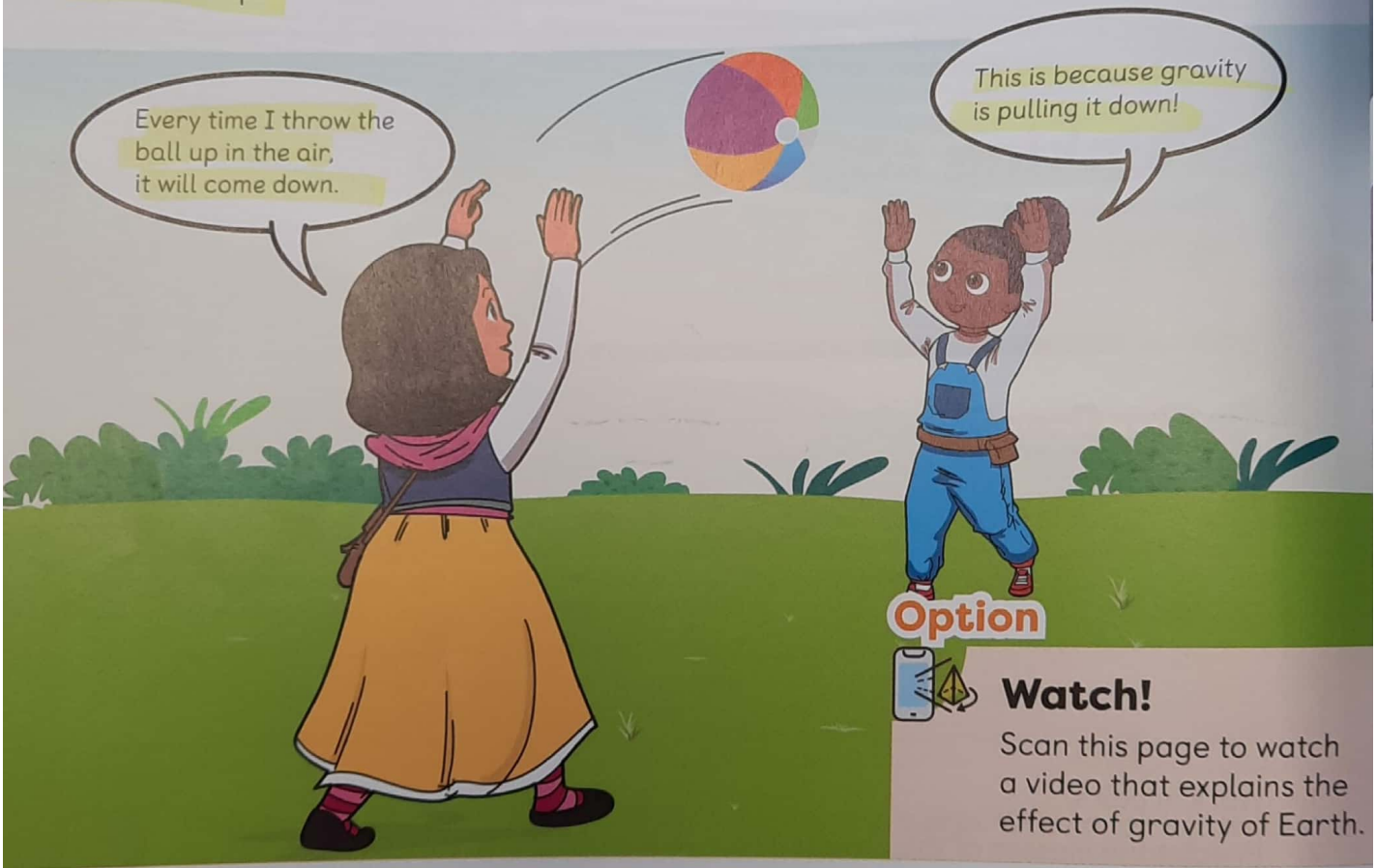
Let's Learn

What Is the Difference Between Mass and Weight?

In Chapter 5, we have learnt that all substances are made up of matter. Mass is a measure of how much matter an object is made up of. The more matter an object has, the greater its mass. Mass is measured in units such as **kilograms** (kg) and **grams** (g).

