Electricity

A magnet has a north- and a south-pole
Like poles repel and unlike poles attract.

Electromagnet : a current carrying wire is an electromagnet

Static electricity: Friction generates static electricity.
Like charges repel and unlike charges attract.

Dynamic electricity: copper +magnet +motion = electricity
Electric current can circulate in a closed circuit.
There is A.C. (alternative current) and D.C. (direct current)
A transformer only works on alternative current

1. Guess the card

Material :

a pack of cards , a partner

Action:

Your partner chooses a card, but he doesn't show it to you. You are supposed to "guess" the card.

You take the card (don't look), rub it over your hair and put it back between the other cards .You slantingly give the pack of cards a short tap.

What?

By tapping, the pack of cards splits up into two packs. Take the upper pack: the undermost card is the one you're looking for.

Why?

By friction (over your hair) the card is charged. When the card makes contact with an other one, it is also charged. The two cards repel because they are likely charged.

2. Producing electricity on your own

Material:

a bicycle and a dynamo, connected by means of a lamp.

Action:

Put the bicycle upside down and turn the wheel by means of the pedals.

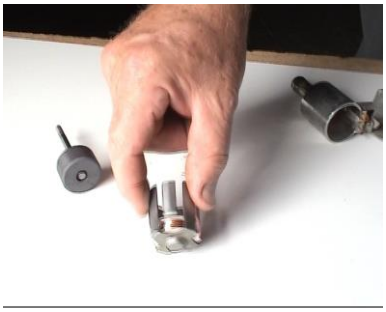
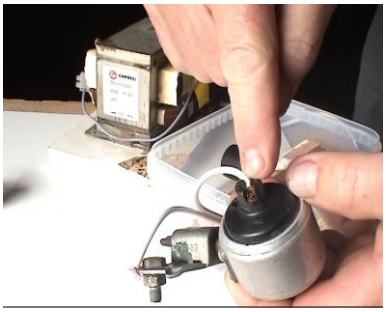
Hold the dynamo against the turning wheel, with its top.

In order to have a bigger lamp shine , you can put a big transformer between the dynamo and the lamp.

What?
The lamp will shine as long as the dynamo turns.

Why?
As long as the circuit is closed, the electricity flows and the lamp shines.

3. What do you need to make electricity? The dynamo

Material:
a dynamo (to open)

Action:
Pull the dynamo to 2 pieces: the magnet and the copper coil.

What?
By turning the dynamo, the magnet moves in the environment of the wire.
Copper + magnet + motion = electricity

Application:
We can compare a power station to a big bicycle dynamo.
The steam (of hot water) makes the turbine move. The turbine puts the dynamo into motion. As in the dynamo, there is a magnet (electro) in the generator.

4. The motor


Material:
2 dynamos, 2 wires

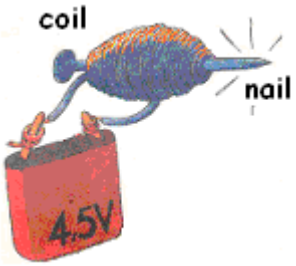
Action:
Connect the 2 dynamos.
We hold one dynamo to a turning bicycle wheel. The first dynamo generates

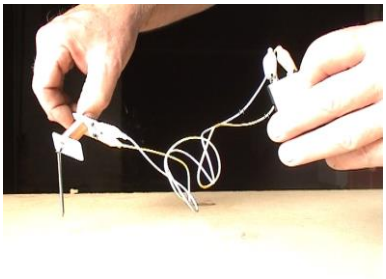
electricity, which flows to the second dynamo.

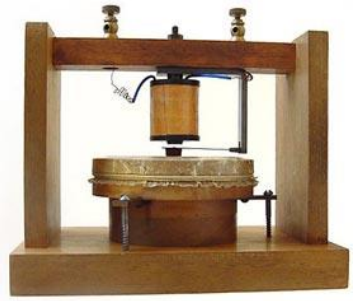
What?
The second dynamo turns.

Why?
Copper + magnet + electricity = motion
Electrical energy is transformed into mechanical energy.
The motor has 2 electromagnets: the stator and the rotor, connected by means of brushes.

5. The electromagnet







the first Bell-telephone

Material:
a battery (4,5 V), a nail, a wire and some small iron objects s.a. paperclips, needles…

Action:
Wind a wire on an iron bar (s.a. a nail) and connect both ends to the poles of the battery, so that electricity flows.
a) Bring the iron bar in the neighbourhood of the small iron objects.
b) Disconnect a wire from the battery (the circuit is interrupted) and bring the iron bar into the neighbourhood of the iron objects again.

What?
a) The iron bar works like a magnet.
b) The iron bar doesn't attract iron objects any longer.

Why?
Every current-carrying wire is an electromagnet; by winding the wire as a coil, the electromagnet grows more powerful.

Application:
an electric bell, the telephone

6. Braking electricity

Material:
- 2 copper tubes of the same length and width (about 50 cm)
- a bar magnet and an aluminium bar of the same size

Action:

Keep the tubes vertically and make the bar magnet and the aluminium bar fall down the tubes at the same time.

