

Forces

Grade 4 CP



What Are Forces?

Forces are often referred to as **pushes** and **pulls**.

Pushes and pulls are totally the opposite

A pull is a force you apply on an object to move it **towards** you.

A push is a force you apply on an object to move it **away from** you.

What do we use to measure force?

We use a **force meter** to measure force.



Look at the pictures below and identify the force in each picture whether it is a pushing or pulling force.



Effects Of Forces

Forces affect the **movement** or **shape** of an object. They can make an object start to move, stop moving, move faster or move more slowly. They could also make an object change its shape or cause a moving object to change direction.

What Are Applied Forces?

In the picture the girl is pushing the table. This is an example of an applied force.

An **applied force** is any force that is applied to another object or person.

In this example, the girl applies force on the table by pushing it.



In the picture the boy is opening the door.
This is also an example of an **applied force**.

He pulls the door towards him. The pulling
action is an applied force.



Conclusion

From the previous examples you can see that an **applied force** happens when an object is **pushed or pulled** by another object. The other object can be a person or a machine or a machine part.

If you throw a ball into the air. The ball comes down again.

- Why does the ball come down again?
- Why doesn't it carry on into the sky?
- What is gravity?
- Why gravity is very important to our lives?



Gravity is very important to our everyday lives. Without gravity we would fly off the Earth! We would all have to be tied down all the time. If you kicked a ball it would fly off forever.

Gravity works on both objects **at rest** and objects that are **moving**.

Gravity is the **force** which **attracts** or pulls all objects towards the Earth.



The gravitational force **direction** is always towards the centre of the Earth.

It is represented by an arrow pointing **down** as in the picture below.



Question

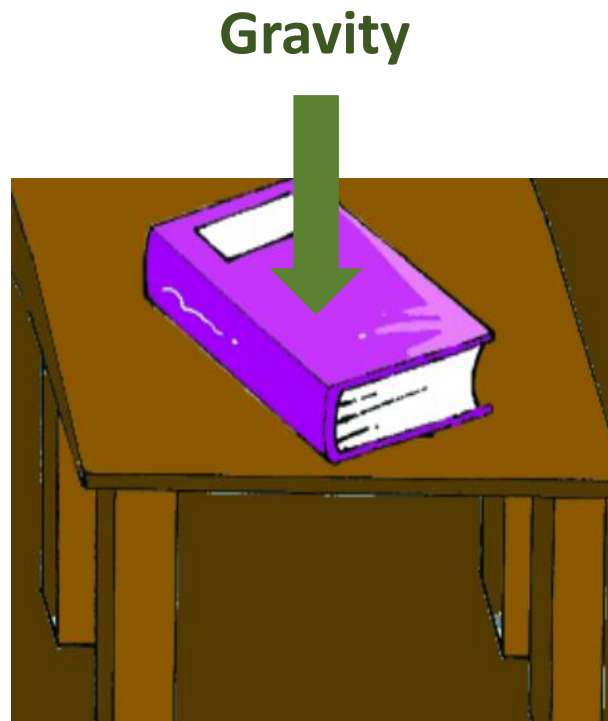


If you put a book on a table, the book is at rest. Are there any forces acting on the book ?

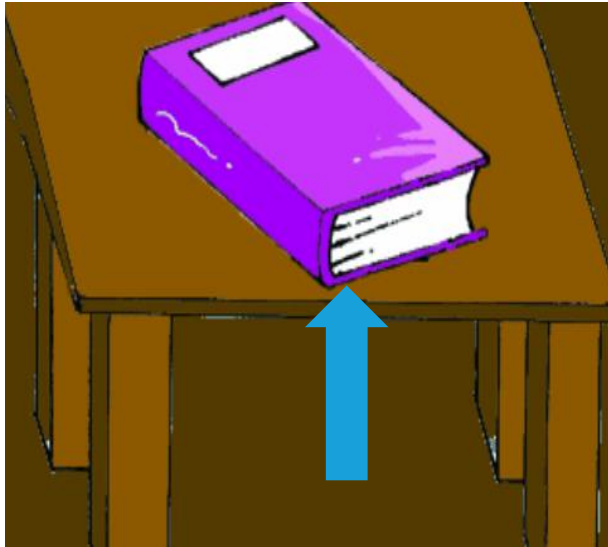


The book will make or exert a **downward** force on the table.

This force is **gravity** pulling the book downwards.