Weight is different from mass. The **weight** of an object is a measure of the effect of gravity on the object. It is measured in the unit **newtons** (N). The unit is named after the famous scientist, Sir Isaac Newton.

Over 300 years ago, Newton came up with the idea of gravity after watching an apple fall. He asked why the apple fell straight down, and not upwards or sideways. Now we know that gravity is the force that pulls objects. The gravity of Earth pulls objects towards its centre. This is why all objects fall onto the ground when they are released from a height or thrown up.



Option

Watch!

Scan this page to watch a video that explains the effect of gravity of Earth.

The gravity of Earth is 9.8 newtons per kilogram. This means that a mass of 1 kilogram has a weight of 9.8 newtons on Earth. If a car has a mass of 1000 kilograms, it will weigh 9800 newtons on Earth.

Look back at the Let's Explore! activity on page 97. Calculate the weight of each object. Compare the measurements of mass and weight. What pattern do you notice? Are there any unexpected results?

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Do Weight and Mass Change When Gravity Changes?

Weight will change if the gravity changes. The gravity of the Moon is less than the gravity of Earth. Therefore, an object has a smaller weight on the Moon than on Earth.

Mass does not depend on gravity. It does not change when the amount of gravity changes.

Check Your Learning

Gravity decreases when we go up a mountain. How does this affect our mass and weight?

Activity Book
Activity 7A, p. 63

Tick (✓) to show what you can do.

- ☐ I can describe the difference between mass and weight.
- ☐ I can describe the effect of gravity and recognise that gravity affects the weight of an object but not its mass.
- ☐ I can use knowledge and understanding to make predictions.
- ☐ I can sort objects by observation and testing.
- ☐ I can take measurements accurately.
- ☐ I can decide when to repeat measurements to get reliable results.
- ☐ I can describe if a prediction was accurate based on results.
- ☐ I can use bar charts to explain my results.
- ☐ I can describe patterns in results and identify any unexpected results.

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B Forces in Action

In this section, I will

- describe forces acting on objects using force diagrams
- describe the effects of forces on objects that are at rest and in motion
- learn that objects sink or float because of factors such as their mass and shape
- describe the use of science locally
- describe how a model can help us understand a scientific idea
- plan a fair test and identify the three types of variables
- choose equipment and use it properly during an investigation
- use knowledge and understanding to make predictions
- describe if a prediction was accurate based on results
- suggest and explain how an investigation could be improved
- decide when to repeat observations to get reliable results
- construct a key based on differences that can be observed

