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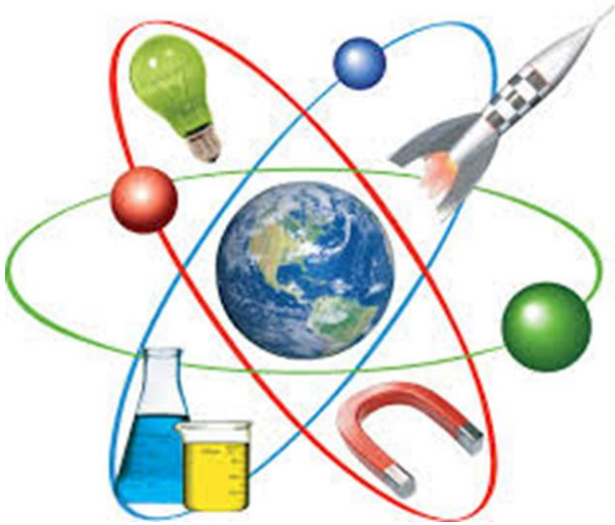
SteAm

Enterprising Science & Technology at Primary School



Mag. Edda POLZ, Bed.

Claude Lévi-Strauss , 1908 - 2009

"The scientist is not a person
who gives the right answers,
he is one who asks
the right questions."

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Primary school curriculum

„Sachunterricht” ~ IPC International Primary Curriculum

⇨ basic knowledge of science & technology including

- physics
- chemistry
- biology
- history
- geography
- intercultural awareness and personal skills

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Science & technology at primary school

- Explain scientific phenomena
- Conduct experiments
- Reflect experiences

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Science & technology at primary school

Experiments facilitate

- application of subject-specific methods
- development of responsibility
- willingness to learn and cooperate
- environmental impact awareness

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Educational tasks and learning outcomes

Pupils learn to

- gather information
- interpret and analyse information
- adopt a critical attitude towards provided information
- do assignments and solve problems
- acquire the ability to work independently and in a goral-oriented way
- reflect their work

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Science & technology in connection with CDT

Field of experience: The child's immediate environment - learning experience

→ Understanding of

- fundamental laws of nature
- technical conditions
- force and effect
- substances and their transformation

→ Requires appropriate and responsible handling

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Educational principals for teaching science & technology

- Activity-oriented learning
- Discovery-based learning
- Exploratory and experimental learning
- Cross-disciplinary learning

→ Profound, matter-of-fact knowledge

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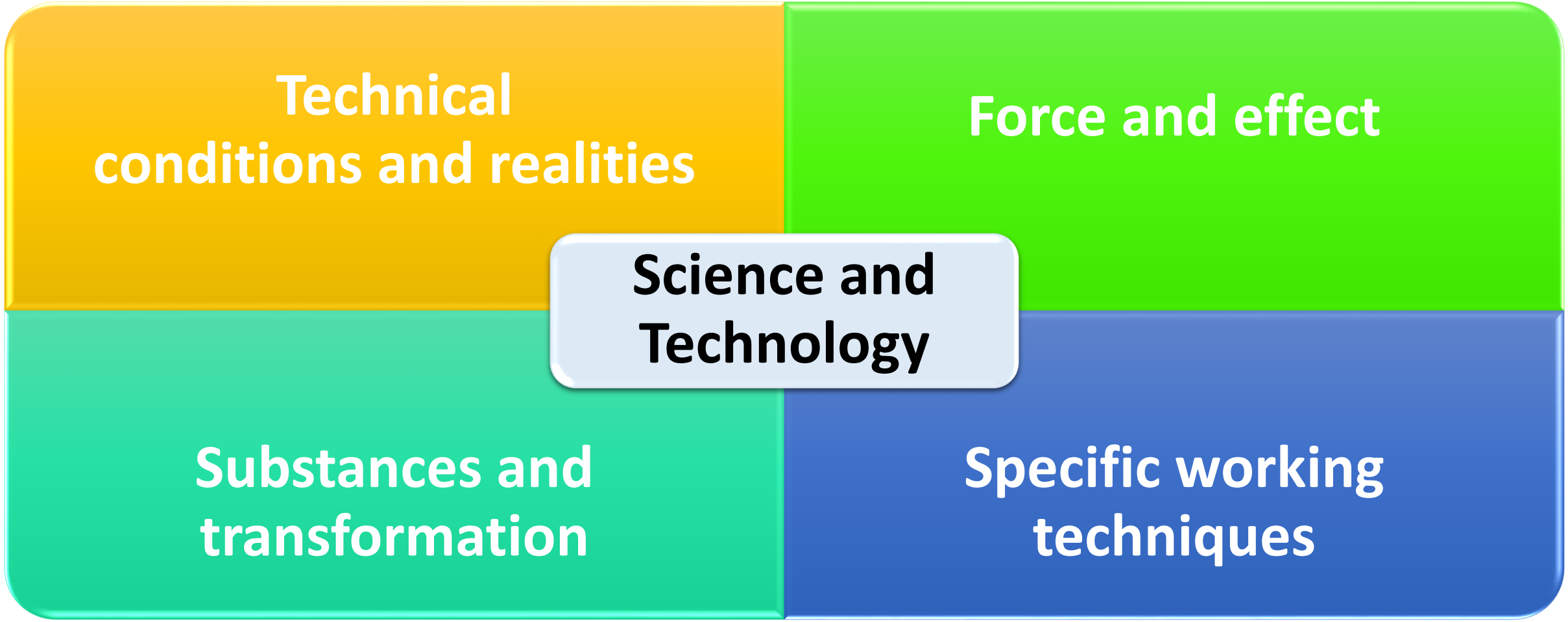
Learning objectives