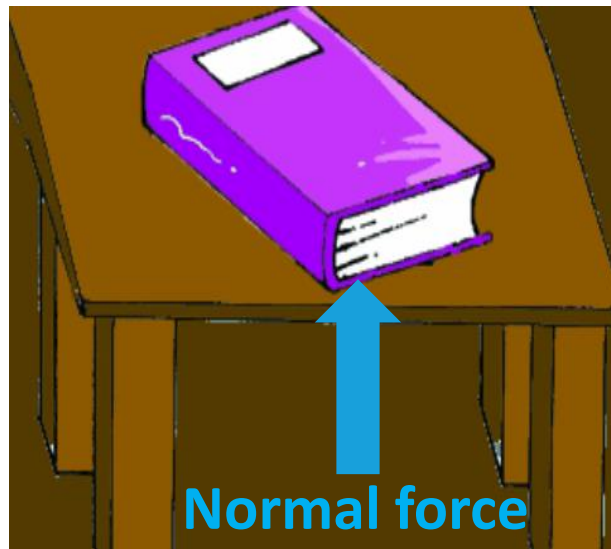


But the book does not fall, so something must be pushing it up.
What do we call this force?



We call it a **normal force**.

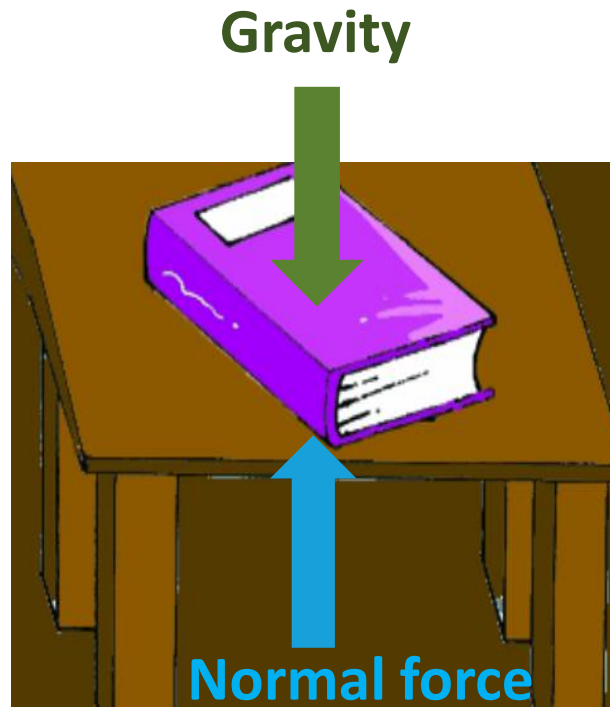
A **normal force** is a support force. It is made on an object that is in contact with another object. The object does not move.



In the picture:

The book exerts a downward force on the table → **Gravity**

The table exerts an upward force on the book → **Normal force**





-The two forces are in opposite directions.

The arrow for the gravity points down, while the arrow for the normal force points up.

-The two forces are equal so the arrows are the same size.

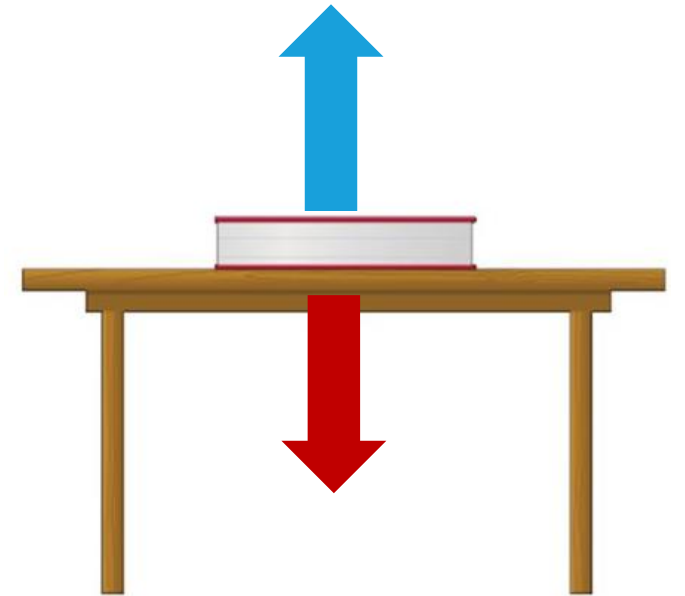
Force Diagrams

What is a force diagram?

It is a diagram showing **the forces acting on the object**.

Each force is shown as an arrow, the direction of the force is shown by the arrow head, and the length of the arrow shows the size of the force.

In the picture, the arrows are the same size since the force of **gravity** and the **normal force** are equal.



<https://www.youtube.com/watch?v=suQDwZcnJdg>

What is friction?

In the picture, Marcus is riding his bike along a gravel path.

The bike's tyres and the gravel path try to slide past each other.

The force between two surfaces that are trying to **slide** past each other is called **friction**.

A **rough surface** will produce **more friction** than a **smooth surface**.



