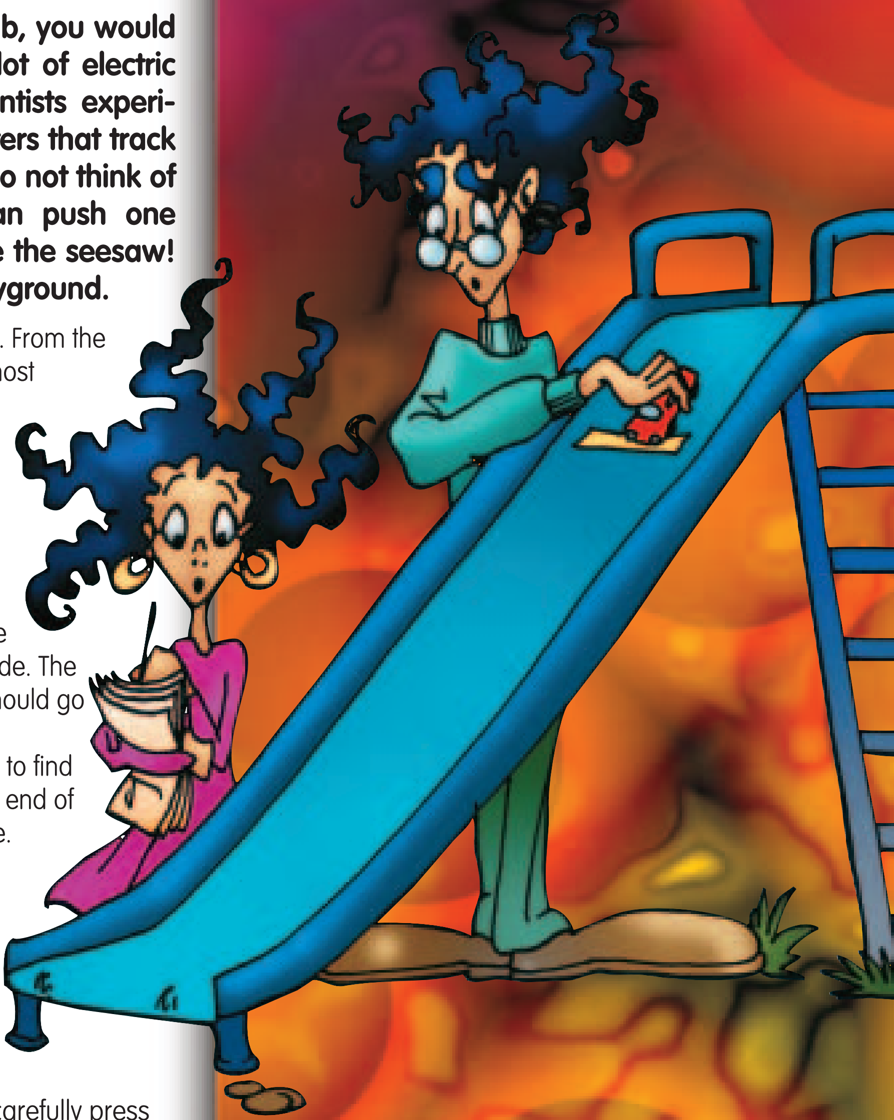
EASY

SCIENCE

PLAYING WITH PHYSICS

If someone asked you to describe a physics lab, you would probably think of a place where there is a lot of electric equipment, or a darkened room where scientists experiment with lasers, or a room filled with computers that track satellites and other spacecraft. You probably do not think of an ordinary playground where scientists can push one another on swings, slide down slides, and use the seesaw! But you can learn a lot about physics at a playground.

One thing that physicists do, is study moving objects. From the tiniest particle even smaller than an atom, to the most giant of galaxies, physicists try to describe how and why things move. What better place to study moving things than the playground? You can see things that swing back and forth, spin around, and move up and down.