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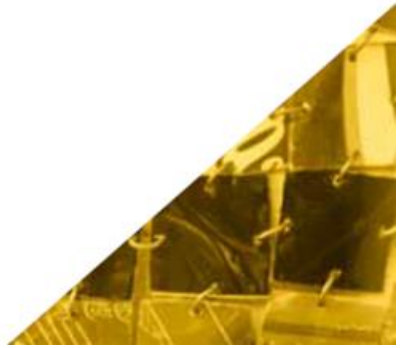
Technical conditions and realities

- Acquiring skills and knowledge on technical factors
- Dealing with objects (investigations)
- Getting familiar with specific ways of working
- Responsible handling of technical devices

Choose a different object for each challenge.

- ☐ Something made from plastic
- ☐ Something made from paper
- ☐ Something that you can see through
- ☐ Something made from natural materials
- ☐ Something you think is strong
- ☐ Something made from more than one material
- ☐ Something that would survive a fire
- ☐ Something really old
- ☐ Something that could keep you warm
- ☐ Something that makes you think of your home
- ☐ Something that would keep you dry in the rain



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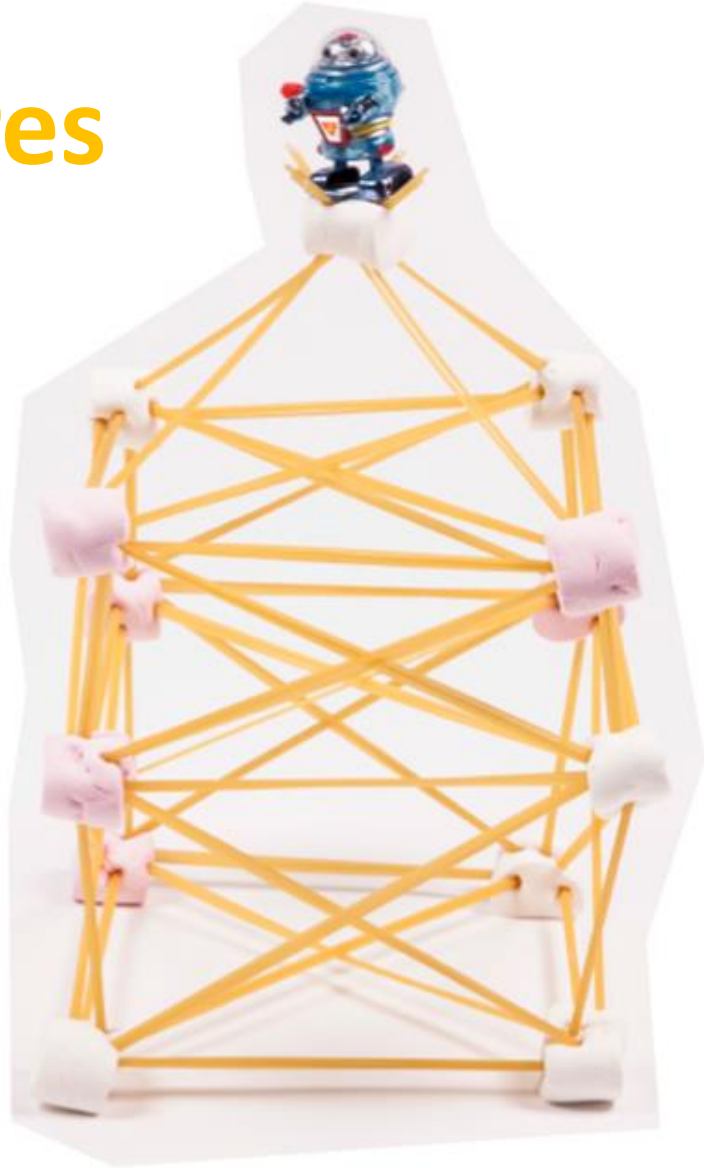
Spaghetti structures



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Overview for adults

Engineers put pure scientific knowledge into practice – but their jobs often involve practical testing, problem-solving and teamwork too. This activity calls all of these skills into action, to help build a tall, strong tower using spaghetti and marshmallows.

