How much would you weigh on other celestial bodies?

Gravity

68

time

55 minutes

learning outcomes

To:

- know that we call an amount of mass on Earth weight
- know that the amount an object weighs depends on the gravitational force of the celestial body
- know that mass is a quantity of matter
- know the concept of gravity: an invisible force that pulls everything towards the centre of the celestial body
- know that gravitational force on the Moon is six times weaker than that on Earth

materials needed

- 6 containers
- 6 atlases
- 6 dictionaries
- 6 maths books
- 6 reading books
- 6 full bottles of drink
- 6 ring binders
- weighing scales

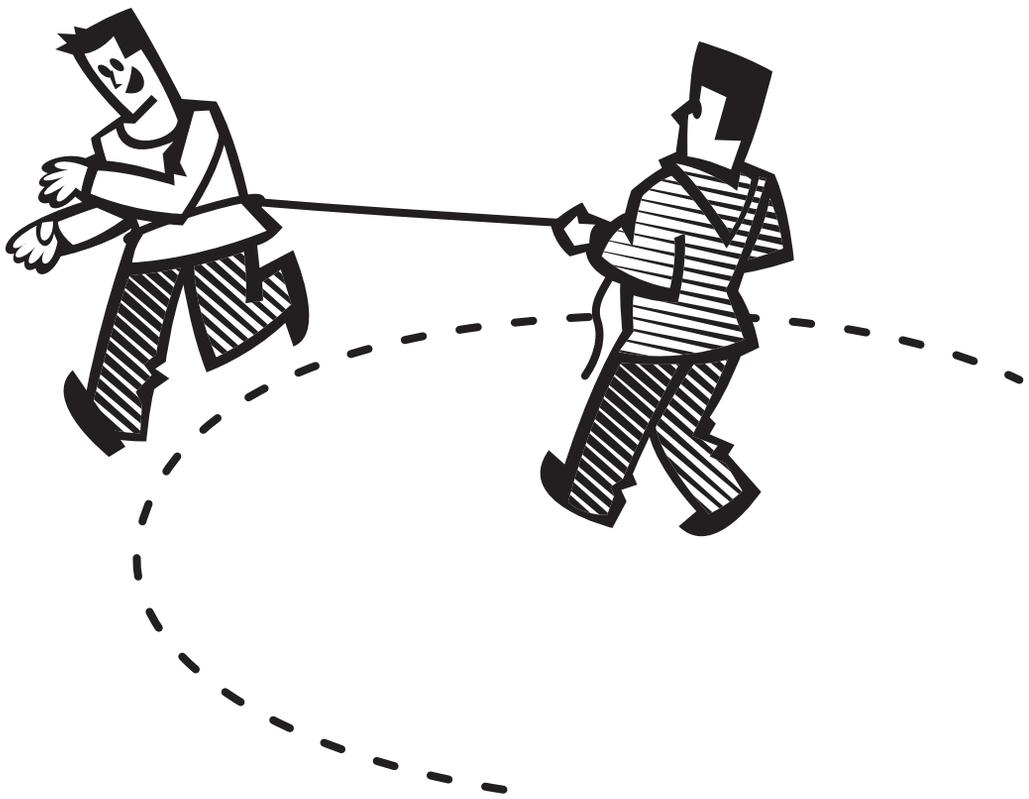
Tip. If possible, carry out the activity **What pulls us?** in the gym.

Preparation

For the activity **Lifting on the Moon** you will need six containers, each of which contains six identical objects. So you will have one container with six atlases, one with six dictionaries, one with six maths books, one with six reading books, one with six full drinks bottles and one with six ring binders.

What pulls us? 10 min.

Organise the children in pairs and give each pair a rope. Child 1 ties the rope around his or her waist as shown in the drawing on the following page.
Child 2 holds the other end of the rope. Child one walks in circles around Child 2. Child 2 must make sure that the rope is kept taut. Ask Child 1 what he or she can feel. The child can feel a force pulling him or her towards the centre of the circle. Gravity is also a force. Explain that gravity is an invisible force that is pulling on everybody. The strength of the gravity that pulls on someone depends upon which celestial body they are on. We cannot see gravity, but it keeps us from floating off into space.



The children investigate the difference in gravitational force experienced on various celestial bodies.

What is weight? 10 min.

Encourage the children to stand on the weighing scales. The children write down their weight in the space provided at the beginning of Task 2 on the worksheet. Ask the children what this number actually means. Explain that when you go to another planet, your weight changes. Why is that? You haven't lost any weight, have you?

Lifting on the Moon 10 min.