SLIDING AND ROLLING

A playground slide is something you can use to study the motion of sliding and rolling objects. Objects placed at the top of the slide build up speed as they move down the slide. The object that is going the fastest when it reaches the end should go the furthest before hitting the ground.

Take up the EasyScience Playground Challenge and try to find the object that goes the furthest distance after leaving the end of the slide. Ask an adult friend to help you do this challenge.

You will need:

- Playground slide
- Boxes or wooden blocks of different sizes and mass
- Rolling toys such a trucks or cars
- Different sized hollow or solid balls
- Unopened food tins
- Clean, empty food tins (Use the back of a spoon to carefully press any sharp edges down against the inside of the tin. Cover the rim of the tin with two layers of masking tape for safe handling.)
- Measuring tape
- Wax paper
- Cloth
- Aluminium foil
- Notebook paper
- Masking tape

With objects of the same shape and size, but differing in mass, friction plays a role.

EASY SCIENCE

EasyScience is produced by the South African Agency for Science and Technology Advancement (SAASTA), an operational unit of the National Research Foundation. SAASTA's mission is to promote the public understanding, appreciation and engagement with science and technology among all South Africans.
Visit the website: www.saasta.ac.za for more information.

Rules of the challenge:

1. All objects must be released from the same point near the top of the slide. Mark this point with a piece of tape.
2. Objects cannot be pushed or helped down the slide in any way.
3. Distance should be measured from a point directly below the end of the slide to the nearest point where the object hits the ground.

Be sure to stand to the side of the slide until the object has hit the ground and stopped moving.

Write down all the results in a notebook.

Some things to think about and try:

1. Should the object slide or roll? Try some objects that slide and others that roll, and see if it makes a difference in how far they go.
2. Should the object be big or small? Do bigger objects go further than small ones?
3. What should the shape of the object be? Try objects that are rectangular, round, or irregularly shaped. Does shape seem to make a difference? Does it seem to matter how much of the object is in contact with the slide?
4. Should the object go straight down the slide or bounce off the sides? Roll a ball down the centre of the slide and then at an angle so that it bounces off one of the sides. Which method makes the ball go furthest?
5. Do heavier of lighter objects go further? Try a small empty box such as a shoe box. Now almost fill the box with some stones and soil and tape the top closed. Which box goes further?
6. Does it matter what the outside of the object is made of? Cover the bottom of your box with wax paper, aluminium foil, or cloth to see if these different materials affect the distance the box travels.
7. Should the object be hollow or solid? Compare how far the hollow and solid objects of about the same shape and size go. You might try an empty tin and an identical unopened tin. Let them both run down the slide. Find out what happens if you turn them on the end and let them slide down. Was sliding or rolling better? For which tin?

Look at all the results of your tests. Describe to your adult partner the kind of object you think should go the furthest. Can you see that you need the object with the greatest speed at the bottom of the slide to win the challenge? An object that bumps into the side of the slide on the way down will lose some of its speed, so it probably won't win. If an object rolls, some of its energy is used to make it turn around and around instead of just moving forward, so maybe it won't win either. If the surface of the object is sticky and rough, there may be a lot of friction and the object won't go as fast. The shape of the object and whether it is hollow or solid also affects how fast it will go.

Can you think of a real object with all the right qualities to win such a challenge?

A SWINGING GOOD TIME!

A swing is like a giant pendulum that moves back and forth. Now you can find out what makes a swing move back more quickly or more slowly.

