Moon in orbit round the Earth c) helps you when swimming?
- 3 a) Which substances are attracted to a magnet? ▲
b) Why can a magnet pick up a tin can? (page 20 will help)
- 4 What does the force of gravity do? ▲
- 5 Explain carefully how gravity affects a firework rocket: a) when it is on the way up b) when it is coming down.
- 6 Try to find out: why upthrust is important to the whale, and why the whale gets into serious trouble when it is beached.

Did you know?

- You can float a pin on water – if you lay it carefully on the surface. Surface tension keeps it up.
- Gases and liquids can both supply upthrust. Upthrust is the force which makes a hydrogen balloon rise when you release it.