Miraculous Motion

PdD (Inquiry Teaching)

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Scientific understandings

What is a force?

A force is a push, pull or twist that can change the speed, shape or direction of an object.

Newton's three laws:

1/ Inertia: "An object at rest will remain at rest, an object in motion will remain in motion". Ie, the earth will keep moving around the sun forever, until something stops it! Also, a Barbie without a seatbelt will keep moving even if the car she is on suddenly stops!
Important ideas to remember:
* Things will only change their motion if a force is applied.
(That is, they will only start, stop, or change direction
If a force is applied.)

2/ F=ma. Defining force: The force (F) an object is equal to its mass (M, in kilograms) times its acceleration (A, in meters per second per second)

3/ The reaction force. "Every action has an equal and opposite reaction"

There are always two forces, equal in size and opposite in direction. For example, when you throw a ball, it pushes you back with the same force. Lucky you are so big, or you'd both fly in opposite directions!

If gravity is pulling you down, why don't you move through the floor? Because the floor is pushing you back!! (law 1: things will only stop if a force is applied). Can things not moving apply a force? Yes, they can. All motion is relative.

Friction

If law 1 is true, why *do* we slow down? Take a moving car, for example. An object will only slow down if something pushes it. What is pushing the car to slow it down?

FRICTION: all the tiny bumps, attraction between atoms, and a thousand other things. Friction acts in the direction opposite motion and is a force that resists motion, turning it into heat. It is a reaction force (it needs an action force to exist).

Experiments

The experiments are detailed in this booklet that are in the show or that you can try yourself. Make sure you read the instructions and assemble the equipment before beginning an experiment. Also, as every science teacher knows; *attempt any experiment by yourself first before trying them out on a class!*

(ps. Technically, most classroom 'experiments' are really 'demo's'. Experiments are used to test a theory, while demo's are used to make a point. Though with some creativity you can test you and your students theories with even these simple demonstrations!)

And last of all, remember: everyone can do science!

Three tricks with high bouncing balls

There is a lot more to bouncing a ball that you might think. Here are three interesting ways you can make things bounce.

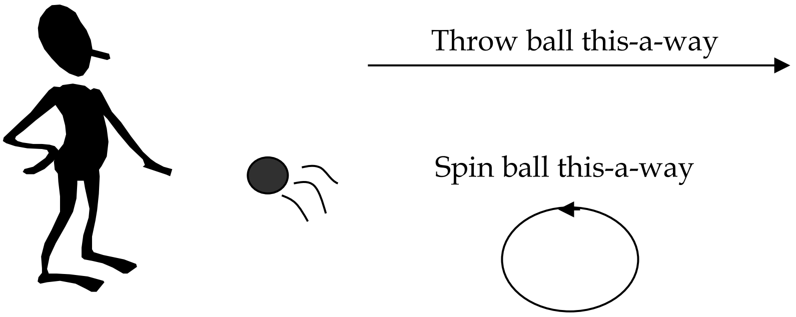
Aim:

- To explore factors such as inertia, elastic potential energy, and friction on motion
- Energy and change 1.1 "Students collect information about the ways that objects of different shapes and sizes [and orientations of spin] move."

Description: There are three experiments in this series

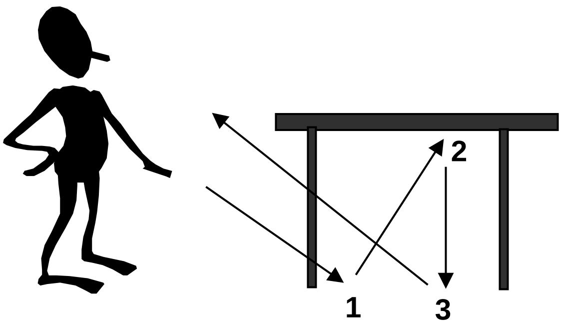
1/ The incredible returning bouncing ball.

Simply toss a ball just in front of your feet, but spin it with your hands in the opposite direction. With enough spin you can throw the ball well away and it bounces right back to you!



2/ The amazing returning high bouncing ball.

A similar trick, you can get a high bouncing ball to return to you by getting it to bounce under a table in a certain way. Three times is all that you need.