What?

Which of the 2 bars will come down first? The heavier magnet or the lighter aluminium bar?

Why?

Copper + magnet + motion = electricity

That's why the copper tube becomes an electromagnet, which slows down the falling magnet bar.

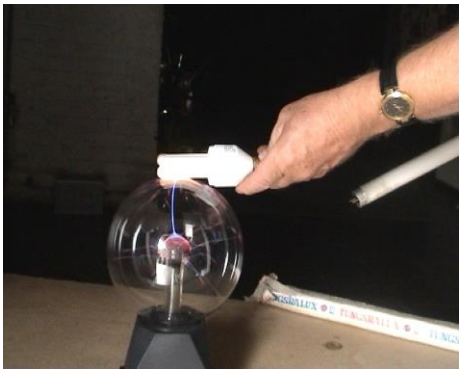
The aluminium bar is not attracted, so it will be the first.

Alternative:

Repeat the experiment with a copper tube and a plastic tube.

Is there a difference? Why?

7. The plasmaball



Material:

You need electricity to switch on the ball. It doesn't give much light, but you will see light flashes inside the ball.

Action:

a) put your hand or finger on the ball

b) put a TL-lamp (or an economic lamp) on the ball

c) put a coin on the ball and bring your finger near to the coin

What?

a)the light flashes will come together to the hand

b)the TL lamp will shine, from the ball up to the place where you hold the lamp

Move your hand over the tube, you will see that a smaller or bigger part of the lamp will shine.

c)when your finger is near, little sparks will jump over.

Why?

There is high tension on the centre of the ball. The ball itself is nearly vacuum and the electricity flows to the outside of the ball. The human body is a good conductor of electricity.

When somebody touches the ball, current flows through his body to the earth-so he connects the ball to the earth.
A TL lamp doesn't need much current to give light. The small amount of current coming to it by way of the ball is enough.
Note that the current passes through the glass because it is alternative current with a high frequency.

Test:

Have somebody put his hand on the ball and have someone else touch the arm of the first person with one finger.
What will happen? Will he feel anything?

8. The flashing light; alternative current

Material:

You need electricity, a double long wire with a small neon lamp (s.a. the lamp of a coffee machine)

Action :

Have the lamp shine and swing the wire.

What?

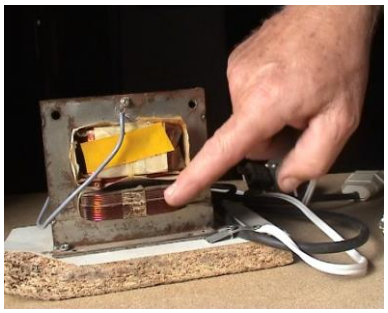
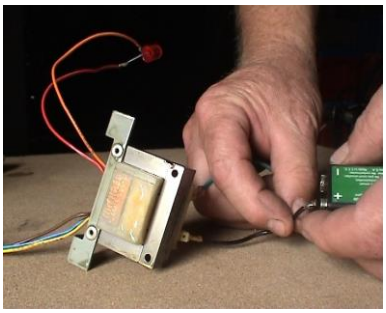
a) do you see a circle of light?
b) or anything else?

You don't see a full circle of light but an interrupted line .

Why?

When we don't move the lamp, it seems to shine constantly - although (because of the alternative current) it lights up and gives out 100 times per second.-
That's because of the effect of the light on our retinas.
When we swing the lamp, we notice that the lamp only lights up some parts of the circle. This is because of the alternative current.
A bulb would show us the whole circle, as the wire keeps glowing.
We may also try out the lamp with direct current (battery) and find out whether it lights up the whole circle or not.

9. The transformer


Material:

A transformer the wrapping of which has been removed, a battery, a lamp.

Action:

a) Connect the wires (ends of the copper wire) of the first coil to the battery and the second coil to the lamp.
b) Constantly switch the battery on and off.

What?

a) The lamp doesn't light up.
b) The lamp lights up while switching on and off.

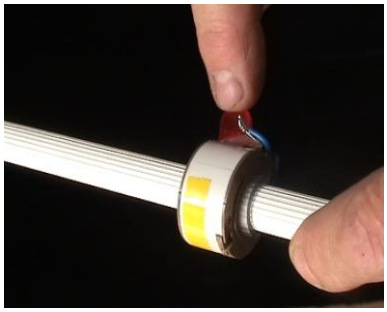
Why?

The transformer is made of 2 coils that are not connected to each other.
So current doesn't flow from one coil to the other.
a) When the first coil receives current from the battery, there won't be current in the second. The lamp doesn't shine.
b) When the first coil receives current alternatively, there is the effect of a moving magnet with respect to the second coil.
Because of this, electricity is generated in the second coil.
Reason: copper + magnet + motion = electricity

The number of windings of the coils may be different and in this way also the voltage generated in the second coil. So there are different transformers, depending on the number of windings.
The transformer in the picture reduces 230 V to 12 V. Therefore transformers only work on alternative current.