NOTE: This activity can get messy. Have some cleaning materials and black bin bags available for clearing up afterwards.

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What's the science?

One piece of spaghetti is not very strong. But if you use lots of pieces you can build a strong, tall tower. Each piece takes a little of the weight – of the tower and of whatever you place on top. The weight is the result of gravity, which pulls everything vertically downwards. That's why it's important to ensure that the tower doesn't lean too much – and that's also why towers are normally thick at the base and thinner at the top.

Science in your world

Electricity pylons, church spires and structures such as the Eiffel Tower are all wider at the bottom than they are at the top to make them stable. Radio masts are among the tallest towers, and although most of them are actually the same width all the way up, they have cables anchored into the ground to stop them toppling over.

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You will need...

Uncooked spaghetti

Marshmallows

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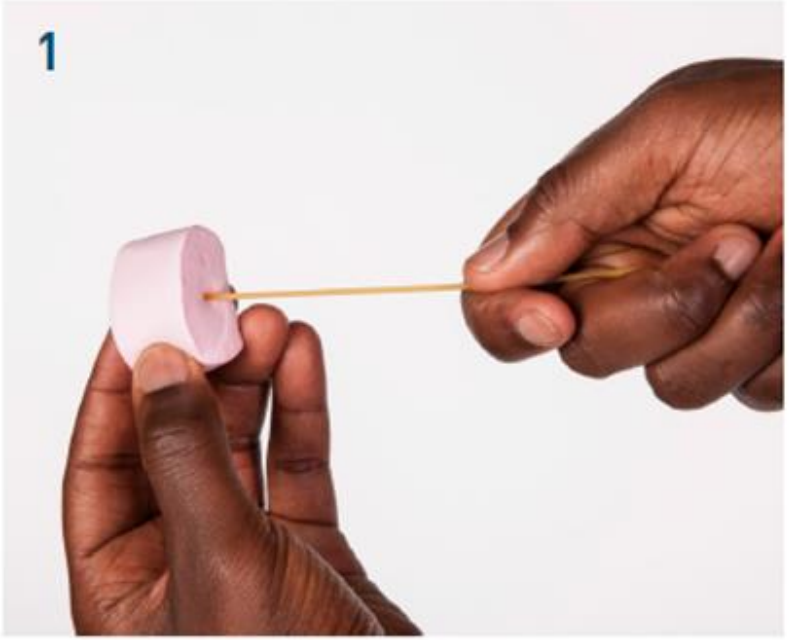
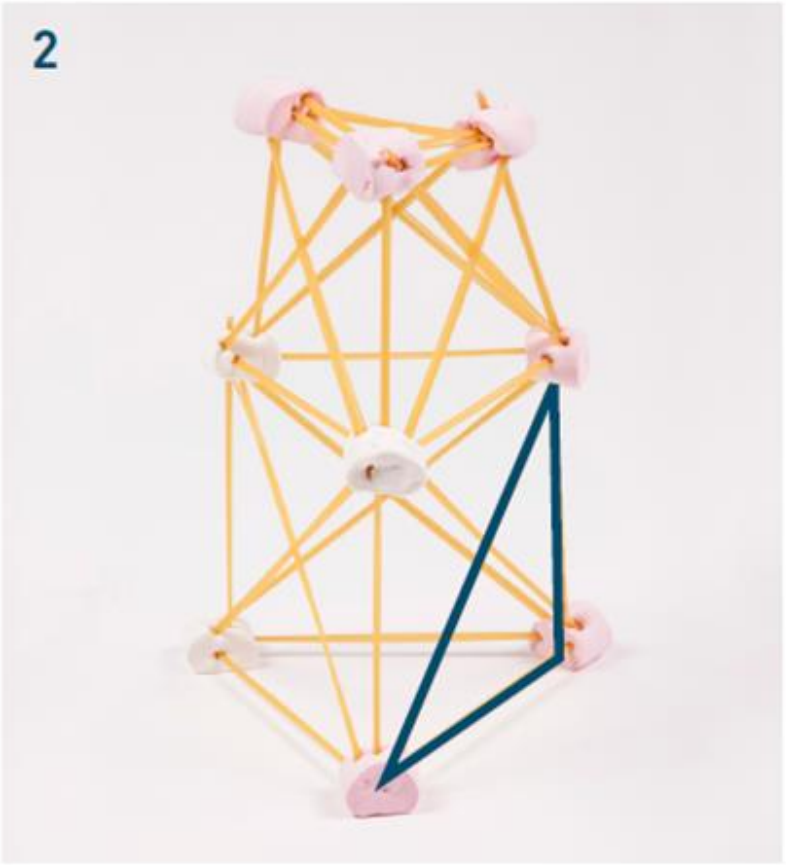
Follow these steps...