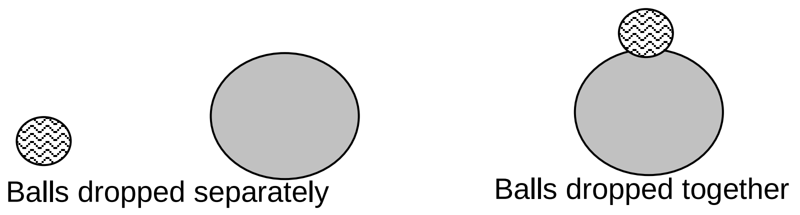
3/ The astonishing helper bouncing ball.

Be sure to use this as a demonstration well away from the children. The balls can bounce surprisingly high!

For this trick you need two balls, one preferably larger than the other: it can even be a little deflated and the trick will often still work.

Show the children how the balls bounce separately. Neither will return to the hight it was originally dropped at.

Now place the smaller ball on top of the larger ball and try to drop them at the same time. The results of the combined bounce might surprise you!



How it works.

1/ As the ball hits the ground, it pushes the away from the ground in the direction of the spin. This is due to something called friction, which is the force between a moving object and whatever it touches. You can choose which direction a ball will bounce in by changing the direction it is spinning it.

2/ Friction is at it again! The high bouncing ball changes the direction it is spinning in each time it strikes a surface. By the third time it is spinning right back in the direction it started in.

3/ Part of the bounce from the large ball is passed directly to the smaller ball, making it bounce much higher. In exchange, the bigger ball will not bounce so high. Did you notice?

Extensions

- Try spinning a high bouncing ball as in experiment one, and letting it bounce as often as it likes. What happens?
- Will the table ball work if the ball bounces 4 times? How about 5?
- What happens if you trade places of the large and small balls from experiment 3?

Projects with Magnets

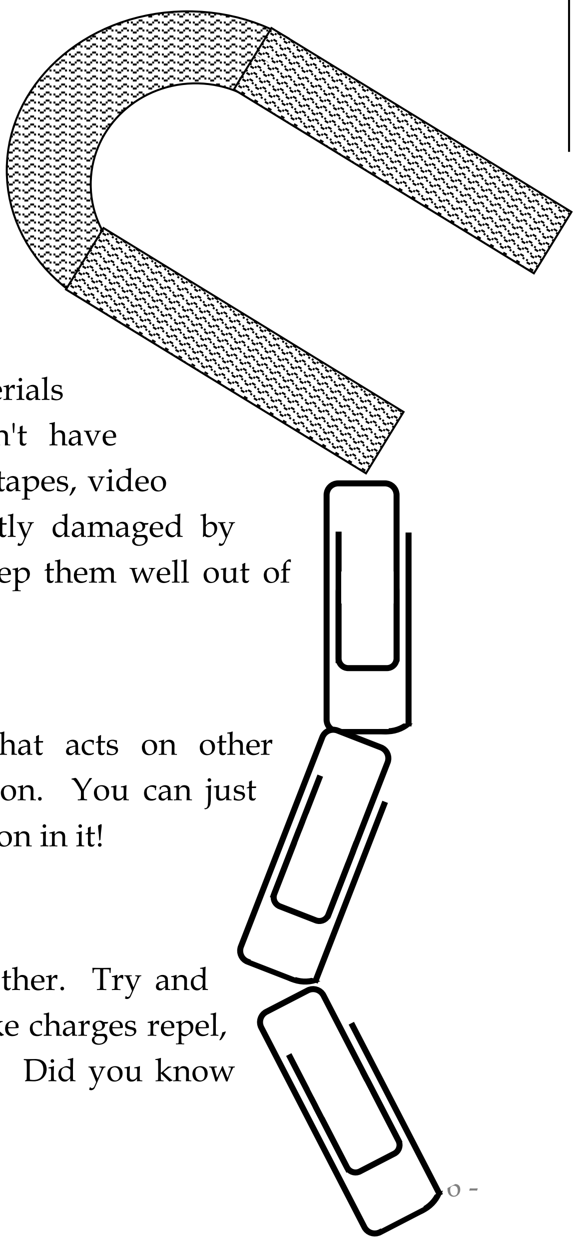
Aim

- Natural and processed materials 1.1 "Students describe observable properties of familiar materials."
- Natural and processed materials D2.4 "Students identify patterns when investigating the properties and uses of different materials."