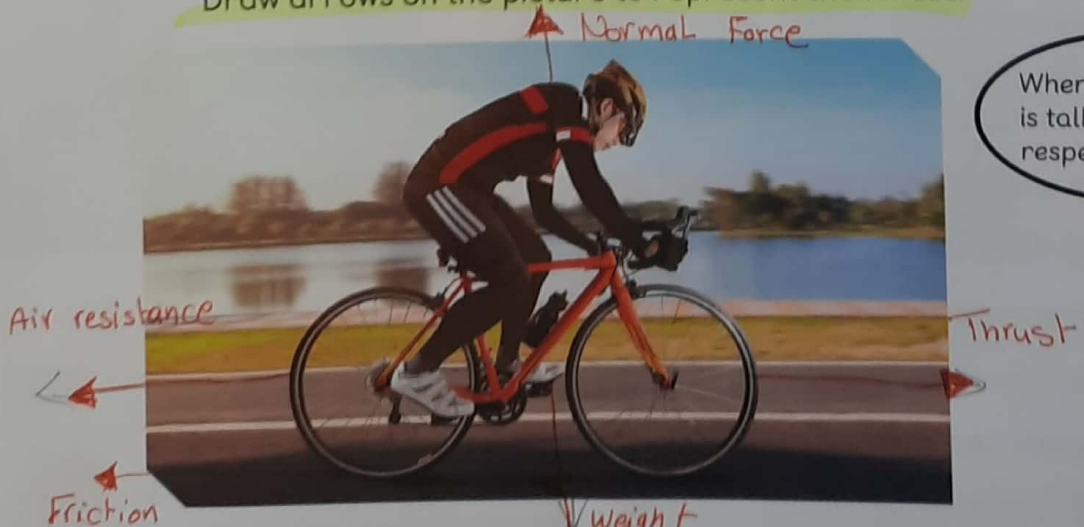
Thinking cap

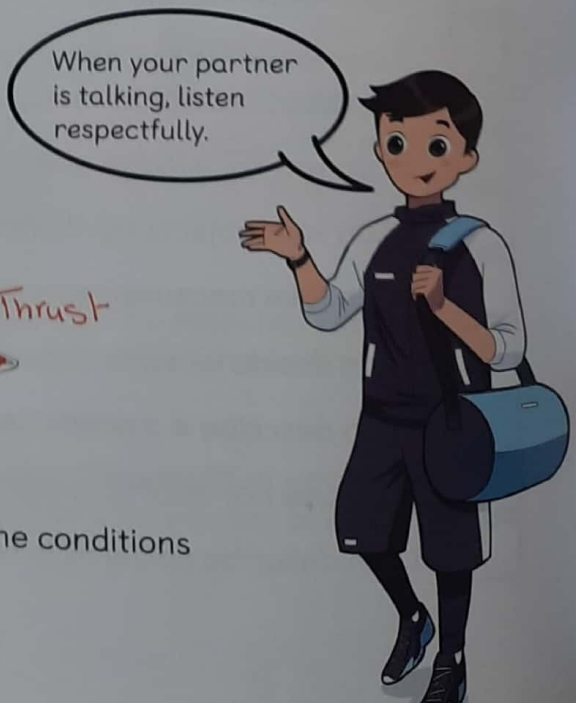
I wonder what forces act on an aeroplane when it is in the air ...

Let's Explore!

What forces are acting?

1. The bicycle is moving forward at a constant speed. What forces are acting on it? Draw arrows on the picture to represent the forces.





2. Share your force diagram with a partner. Discuss the conditions under which the bicycle will speed up.

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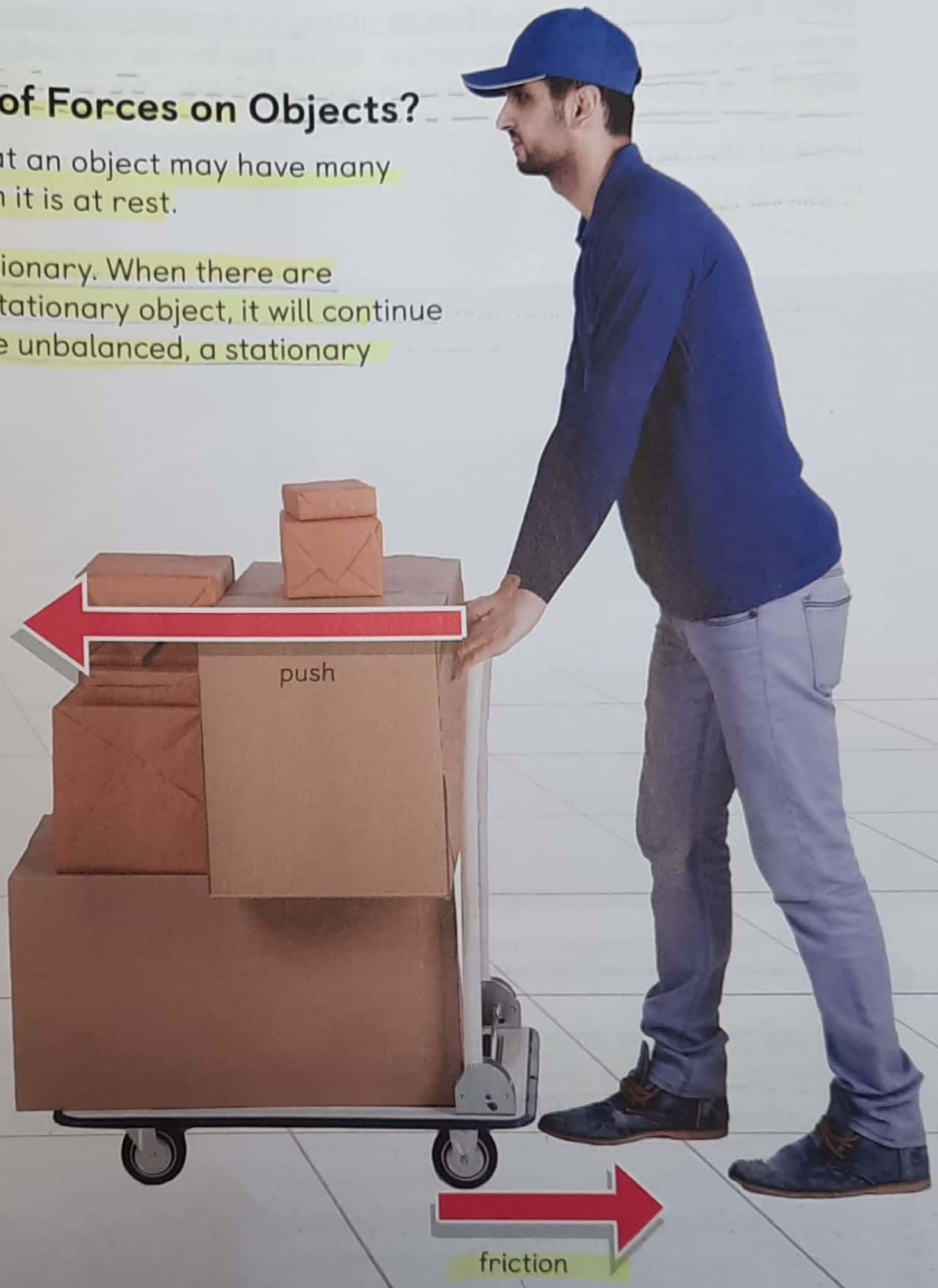
Let's Learn