1



Start building your structure by pushing a piece of spaghetti deep inside a marshmallow.

2



Keep adding spaghetti and marshmallows to build a structure however you want. But remember that triangle shapes are very strong.

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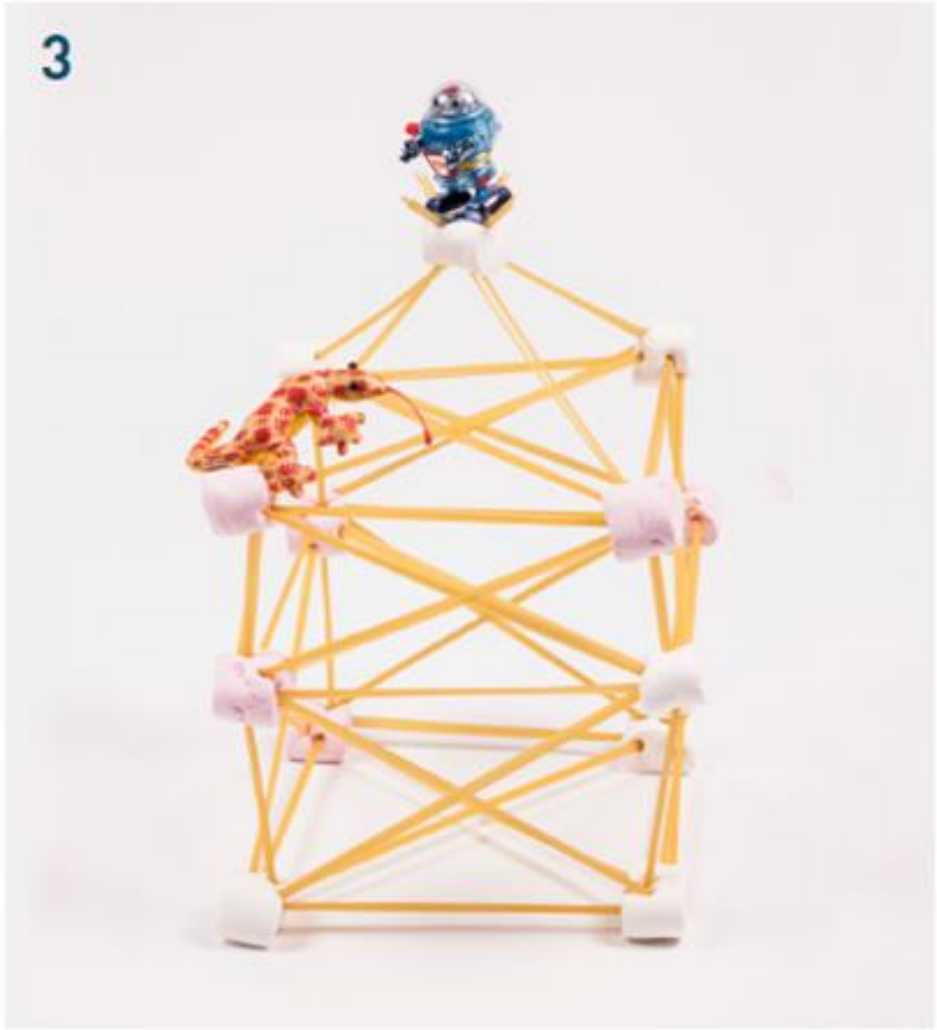

Test your structure's strength by balancing objects on top of it.

Try making structures that have different shapes, and see which one is strongest.

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Think and talk about...

- What shapes can you identify in your tower?
- What challenges did you have while you were building your tower?
- What do you think engineers have to consider when they are building structures?

Investigate...

- Can you make a strong tower using only right angles between your pieces of spaghetti?
- Try to make your tower stronger by adding or replacing parts with different materials.
- See if you can make a bridge across a gap with the spaghetti and marshmallows.