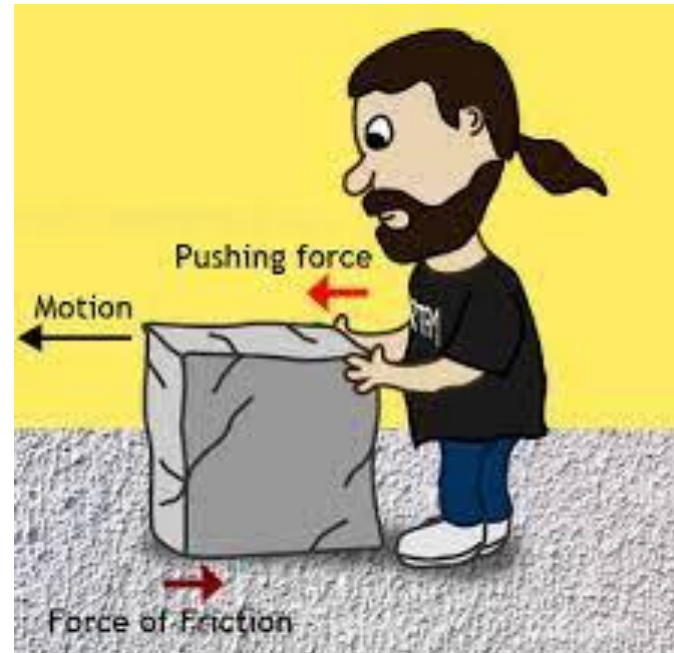
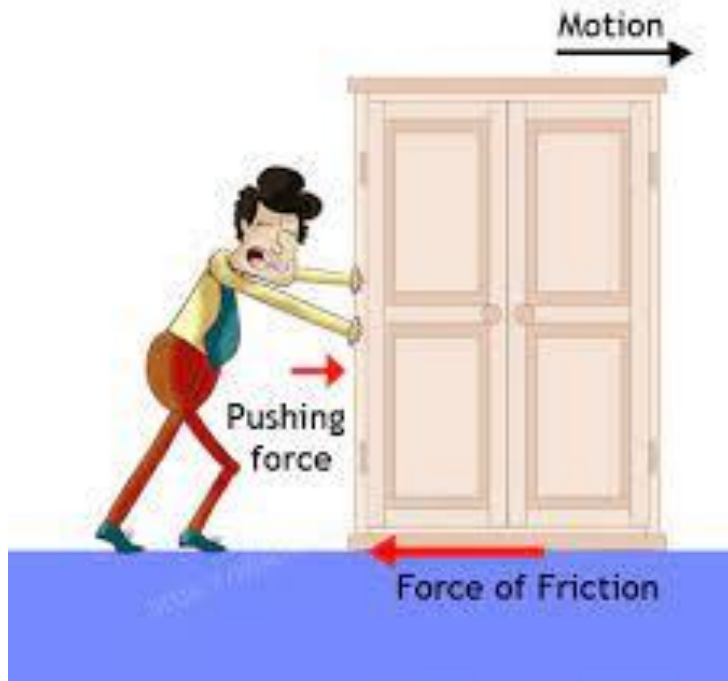


→ Friction only acts on **moving** objects.

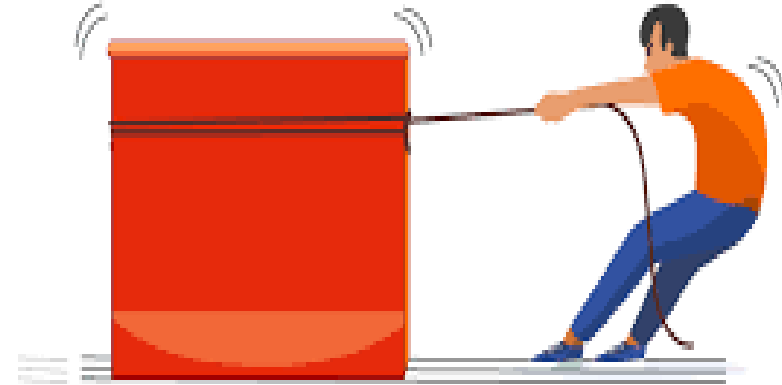
→ Friction always works in the direction **opposite** to the direction the object is moving.

→ This **slows down** the moving object.

Look at the pictures below which show the direction of friction force:



Show the direction of friction on the pictures below:



Conclusion

Friction is a force between two surfaces that slide past each other.

The direction of friction is always **opposite** to the direction of the moving object.

Friction **slows down** the moving objects.

Rough surfaces produce more friction than smooth surfaces.