What Are the Effects of Forces on Objects?

We have learnt in Stage 5 that an object may have many forces acting on it, even when it is at rest.

If an object is at rest, it is stationary. When there are balanced forces acting on a stationary object, it will continue to be at rest. When forces are unbalanced, a stationary object will start moving.



The push applied is greater than the friction between the wheels and the floor, so the trolley starts moving.

We can draw the force diagram for the trolley in this way. In such a diagram, we represent the object using a box.

Recall what you have learnt about force diagrams. When we draw a force diagram, we are using a model to represent the forces acting on an object. Each arrow shows the direction of a force. The length of the arrow shows the size of the force. The longer the arrow, the larger the size of the force. Each arrow should be labelled with the name of the force.

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When there are balanced forces acting on a moving object, it will continue to move at the same speed in the same direction. When the forces are unbalanced, the motion of the object will change. The object will speed up, slow down or change in direction.

Look at the diagram below. **Thrust** is the force that moves the car forward in the direction that it is moving. **Drag** is the force that acts opposite to the direction of motion.

The car changes in motion because of the forces acting on it.

The diagram below shows an aeroplane flying straight, level and at the same speed. The thrust and drag are balanced, and the lift and gravity are balanced. How do these balances change if the aeroplane rises and speeds up?

The pairs of forces acting on the aeroplane are balanced.

Think of other examples of forces acting on objects at rest or in motion. Draw a force diagram to show the direction, size and type of forces acting on each object. What is the effect of these forces?

Word Boost

motion
level

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Forces can also change the shape of an object.

When we fold a piece of paper, we are applying forces to it. The shape of the paper changes.

Science at Work

A skateboarder makes use of the effects of forces to move the skateboard forward. He or she pushes off the ground with a foot to start the skateboard moving. The push must be greater than the friction between the skateboard wheels and the ground. The moving skateboard slows down because of friction. What does the skateboarder have to do to keep the skateboard moving? Why?

What forces are acting on the objects in different places around you? Find out about the effects they have.