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Force and effect

Gaining an insight into forces and their effects

- Magnetism, wind energy, hydropower
- Effects of heat
- Physical expansion of substances
- Weather conditions and possible threats
- Operating principles of various forces
- Buoyancy, floating, sinking

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Magnetic Maze

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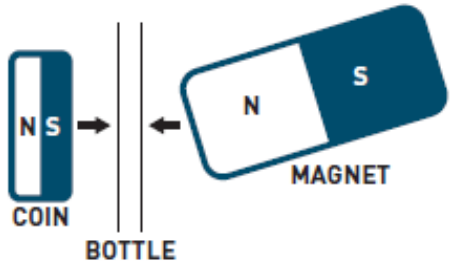
What's the science?



A magnet is anything that has a magnetic field around it. In this activity, the magnet's field temporarily makes the coin into another magnet. The two magnets attract, and the coin is pulled towards the magnet. Only certain materials are affected by magnetic fields in this way; by far the most affected is iron. Many modern coins are made of steel (an alloy made mostly of iron) coated with a thin layer of either copper or nickel. Twenty-pence coins are made of an alloy of copper and nickel, and will not work in this activity.

Science in your world

Among the many everyday applications of magnets are fridge decorations that cling to (steel) fridge doors, and the magnetic strip on the inside of a fridge door that keeps the door closed. Electromagnets are coils of wire wound around an iron core. When current flows through the coil, it produces a magnetic field, which magnetises the iron. Electromagnets are found in electric motors, cranes in scrapyards and in loudspeakers and headphones.

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Can you guide a coin through a maze, using the invisible force of magnetism?

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You will need...

A plastic bottle

A 10p coin, 20p coin
or a ball bearing

A magnet

A marker pen

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Follow these steps...

1

Draw a maze onto the bottle with a marker pen.

2

Drop the coin or ball bearing inside the bottle and use a magnet to guide it through the maze.

3

Try doing the same with your other objects. Which ones work, and why?

4

Try some different maze patterns too.

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Think and talk about...

- What happens when you hold the magnet near the coin or ball bearing?
- Why doesn't the bottle stick to the magnet?

Investigate...

- Does this work with all coins?
- Try some other things inside your bottle maze, such as a button, marble or hair clip. Which materials stick to the magnet?

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Make your own volcano

You will need:

1. Washing up liquid
2. Vinegar
3. Plastic cup
4. Baking soda
5. Red food colouring

You could build a paper mache volcano and put the cup inside it for extra effect!

www.twinkl.co.uk

Method:

1. Fill your glass just over half full with water, add 3 teaspoons of baking soda and give it a good stir until most of the baking soda dissolves.
2. Add a good squirt of washing up liquid into the cup and once again give it a stir.
3. Make sure your volcano is in the kitchen or outside (or somewhere you don't mind making a mess).
4. Quickly pour in just under a quarter of a cup of vinegar and enjoy your very own volcanic eruption!

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The science behind it:

You just made a chemical reaction! By mixing the acid (vinegar) and the alkali (bicarbonate of soda), bubbles of carbon dioxide (CO2) were released like in a pyroclastic flow. A pyroclastic flow moves very fast and is extremely dangerous, whilst lava flows move slowly and aren't much of a threat.

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Pinball Power

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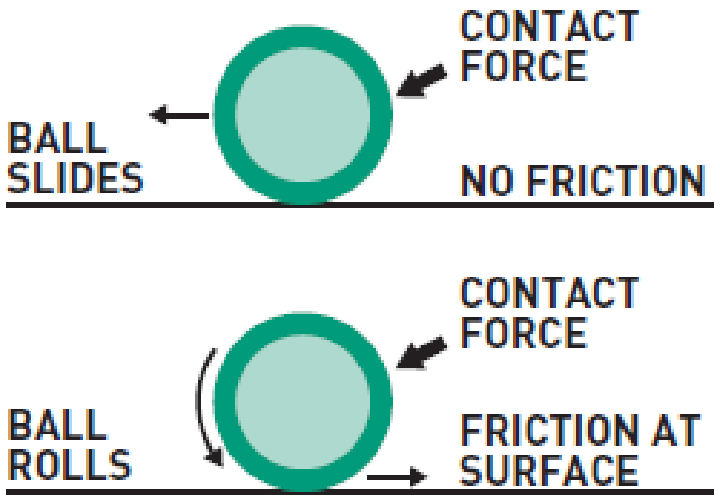
What's the science?



There are three main forces that change the motion of the ball. First, the flipper starts the ball moving by applying a contact force directly to it. When the ball collides with the various elements within the pinball machine, contact forces change the ball's direction of motion. The ball rolls because of friction between the bottom of the ball and the cardboard box; without that friction, the ball would simply slide. Finally, because the box is inclined (sloping), gravity slows the ball and then begins to speed it back down towards the flippers again.