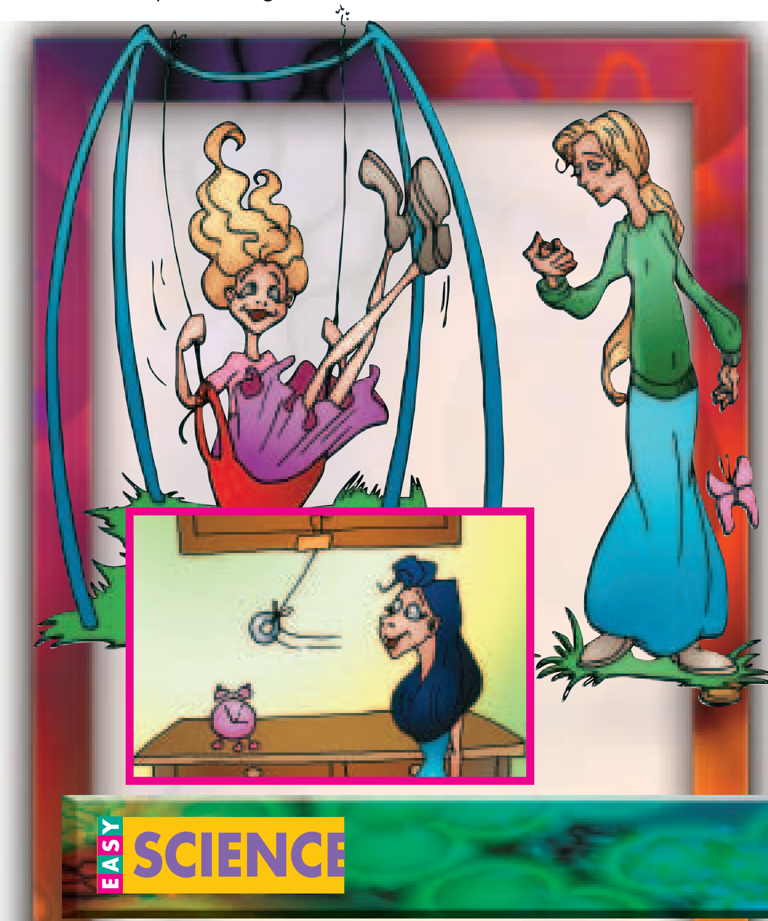
About how long do you think it takes for a swing to go back and forth once when you are sitting in it? Does it always take the same amount of time?

If you can't go to a playground to try this activity, you can still do it at home or at school. Instead of a swing, make a pendulum by hanging a metal washer from a string as illustrated. The washer represents you sitting in the swing.

You will need:

- A playground swing
- Watch or clock with second hand
- Metal washers
- String

1. Sit in the swing and have your adult partner time how long it takes you to swing back and forth 30 times. (Or time how long it takes your pendulum to swing 30 times.) Divide this time by 30 to see how long it takes to swing back and forth once. This is your Swing Time.
2. Do you think your Swing Time depends on how big your back and forth motion is? Have your adult partner time you as you swing **high** back and forth 30 times. Then do 30 very **small** back and forth swings and see how long it takes. Repeat your measurements at least twice. How does the swinging distance affect the time?
3. What do you think would happen to your Swing Time if your mass was a lot more? To find out, ask your adult partner to sit in the swing. (If you are using the pendulum, add a few more washers.) Time your adult partner's 30 swings. Did the extra mass seem to make a difference?
4. All swings are not the same. If you can find a swing that is longer or shorter than the one you used, repeat steps 1 and 2 with the new swing.
5. With your adult partner, make a pendulum with your washer and string. Make your string longer or shorter and repeat steps 1 and 2. Does the length of the string affect your Swing Time?

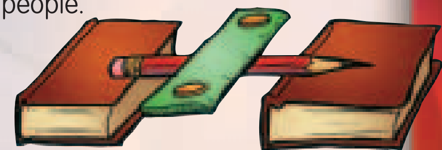


Your Swing Time is not affected by either your weight or by the distance through which you swing. The only thing that changes the Swing Time is the length of the swing. Air resistance does play a role if the body on the swing is big.

CAN YOU SEESAW?

When sitting on a seesaw, you have probably noticed that a person who doesn't weigh much can balance a heavy person if the people are positioned at different places along the seesaw. In the following activity, you can use a real seesaw, or a ruler as the seesaw and five-cent coins as the people.