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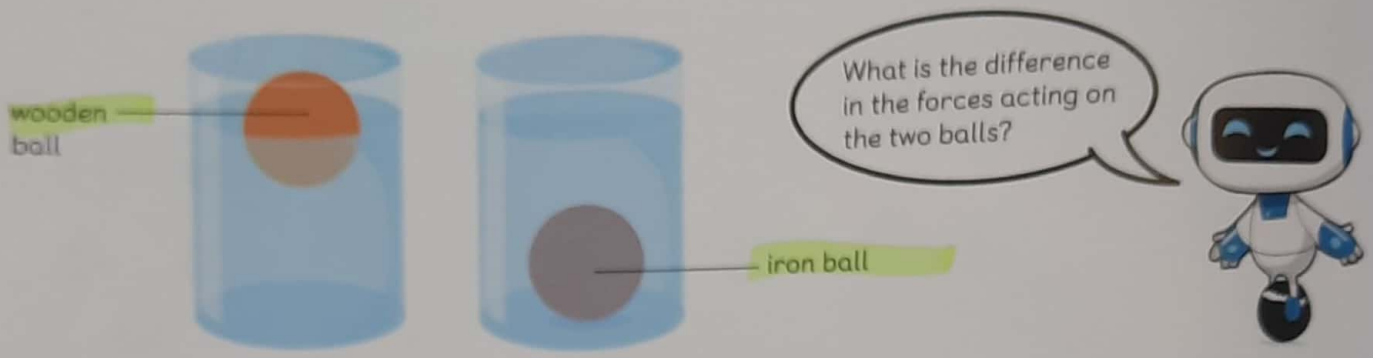
How Do Mass and Shape Affect Floating and Sinking?

We know that upthrust is the upward force that helps keep an object from sinking in water. An object will float if the weight is equal to or less than the upthrust. An object will sink if the weight is greater than the upthrust.

The mass of an object can affect if the object floats or sinks. When an object has a larger mass, it will have a larger weight. If we have two objects of the same size, the object with a larger mass is more likely to sink. Look at the diagram below. The wooden ball floats, while the iron ball sinks. The balls have the same size but different masses.



An empty plastic bottle floats when placed in water. Does changing its mass make it sink? Discuss and plan an investigation to find out how the mass of a plastic bottle affects how well it floats or sinks.

1. What materials and equipment would you use?
2. How would you make your investigation a fair test?
3. Make a prediction about what you will observe.
4. Test your prediction and record your observation. Does your observation support your prediction? Make a conclusion from your observation.
5. Explain your observation using the idea of forces acting on an object in water.
6. How do you think you could improve your investigation? Explain the changes that you would like to have.

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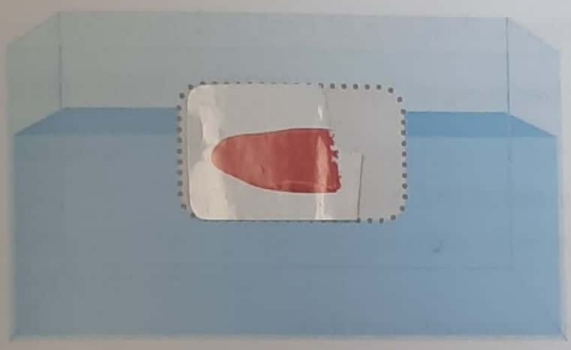
The shape of an object can also affect if the object floats or sinks. Why do you think ships have a flat base? The following activity can help you find out.

1. Shape a piece of plasticine into a ball. Drop it into a container of water. What do you observe?
2. Now flatten the ball of plasticine. Drop it into the container again. What do you observe?
3. Use the stickers at the back of the book to show which shape of plasticine floats and which sinks.



4. Do you need to repeat your observations in order to get more reliable results?

When we change the shape of an object, we are changing the surface area that the upthrust can push against. If the surface area increases, the size of the upthrust will increase. The object is likely to float.

Look back at the various types of forces that you have learnt. Construct a key to sort and identify the types of forces. You may use these questions to help you.

- Where is this force present?
- Does it attract specific types of materials only?
- In which direction does it work?
- Does it both stop and move objects?
- Does it slow down objects?

Draw your key in the space given.