Water resistance Air resistance & Upthrust

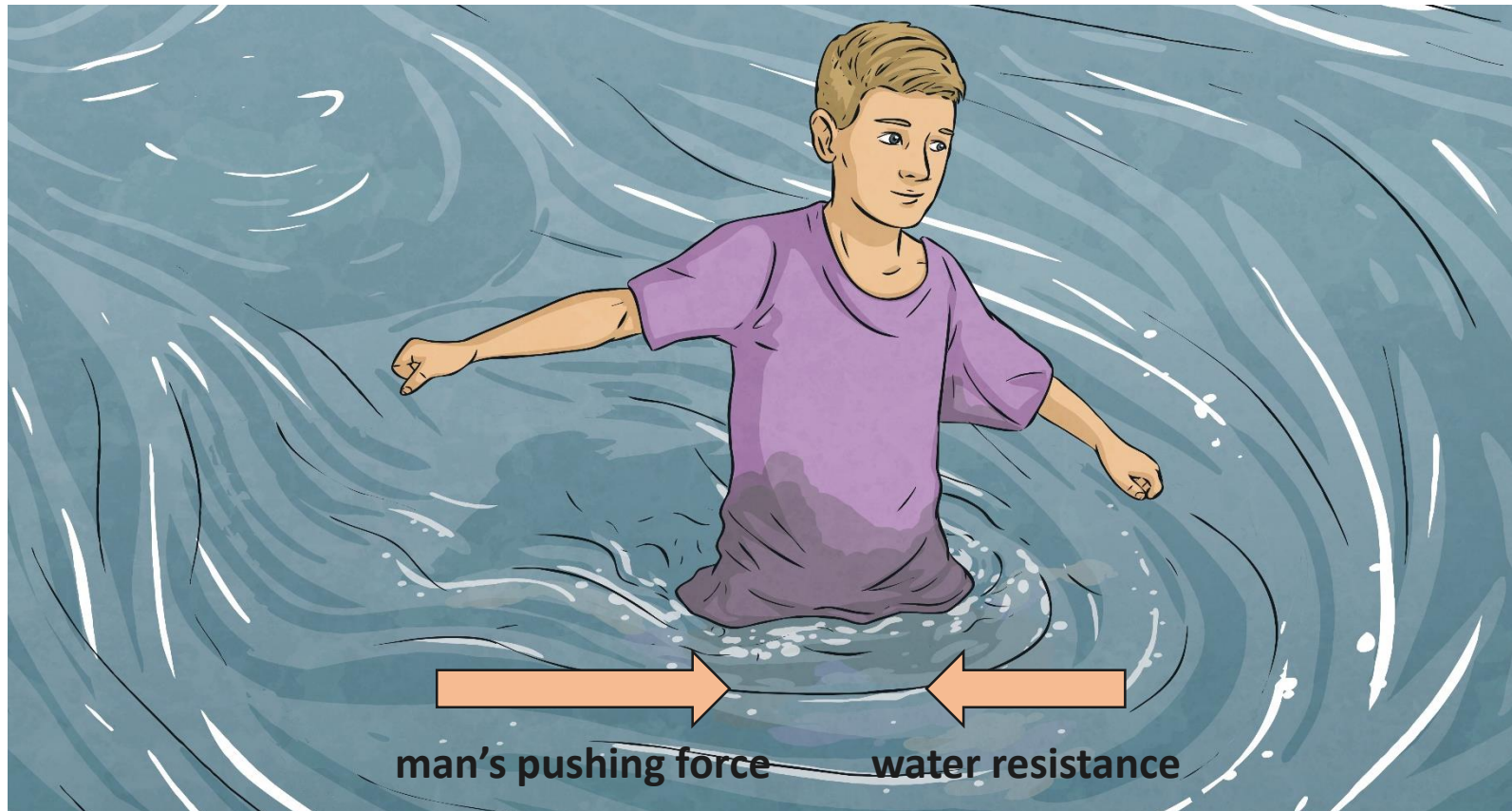
Water Resistance

Can you walk in water as fast as you walk on ground? Why?

Water Resistance is a force that **slows** things down that are moving through **water**.



As objects move, the **water** pushes **against** the object, **slowing down** its movement.



Any object that moves through water will be slowed down by **water resistance**.

The **shape** of the object can help to **reduce** the resistance.

Objects like the fish in the picture have a **streamlined** shape.

This causes less disturbance of the water and therefore **less** water resistance.



Upthrust Force

Have you tried to push a beach ball down in the sea or a swimming pool? Will the ball stay down? Why?