You will need:



- Seesaw or ruler
- Tape
- Pencil
- Two books of the same thickness (about 4 cm)
- Five-cent coins

You and your adult partner should sit on opposite ends of the seesaw. If you both lift your feet off the ground, which one of you tilts down to the ground? If your adult partner is heavier, where should he or she sit on the seesaw so that it would be balanced? Try it and find out.

If you sat halfway between your end and the centre of the seesaw, where would you adult partner have to sit so that the two of you will be balanced?

If you can't get to a seesaw, you can make a model of one. Take a flat ruler and tape a pencil across the back of the centre of the ruler as shown. Place the pencil and ruler between two books. It may not balance right away, but you can use coins to make it balance.

Place a coin at each end of the ruler. Adjust the coins back and forth until the ruler is balanced. Now stack another coin on one of the five-cent coins. How do you have to move the coins to get the ruler to balance?

Now stack another coin so that you have three five-cent coins stacked on one side and one on the other. See if you can make them balance. How many coins can you stack and still be able to balance them with one five-cent coin at the other end?

With the large stack of coins still on one side, add another coin to the end with one. What are the two ways you could make the ruler balanced? Try other combinations and see if you can begin to predict where the different stacks of coins will need to be to balance the ruler.

A NEW TWIST

Some swings that are hung from long ropes can be twisted so that as they unwind, they spin around and around. When used in this way, a swing can help you learn about spinning objects. You may have seen ballerinas or figure skaters pull their arms in very close to their bodies when they want to spin really fast. You can see how this works in this activity. You can also find out how changing the mass, size or shape of an object changes the way it spins.

You will need:

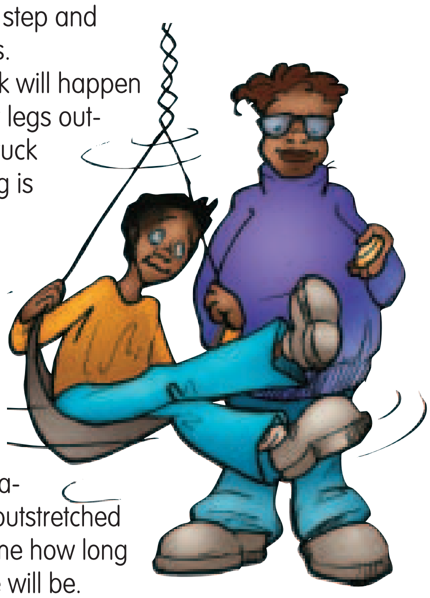
- A rope swing (do not use a chain swing)
- Clock or watch with second hand
- Paper
- Pencil

On a separate piece of paper, make a chart like the one below. Sit in the swing and ask your adult partner to turn you around 8 – 10 turns. Count the number of complete turns the swing is twisted, and record this number in your chart.

Stretch your legs straight out in front of you. Ask your adult partner to time how many seconds it takes for the swing to completely unwind. Record the unwinding time next to Trial 1 in your chart.

Repeat these steps and record the unwinding time next to Trial 2. Add the two unwinding times together and divide this number by 2 to get the average unwinding time. Record this number in your chart.

Do you think the swing will unwind faster or slower if you tuck your legs under the swing? Try it and see! Use the same number of turns as before. Record the number of turns and the unwinding time in the chart for "Legs tucked". Repeat this step and average your results.



What do you think will happen if you start with your legs outstretched and then tuck them in as the swing is unwinding? How about if you start with your legs tucked and then stretch them out? Try and find out.

Experiment with different numbers of turns and combinations of tucked and outstretched legs. Predict each time how long your unwinding time will be.

		Turns	Unwinding time	Average
legs outstretched	Trial 1			
	Trial 2			
legs tucked	Trial 1			
	Trial 2			
		Turns	Predicted Time	Actual Time
legs outstretched and tucked	Trial 1			
	Trial 2			

PICTURES:

Right: NASA/JPL/ Space Science Institute

Others: ESA/NASA/ University of Arizona

FIRST CLOSE-UP PHOTOS OF TITAN SENT TO EARTH

In January, the Huygens space craft plunged through the atmosphere of Saturn's mysterious moon, Titan. It then started sending back to Earth the first images of this, the furthest place from Earth a spacecraft has ever landed.