10. The lamp that has to be shaken





Material:
a torch- see picture or to make yourself: a plastic tube, a coil around the tube and a led connected to the coil

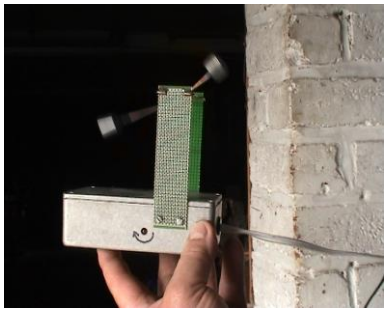
Action:
a)shake the torch and switch on
b)move the tube upside down

What?
a) the torch lights up
b)the led lights up

Why?
In both objects are a magnet and a coil. By moving, we generate electricity.
In the torch there is still a capacitor, which stores the energy, so we don't have to shake the lamp continuously.

11. The electric swing





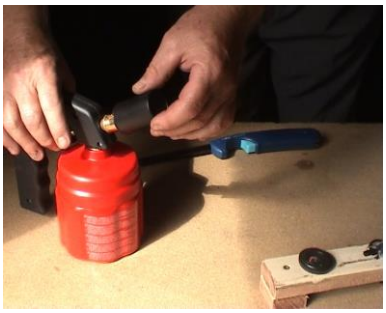
Material:
in the kit

Action:
We move the swing by pushing slightly

What?
the swinging doesn't stop

Why?
In the foot of the swing are a switch connected to a battery and a coil.
At the bottom of the swing is a magnet.
When the swing (with magnet) passes the foot, a switch closes the circuit of the battery and the coil. So the coil becomes an electromagnet with the same pole as the magnet in the swing. The two poles repel each other .This happens every time the magnet passes the foot. So the swing doesn't stop.

12. The gun


Material :
(see kit or make it)
- a crystal with switch (piëzo electricity) from a lighter, used to light a cigar
- two wires from the crystal to the led of a film box
- gas; a film box.

Action:
Press the switch and see the sparks
Fill the box with gas, put it in the lid and press the switch

What?
The box flies away in the air with a loud crack

Why?
When we press the switch, an electric spark springs up in the box so that the gas explodes with a crack (implosion of the air).

Piëzo electricity is the phenomenon that crystals generate an electric voltage when we press them. On the other hand they remodel under the influence of electric voltage.

13. The chemical battery or cell

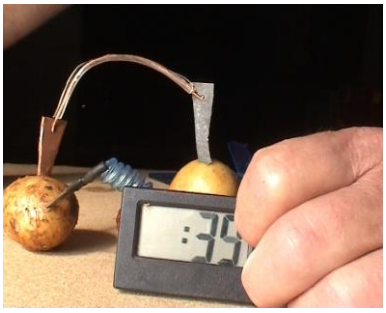
a)experiment
Material:
an old cell
Action:
open the cell
What?
What do you see?
A cell consists of two unlike metals, (zinc and carbon) and an electrolyte.

The voltage is 1.5 volt
Cells of 4.5 volt are three cells connected in series.
The small top of the battery is connected with carbon (+) and the other one (-) with zinc

Why?

If the zinc is used, the battery is out of energy.
In modern cells we use nickel and cadmium.
In rechargeable batteries the process of running down may be converted.

b)making a battery



Material:

a plate of copper and zinc, two wires, a potato or an apple and a clock that works on a low voltage

Action:

connect the wires of the clock to the copper plate and the zinc.
Put the two plates into the apple.

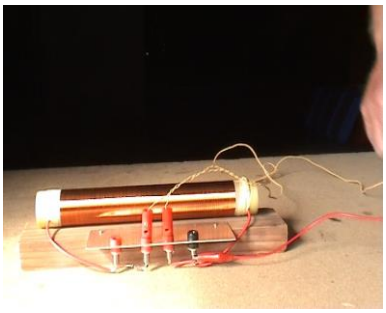
What:

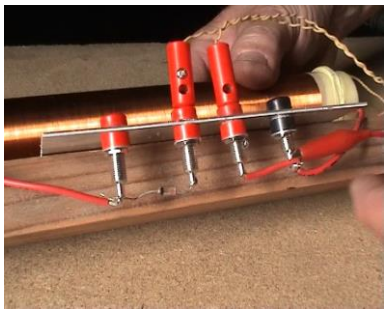
the clock works

Why?

The apple is the electrolyte

14. Music for free





Material:

a diode, a resistance of 47000 ohm, a lot of copper wire and a plastic tube

Action:

-wind copper wire round the plastic tube (100 windings) and make a circuit of the wire, the diode, the resistance and put the ear-phone parallel to the resistance.
-connect the circuit to the earth
-connect the antenna

What?

you can hear music over the ear-phone.

Maybe you should hold the coil (with your finger) in different places to find the exact frequency ,in order to have the best reception.

Why?

The coil works as the second coil of a transformer.

The first coil is the transmitter and uses alternative current with a high frequency;

The diode is the rectifier.

You hear the strongest transmitter without using electricity.

When using an amplifier instead of the ear-phone the music sounds louder, but in that case you need electricity.