Give each pair a filled container. The children complete Task 1 on the worksheet. They are going to feel the difference between lifting something on Earth and lifting something on the Moon.

Discuss the results. Explain that the gravity on the Moon is a lot weaker than the gravity on Earth. This means that on the Moon you are not being 'pulled' as strongly as you are on Earth. So it is easier to lift objects on the moon; they do not feel as heavy as they do on Earth. The children have calculated that the gravity on the Moon is only 1/6 of the gravity on Earth.
So on the Moon their filled container will only weigh 1/6 of its weight on Earth.

Your weight on other planets 10 min.

Now the children calculate how much they would weigh on other celestial bodies. The children fill in the information in Task 2 on the worksheet. When they have finished, discuss the answers.

Weight and gravity 10 min.

The children have calculated that their weight is not the same on every celestial body. They use the list in Task 3 to see the relationship between their weight and gravity. The children come to the conclusion that the stronger the gravitational force, the greater your weight. So, the amount you weigh depends on gravity.

What is your mass? 5 min.

Explain to the children that your weight changes, but your mass remains the same on another planet/celestial body. Your mass is 'how much' you actually weigh. The unit of mass is the kilogram. If we say we weigh fifty kilograms, we mean our weight on Earth. Come to the conclusion with the children that your weight is dependent upon which planet/ celestial body you are on.

How much would you weigh on other celestial bodies?

In this experiment you will be answering the research question:

What is the difference in gravity on various celestial bodies?

1 Lifting on the Moon

What do you need?

- a container from your teacher

What do you need to do?

1 Pick up the full container. Make sure you lift it safely by bending your legs and not your back. The container is heavy!

a Are you able to lift the full container?

_____

b How many items are in the container?

_____

2 Take out five of the items.

c Can you lift it now?

_____

b How many items are still in the container?

_____

e What fraction is this of the whole?

_____ part

On the Moon everything weighs 1/6 of what it weighs on Earth. You have just experienced the difference between the Moon's and the Earth's gravitational force. It is much easier to lift the full container on the Moon than on Earth!

2 Your weight on other celestial bodies

On Earth I weigh: _____ kilograms

Mercury

A (weight on Earth) _____ ÷ 5 = _____

B (answer to a) _____ x 2 = _____

C (answer to b) _____ is my weight in kilograms on Mercury

Venus

A (weight on Earth) _____ ÷ 10 = _____

B (answer to a) _____ x 9 = _____

C (answer to b) _____ is my weight in kilograms on Venus

Mars	A (weight on Earth)	_____	÷ 5 = _____
	B (answer to a)	_____	x 2 = _____
	C (answer to b)	_____	is my weight in kilograms on Mars
Jupiter	A (weight on Earth)	_____	÷ 2 = _____
	B (answer to a)	_____	x 5 = _____
	C (answer to b)	_____	is my weight in kilograms on Jupiter
Saturn	A (weight on Earth)	_____	÷ 7 = _____
	B (answer to a)	_____	x 8 = _____
	C (answer to b)	_____	is my weight in kilograms on Saturn
Uranus	A (weight on Earth)	_____	÷ 11 = _____
	B (answer to a)	_____	x 12 = _____
	C (answer to b)	_____	is my weight in kilograms on Uranus
Neptune	A (weight on Earth)	_____	÷ 5 = _____
	B (answer to a)	_____	x 7 = _____
	C (answer to b)	_____	is my weight in kilograms on Neptune
The Moon	A (weight on Earth)	_____	÷ 6 = _____
	B (answer to a)	_____	is my weight in kilograms on the Moon
The Sun	A (weight on Earth)	_____	÷ 30 = _____
	B (answer to a)	_____	is my weight in kilograms on the Sun

3 Weight and gravity

Read carefully through the information below. Compare it with your answers in Task 2. Then answer the questions at the bottom of the page.

On **Mercury** the gravity is **weaker** than on Earth

Op **Venus** the gravity is **weaker** than on Earth

On **Mars** the gravity is **weaker** than on Earth

On **Jupiter** the gravity is **stronger** than on Earth

On **Saturn** the gravity is **stronger** than on Earth

On **Uranus** the gravity is **stronger** than on Earth

On **Neptune** the gravity is **weaker** than on Earth

On **the Moon** the gravity is **weaker** than on Earth

On **the Sun** the gravity is **stronger** than on Earth

a If the gravity is weaker than on Earth, I weigh
more / less than on Earth.

CIRCLE the correct answer

a If the gravity is stronger than on Earth, I weigh
more / less than on Earth.

CIRCLE the correct answer

c How much you weigh
does / does not depend on the gravity

CIRCLE the correct answer