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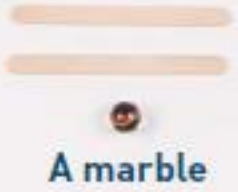
You will need...

A small- to medium-sized shallow box, e.g. a shoebox or a pizza carton



Two wooden sticks from ice lollies

A marble

Scissors

Sticky tape

Extra cardboard, paper and colouring pens for decorating

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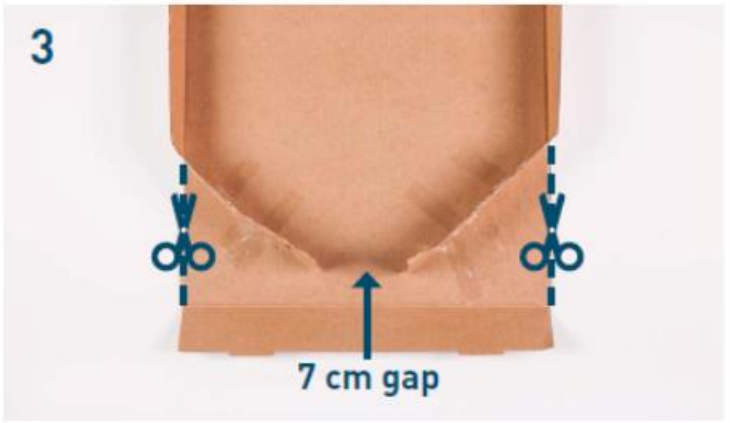
Follow these steps...

Unfold one end of your box so that the two flaps come free.

Cut a small slit in each flap, going roughly halfway across.



Angle the two flaps, like in the photo, and stick them down with tape, leaving a gap between them of about 7 cm.

Slide the lolly sticks into the slits – these will be your pinball flippers.

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Make an obstacle course or maze on your board by adding curves, arches, ramps and tunnels. Use the lolly sticks as flippers to launch your marble onto the course.

Get creative! Decorate your pinball machine and see how challenging you can make it by adding different obstacles. Lean your board on some books to help the marble roll.

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Think and talk about...

- What forces change the motion of the ball in your pinball machine?
- What do you think would happen if the box didn't slope?
- Which parts of the pinball board are hardest to reach?

Investigate...

- How could you change your pinball machine to make it easier or more challenging?
- Investigate how bigger or smaller marbles work in your pinball machine.
- Can you find another way of launching the ball, perhaps with a spring?

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Substances and transformation

- States of matter (solid, liquid, gaseous)
- Conditions for changing the physical state (e.g. temperature)
- Water-soluble and water-insoluble substances
- Air (respiration, incineration, combustion, …)
- Pollutive substances (exhaust fumes, synthetics, detergents, …)

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Instant Ice Cream

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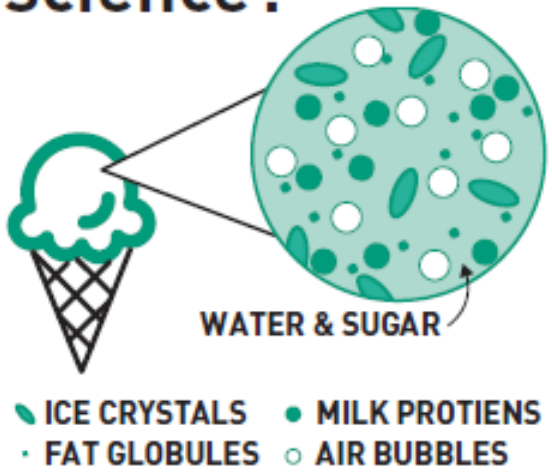
What's the science?



Pure water freezes at 0 degrees Celsius. Add salt and the freezing point drops by a few degrees. When you add salt to the ice in the outer bag, the ice (at 0 °C) is now above its freezing point – so it begins to melt. Melting requires energy, and in this case that energy comes from the flavoured milk mixture in the inner bag. Ice crystals start to grow in-between the tiny globules of fat in the milk and bubbles of air, causing the milk to freeze and change state from a liquid to a solid.

Science in your world

During the winter, grit spreaders often throw rock salt onto major roads if the temperature is forecast to drop below freezing. When snow falls on the salt, it melts in the same way as the ice in the outer bag in the activity. And spreading the salt before the temperature drops below 0 °C means ice cannot form on the road – unless the temperature plunges much lower.

You will need...

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Follow these steps...