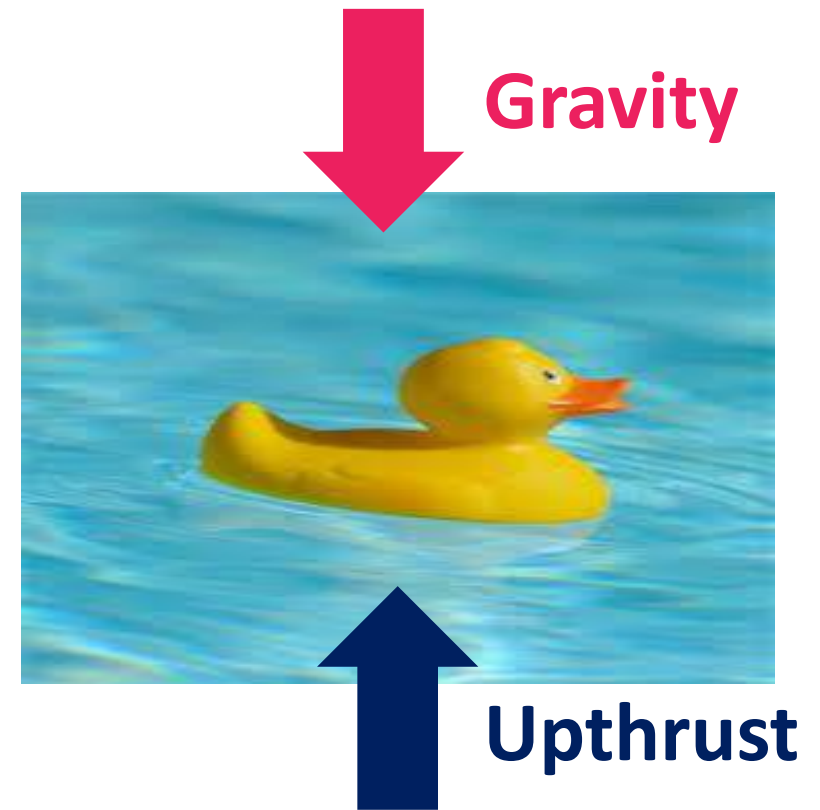
The ball will not stay down. It **floats** on the surface.

This is because there is a force in the water that **pushes things up**.

This is called an **upthrust** force.



In this example, the duck doesn't sink because there is an **upthrust force** created by the water. It is the balance of the **gravity** and the **upthrust** force that keeps the duck floating.



Air Resistance Force

When objects move through the **air**, an invisible force acts upon them and **slows them down**. This is called an **air resistance**.

Air resistance is a force that slows things down that are moving through air.



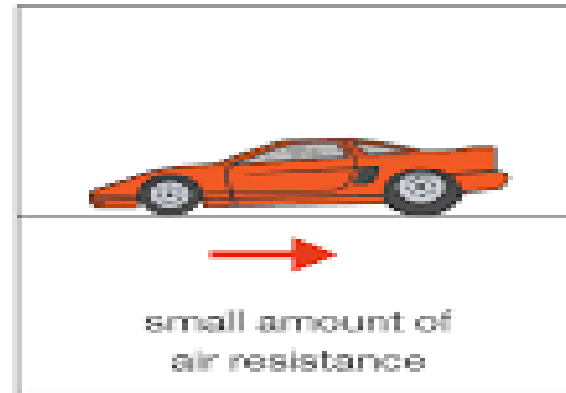
As objects move, the **air pushes against** the object, **slowing down** its movement.



Note

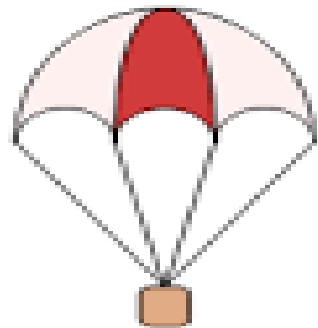
Both water resistance and air resistance are sometimes called **drag**, because they drag back the moving object.

The **larger** the **surface area** of the moving object,
the **more** air resistance there is.

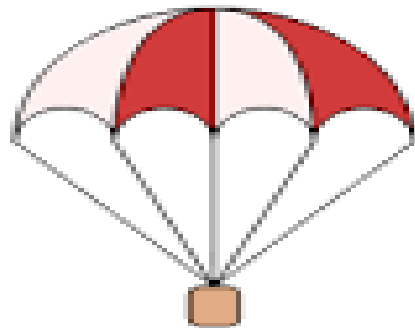


Question

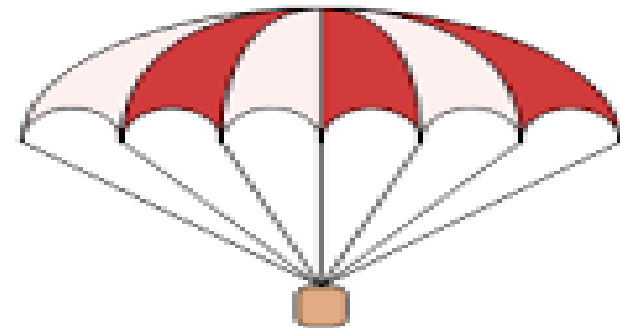
Which parachute has the more air resistance?