Description

Set up a box of objects, including lots of metal ones such as paper clips, coins and keys. Using some school magnets, find out which objects are attracted to magnets. Why are some objects attracted and others aren't? Are magnets attracted to each other? The answers might surprise you.

Caution



- Magnets can cause sever and permanent disruption to electronic devices. Do not place magnets on or near electrical equipment that you value, such as mobile phones, computers, TV screens and DVD players etc.
- Any device which uses magnetised materials can also be damaged, even if they don't have obvious electrical features. Audio cassette tapes, video tapes and PC disks can all be permanently damaged by passing a magnet across their surface. Keep them well out of reach during these experiments.

How it works

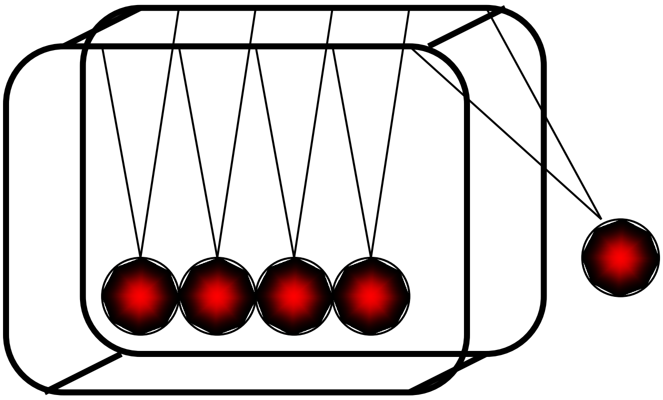
Magnets produce a powerful force that acts on other magnetic objects: principally a metal called iron. You can just about guarantee that any magnetic object has iron in it!

Extensions

- Explore the effect magnets have on each other. Try and see if the children can work out the law "like charges repel, unlike charges attract" in their own words. Did you know magnets have sides, a northward facing and southward facing side!

- Go around the home to see what sticks to metals. You might be surprised that MOST METALS ARE NOT MAGNETIC. Do you know what the only strongly magnetic, pure, metal is? It's very common, it's in lots of things.
- Explore the whole room (except electronic equipment!) to see what else is attracted to magnets.
- PAPER CLIP COMPETITION. See whose magnet can lift the most number of unlinked paper clips.
- Magnet maze. Make a maze using paddle pop sticks and thick cardboard. You can then use a magnet to guide a paperclip through the maze and out to the finish line.
- Or, you could make up some scenery and stick a picture of person to your paperclip. Then you can use the scene to create a story. Try the three little pigs told entirely by the children with the help of the magic of magnets!
- SCULPTURES. With a strong enough magnet and a large collection of paper clips (or similar readily magnetisable objects) you can create all sorts of weird and wonderful sculptures. Try it and see.
- How Magnets destroy televisions: This is a fun activity that can be used to drive home the importance of *not* using magnets near electrical devices. Bring a magnet close to an old, unloved, but still functioning television. As long as it still uses cathode ray technology, the colours should change and the picture will warp in the direction of the magnet. Usually the change is not permanent; but you could be unlucky. This works because the TV's use beams of energy (charged electrons) to make the back of the TV screen glow. Powerful magnets in the TV direct the beams right to where they need to be: unless your magnet redirects the electrons somewhere else… (Ps. It is possible to permanently damage a television doing this.)
- Try making a compass. All you need to do is suspend your neodymium up by a string, or place it in an upturned lid floating in some still water. It will ALWAYS turn to face north and south. The side that faces north is called the 'northward facing side' or N for short. Can you guess what the S is for?

Newton's Cradle



How

Pick up one ball and let it fall onto the others. What happens?

Why

Each ball pushes the next. As it does, it's push moves to the next ball down the line, till the last ball is pushed off. It swings out until gravity pulls it back again.

Questions:

What happens when you try two balls from opposite sides?

Newtons 1st law says that objects only start, stop or change direction if they are pushed. What, then, causes a moving ball to stop once it pushes against the other balls? What pushes it?

Why does it run down?