Pour half a cup of flavoured milk into the small zip-lock bag and seal it tight.

Put a generous amount of ice into the large zip-lock bag, then add 6 tablespoons of salt. The salt lowers the freezing point of the ice, and you will see the ice begin to melt.

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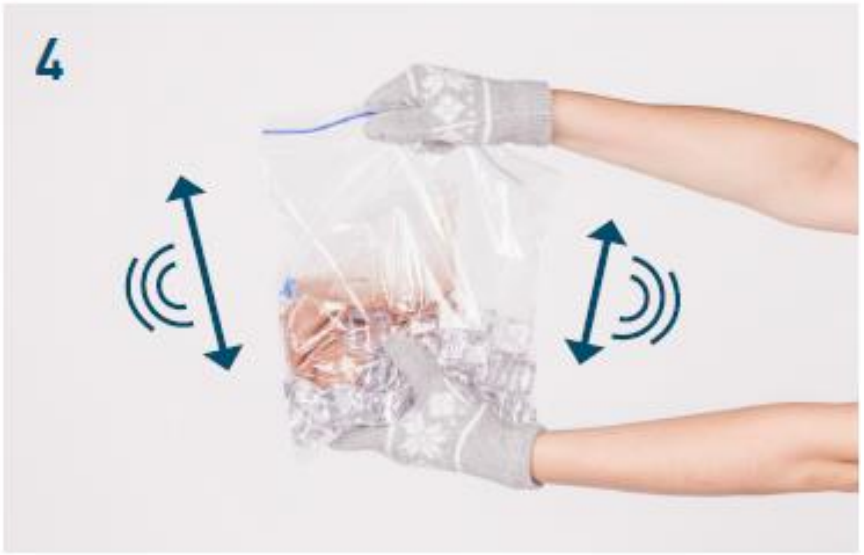
3

Place the small zip-lock bag inside the large bag with the ice and salt, and seal the large bag.

4



Put on some gloves (so your hands don't get cold) and start to gently shake and squeeze the bag.

5

After five minutes of shaking, carefully take the small bag out and taste your ice cream!

Top tip: Be careful not to spill any of the salty ice water or mix it with your ice cream as you get it out of the bag.

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Think and talk about...

- What do you see happening to the ingredients?
- What do you think the salt is doing? How could you find out more?
- How does the finished product compare with shop-bought ice cream?

Investigate...

- Can you make the ice cream freeze faster? Try altering the amount of salt or how much you shake the mixture.
- Try different ingredients – do they behave in the same way?

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Science in your world

In freezing weather, lorries are sent out to spread salt on the roads and pavements, to help melt ice and snow and make it safer to walk and drive around.

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Fireworks in a Glass

This is a very cool, simple and fun experiment, and also completely safe, just don't drink the water!

You will need:


Warm Water


Oil


A Tall Glass

Food Colouring

www.twinkl.co.uk

Method:

1. Fill the tall glass with warm water.
2. Pour a small amount of oil into another container and add a few drops of food colouring.
3. Give it a good stir, if it doesn't mix, add a bit of water.
4. Pour the food colouring and oil mixture into the warm water and watch the fireworks!

www.twinkl.co.uk

The Science Bit

Oil and water don't mix. Also oil is less dense than water (meaning there is less of it in the same volume) and therefore floats on top of water in a nice layer. The food colouring we used was water based and therefore does not mix with the oil, instead it sinks through the oil into the water below. Since the addition of the colouring makes the food colouring heavier than the water, it sinks to the bottom leaving trails (resembling fireworks) as some of the colour diffuses into the water.

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Specific working techniques

- Observation
- Categorisation/Classification
- Experimentation
- Documentation
- Conclusion

- [ ] Something that is bigger than you

.....