(A)



(B)



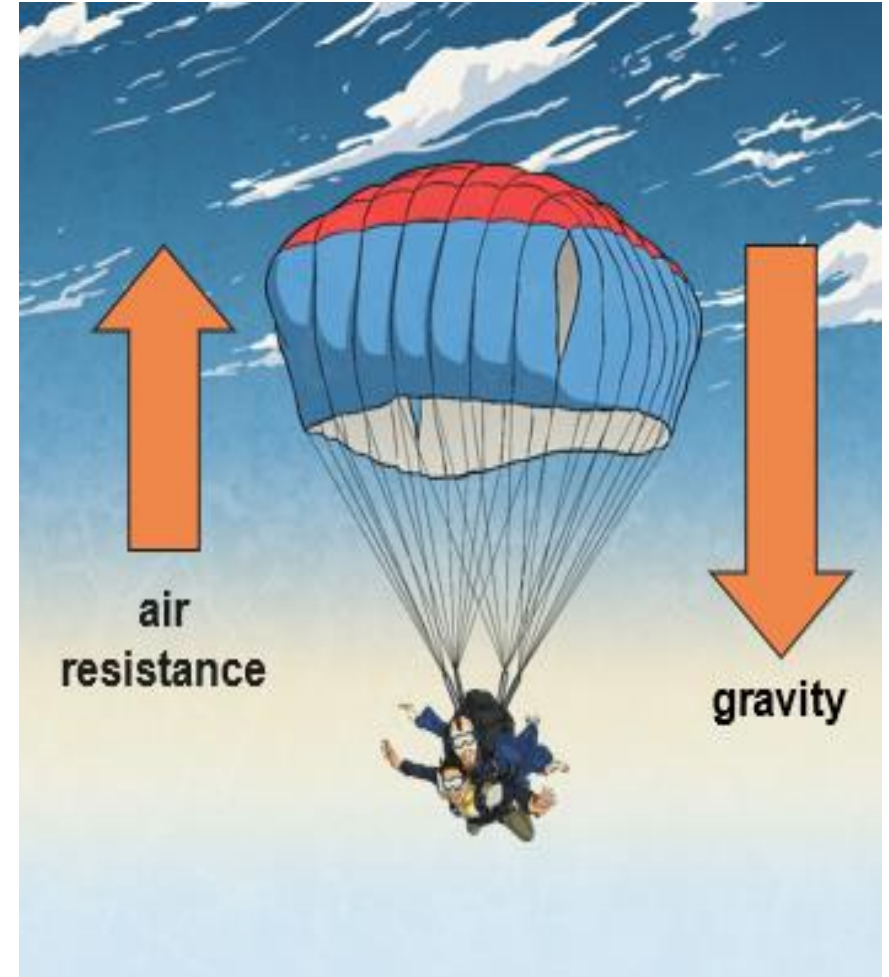
(C)


There is more air resistance in parachute C, since it has the largest surface area.

A **parachute** uses air resistance to work. The person needs parachute to help them reach the Earth slowly and safely.

Gravity is **pulling** the skydivers towards the ground. However, they are slowed down because a force (**air resistance**) **pushes** against the inside of the parachute and they descend more slowly.

Gravity and air resistance are **opposing** forces in this situation.



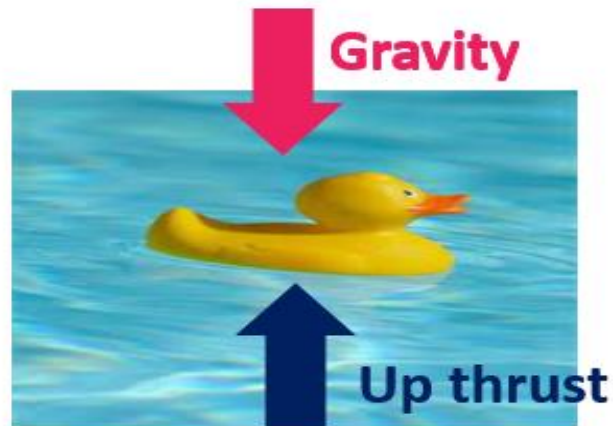


A parachute is **very light** in weight and has a
very big surface area.
It **catches lots of air** in it as it falls down.
This creates a lot of air resistance.

Recall

Up thrust is a force applied by water to carry or push things up.

If an object is floating then upthrust force applied by water equals exactly the gravitational force acting on it.



What makes a bus move forward?



What makes the boy move forward?