The images show what looks like a shoreline of an oily ocean. Scientists are now piecing together the images, measurements and sounds that were beamed back to Earth to get a better picture of this moon.

One stunning black and white image of Titan shows what looks like drainage channels on a land surface leading out into a dark body of liquid. Another shows a flat surface that is apparently strewn with boulders. Huygens captured more than 300 images as it dived through Titan's atmosphere.

The Cassini spacecraft carried Huygens for the past seven years and arrived at Saturn – the sixth planet from the Sun – in July 2004. It released Huygens towards Titan on 25 December 2004.

Saturn has a lot of moons (33 discovered as of August, 2004) of which 30 have been named. Titan is Saturn's biggest moon and it has a thick nitrogen atmosphere.

Why did the scientists want Huygens to land on Titan? They believe that conditions on Titan are like those on Earth 4.6 billion years ago. As such, Titan may tell scientists more about the kind of chemical reactions that set the scene for living organisms to start developing on Earth.

Scientists think that it is highly unlikely that they will find living organisms on Titan, though. It's really very cold on Titan, with temperatures hovering around -180 C. This rules out the chances of finding liquid water. The low temperature also hinders chemical reactions needed for organic life.

The mysteries of Saturn have always puzzled researchers. Scientists wonder why Saturn, a gas-giant composed primarily of hydrogen and helium, releases more energy than it absorbs from faint sunlight. Titan is also the only moon in the solar system to have a substantial atmosphere, one even thicker than Earth's.

The Cassini-Huygens mission is a $3.3-billion (about R20 billion) effort between USA's National Aeronautical and Space Agency, the European Space Agency and Italy's space program to study Saturn and its known moons. The two vehicles were launched together from Florida in 1997.

As the largest and most sophisticated interplanetary vehicle ever launched, Cassini-Huygens has performed well on its 3.5 billion km journey. Cassini crossed Saturn's rings without mishap in June 2004 and produced the most revealing photos yet of the rings and massive gas-giant. Cassini will remain in orbit around Saturn until at least July 2008.

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Here are the names of 30 of Saturn's moons. Try and find them in this word puzzle:

Mimas	Tethys	Rhea
Hyperion	Pan	Prometheus
Epimetheus	Calypso	Helene
Ymir	Siarnaq	Kiviuq
Thrym	Mundilfari	Albiorix
Enceladus	Dione	Titan
Iapetus	Atlas	Pandora
Janus	Telesto	Phoebe
Paaliaq	Tarvos	Ijiraq
Skadi	Erriapo	Suttung

Wordsearch by: Germani de Villiers, Johannesburg Planetarium

A	S	U	E	H	T	E	M	O	R	P	B	N	A	P
M	U	N	D	I	L	F	A	R	I	C	D	E	G	F
I	T	A	I	E	N	C	E	L	A	D	U	S	I	H
M	T	R	J	A	N	U	S	T	P	H	O	E	B	E
A	U	O	I	K	L	M	L	H	E	L	E	N	E	P
S	N	D	R	J	N	A	P	Q	T	H	R	Y	M	I
O	G	N	A	R	S	A	K	S	U	T	V	M	H	M
U	B	A	Q	A	N	R	A	I	S	W	X	I	Y	E
O	S	P	Y	L	A	C	L	C	V	K	D	R	P	T
T	I	T	A	N	S	Y	B	D	Z	I	A	E	E	H
S	F	H	G	Y	S	T	I	U	H	I	U	D	R	E
E	J	L	H	K	O	O	O	M	N	L	X	Q	I	U
L	P	T	R	Q	N	V	R	H	E	A	W	Y	O	S
E	E	A	C	E	R	R	I	A	P	O	B	D	N	E
T	A	R	V	O	S	Z	X	P	A	A	L	I	A	Q