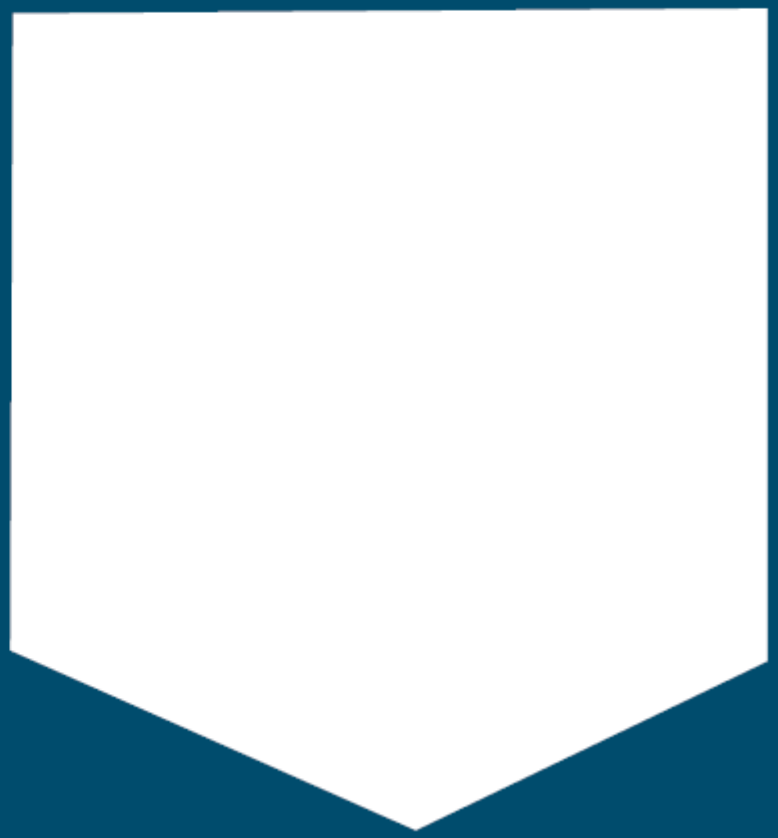
- [ ] Something that could help save someone's life

.....

- [ ] How may objects can you find that have numbers on them?

.....

Something that you could fit in your pocket



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Something that could keep you dry in the rain

.....

Something that looks really old

.....

Something you could use to travel across water

.....

Something that makes you feel happy

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Are your looks all in your genes?

What is normal?

Is it better to stand out or blend in?

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Are you a fan of my feathers?

A genetic quirk (different from albinism) means this peacock has no colour-producing cells in its feathers. Humans are just like other animals in that our genes play a big part in our appearance. But we have also become incredibly good at changing the way we look, from hair colour to high heels.

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What would it be like if you weren't scared of anything?

Can fear be fun?

Have you inherited any phobias?

How does this make you feel?

Some people might find this hairy tarantula truly terrifying! In a dangerous situation, fear can help you react and escape quickly. But when fear goes into overdrive, people can develop phobias – irrational fears shaped by your genetic inheritance, your experiences and your environment.

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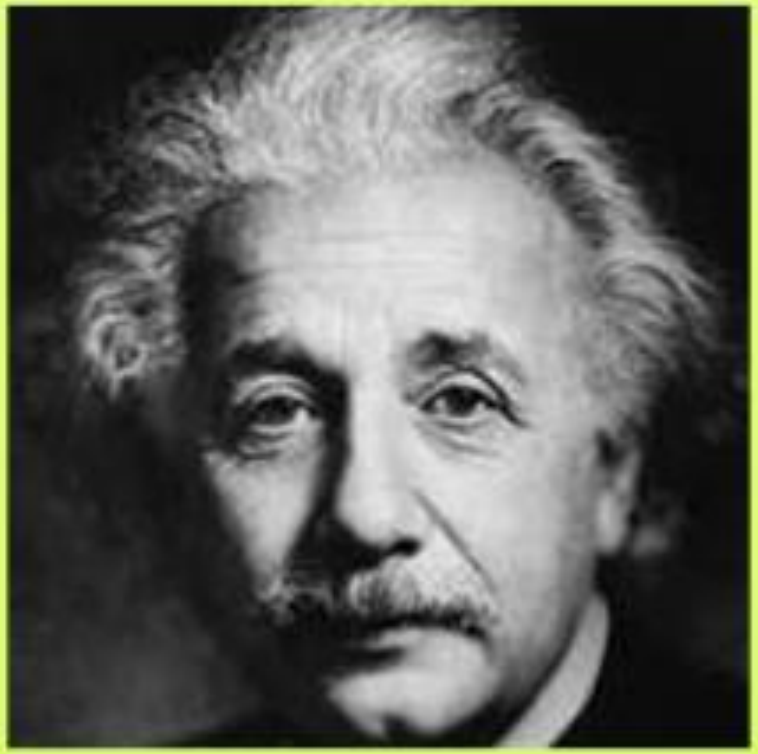
Great Object Hunt - Talking points

- Exploring – observing – communicating
- Follow curiosity and topics of interest
- Practice questioning skills
- Think and talk about how technology shapes our lives



"I Have No Special Talents, I Am Only Passionately Curious"

www.goldenmessages.wordpress.com

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SCIENCE MUSEUM LONDON: http://www.sciencemuseum.org.uk/educators/classroom-resources

TWINKL PRIMARY RESOURCES: http://www.twinkl.co.uk

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Thank you
for your kind attention!

Mag. Edda POLZ, Bed