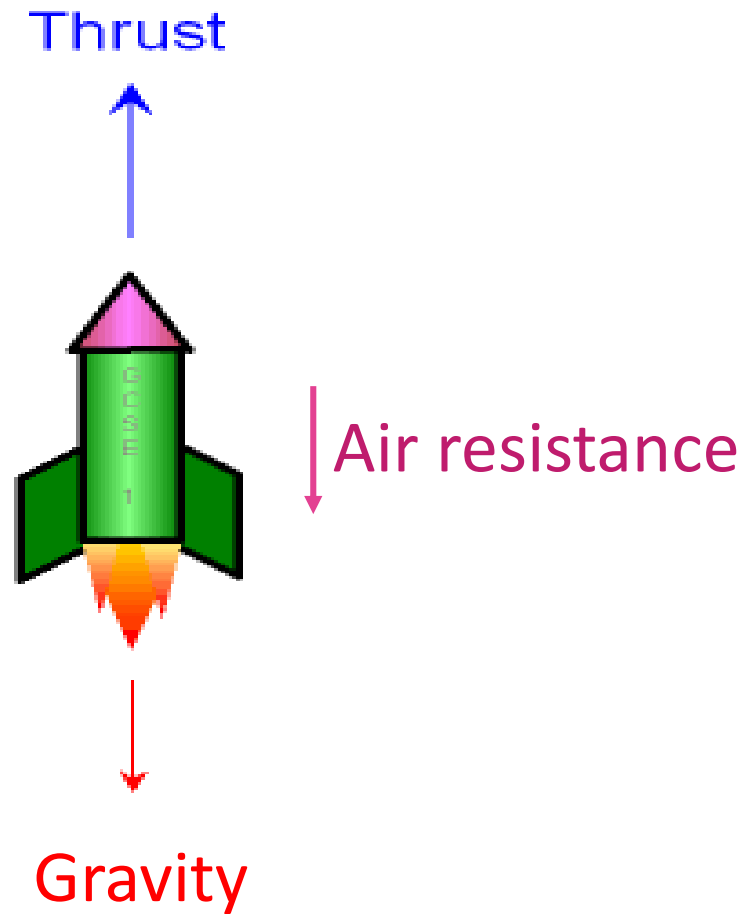
What is thrust ?

Thrust is a force that makes an object move in a certain direction.

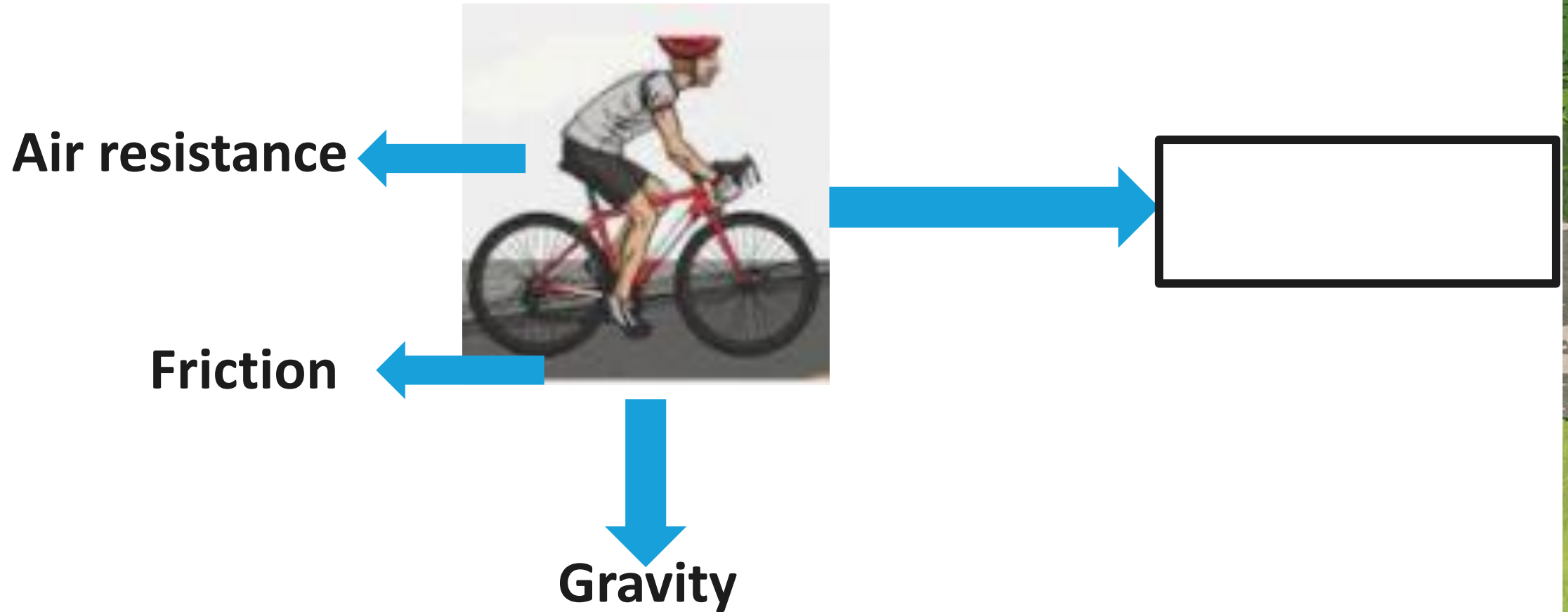
For example, in a car the force produced by the engine making the car move forward is the **thrust**.