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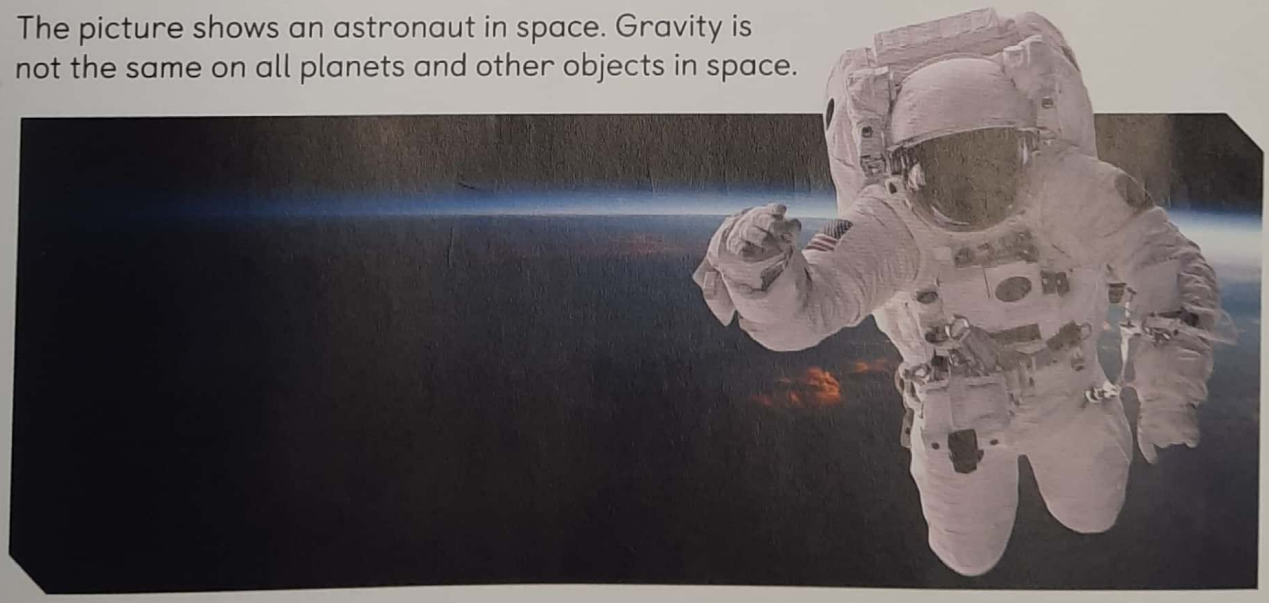
Practice Worksheet

1. Tick (✓) the correct box beside each sentence.

	True	False
Mass can be measured in kilograms, while weight is measured in newtons.	☑	☐
The mass and the weight of an object are the same.	☐	☑
In force diagrams, we use an arrow to show the size and direction of a force.	☑	☐
An object that is not moving has no forces acting on it.	☐	☑
Only the mass of an object affects whether the object will float or sink.	☐	☑

2. The picture shows an astronaut in space. Gravity is not the same on all planets and other objects in space.



(a) Why do astronauts float in space? Use **increases** or **decreases** to complete the sentence.

As astronauts move away from Earth into space, the gravity acting on them decreases.

(b) The astronaut lands on the Moon. What will happen to his mass on the Moon?

His mass stays the same.

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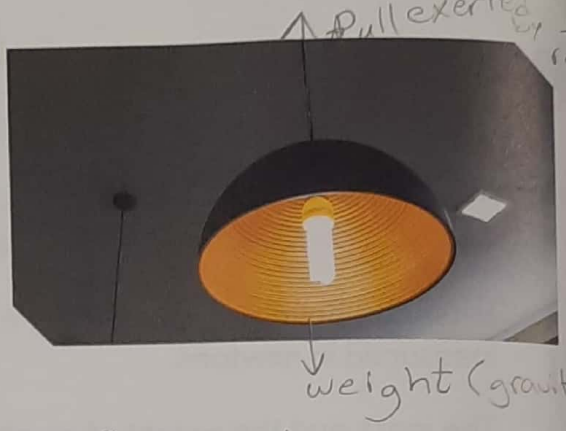
3. The picture shows a lamp that hangs from the ceiling by a rope.

Draw arrows to show the pull exerted by the rope and the gravity acting on the lamp. Label the arrows.



4. Noraini makes a boat using a piece of tin foil. The boat floats on water.

Suggest **one** way to make the boat sink.

Add objects onto the boat.

Science Words

D

drag
the force that acts opposite to the direction of motion

G

grams
a unit of mass

K

kilograms
a unit of mass

N

newtons
the unit of weight

T

thrust
the force that moves a vehicle forward in the direction that it is moving

W

weight
a measure of the effect of gravity on an object

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