

1.3 Drag forces and friction

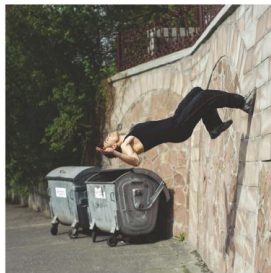
Learning objectives

After this topic you will be able to:

- describe the effect of drag forces and friction
- explain why drag forces and friction arise.

Fantastic Fact!

Which material has the lowest friction? BAM is a material that contains aluminium, magnesium, and boron. It is twice as slippery as ice.



▲ You need friction to move across surfaces.

Fantastic Fact!

In 1995 Fred Rempelberg travelled at 167 mph... on a bicycle! He did it by cycling behind a lorry where there was very little air resistance.

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Slide your finger along the desk. Does the surface feel smooth or rough? Even really smooth surfaces exert a force.

What is friction?

A surface such as a metal slide in a playground looks and feels really smooth. Now imagine zooming in on it; you will see that it is actually rough.

When a book is resting on the table you can push on it but it may not move. **Friction** grips objects. As you increase the force by pushing harder the book will start to move. If you remove the force the book slows down and stops. This is because the rough surfaces can no longer move past each other.

A State two things that friction does.

Is friction useful?

Friction can be a good thing. You need friction to walk, as the friction between your foot and the road produces the force to move you forward. The brakes on your bike and in a car work because of friction.

B Describe how friction helps you to walk.

How can you reduce friction?

One way to reduce friction is by using oil or grease. This is called **lubrication**. When you oil the chain of your bike the surfaces move past each other more easily. Snowboarders wax their boards to reduce the friction between the board and the snow.

C Suggest why the hinges of a door need to be lubricated.

What are drag forces?

A dolphin swimming through the water and a surfer paddling through water will both experience **water resistance**. As a snowboarder jumps through the air he will experience **air resistance**. Water resistance and air resistance are **drag forces**.



▲ When you move through water you experience water resistance.

To understand drag forces you need to think about the particles in the air and the water.



A solid moves through a gas.

A solid moves through a liquid.

▲ A moving object is in contact with air or water particles.

As a dolphin moves through the water it pushes the water particles out of the way. This produces a drag force, which slows it down.

D Name the drag force acting on an aeroplane in flight.

How can you use drag forces?

Parachutes are used to slow down drag-racing cars and skydivers. The contact with the air produces a drag force.

How can you reduce drag forces?

An Olympic cyclist will tuck her arms in close to her body as she cycles. She will even make sure that her thumbs are as close to the handlebars as possible. This makes her more **streamlined**, which reduces the force of air resistance.

Testing a parachute

A company wants to compare different materials for making parachutes. Name **three** ways that they could make it a fair test.



● P1 Chapter 1: Forces

Key Words

friction, lubrication, water resistance, air resistance, drag force, streamlined

Summary Questions

1 Copy and complete the sentences below.

The force of _____ acts between two solid surfaces in contact that are sliding across each other. The surfaces are _____ and will grip each other. This is why you need to exert a _____ to make something move. There are two drag forces: _____ and _____. When a moving object is in contact with _____ or _____ particles it has to push them out of the way.

(7 marks)

2 Describe the effect of water resistance acting on a bird diving into a lake to catch a fish.

(1 mark)

3 Suggest and explain a reason why the brake blocks on a bicycle need to be replaced from time to time.

(2 marks)

4 A dragster is a car that uses a parachute as a brake. Use the ideas on this page to compare the drag force due to the parachute acting on cars travelling at different speeds, or using parachutes of different sizes.

(6 marks)

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