In a rocket the **thrust** of the engines makes the rocket take off.

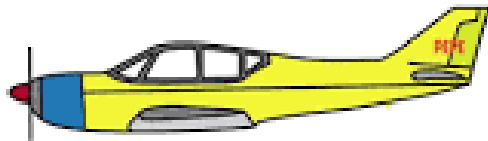


Look at the picture of the boy riding the bicycle.

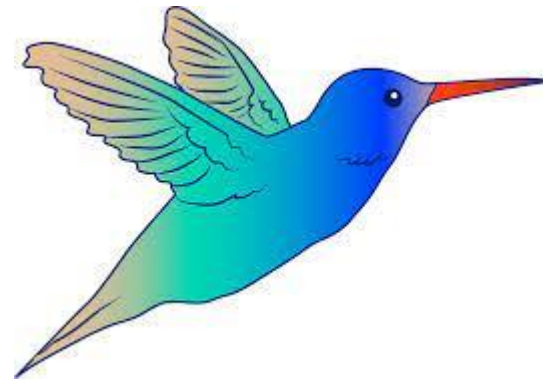


Identify the direction of thrust force in each of the following situations

1.



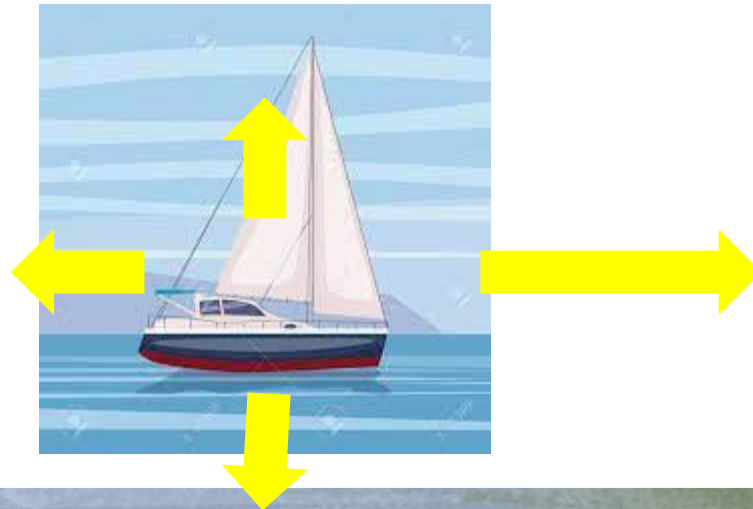
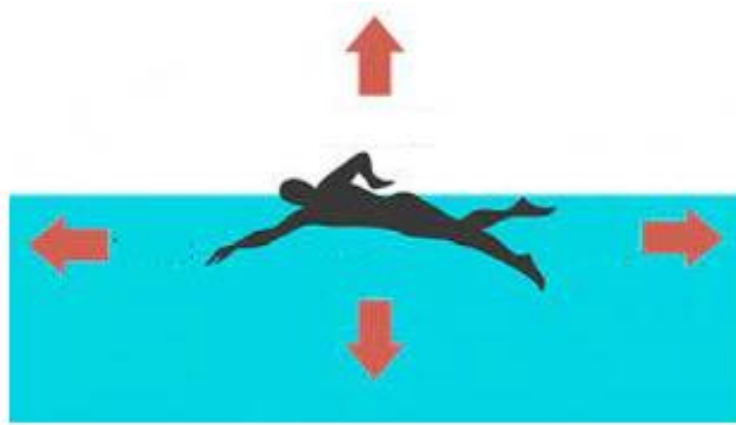
2.



3.



Label the following force diagrams with the correct forces.



MAIN CONCEPTS:

Types of forces:

- Applied force – the push or pull on an object
- Forces act upon us when we stand still.
- Gravity – Pulls us toward the centre of the Earth
- Forces always act in pairs.
- Normal force acts against gravity.
- Upthrust works against gravity to keeps ships floating.
- Friction – force that exists between two surfaces.
- Air resistance is the force that acts against gravity when falling.
- Water resistance is the force that acts between the water and the object trying to move through it.

MAIN CONCEPTS:

Force diagrams:

- You can show the different forces acting on an object by using a force diagram.
- The size of the force is shown by the length of the arrow.
- When forces are equal, they are called balanced forces.
- When one force is greater than the other, the forces are unbalanced.
- When forces are balanced on an object, it experiences no change in movement.
- Unbalanced forces cause a change, be it in movement, speed or direction of the object.

