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Information Guide

Rubbish Science

A guide to teaching students science using ONLY items from the recycling bin

Information Guide

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FORWARD

The ethos behind this work is that everyone can have a good basic start in science - it does not require expensive equipment, the power point presentations and use of modern technology that is deemed 'essential to study life on this planet'.

So the book has been written for those unable to have so-called modern technology.
It is sourced with **recycled rubbish**. **Free. Unwanted thrown away items.**

After many years of teaching science to pupils aged 10-18 I have followed basic fundamental knowledge needed to enjoy learning science at school, using real materials, plant materials and animals in a way that will inspire both teachers and pupils.

I would like the pupils to have **all the facts** written to read..... bright pupils will easily follow the teacher information.
This is a purposeful extra to stretch the talented.

I have concluded each chapter with filling in missing words, as I think the pupils are working with **well constructed science statements**, which is a good grounding for making future progress.

Before using recycled containers, ensure they are hygienically cleaned. Some of the 3D models can be adapted to what you have in your recycle boxes.
Please send the publisher any exciting new pictures.

There may be a small outlay on scissors, sellotape, a permanent marker pen, a lemon and some shiny small balloons. You could also use a stop-watch or make a pendulum counter or a sand clock (egg timer).
It is likely that most if not all these items are already available in your school, club or home.

This course is 99% recyclable!! Without harm to the environment.
Young people loving the environment and understanding their responsibilities to it in the future is very precious..... **SO ENJOY THE BIOLOGY.**

The Author

Rubbish Science

A guide to teaching students BIOLOGY
using ONLY items from the recycling bin

BIOLOGY FORWARD

The ethos behind this work is that everyone can have a good basic start in biology - **it does not require expensive equipment**, the power point presentations and use of modern technology that is deemed 'essential to study life on this planet'.

So the book has been written for those unable to have so-called modern technology.
The practical activities are sourced with **recycled rubbish**. **Free. Unwanted thrown away items.**

After many years of teaching science to pupils aged 10-18 I have followed basic fundamental knowledge needed to enjoy learning science at school, using real materials, plant materials and animals in a way that will inspire both teachers and pupils.

Throughout the chapters bright pupils and teachers can read the more in depth scientific information written in smaller type.
This will stretch the TALENTED

I have concluded each chapter with filling in missing words, as I think the pupils are working with **well constructed science statements**, which is a good grounding for making future progress.

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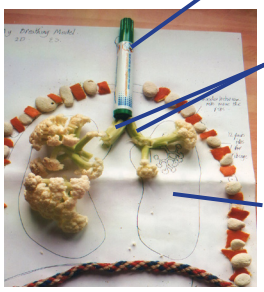
The Author

Muscles - the hard workers

Lung Models:

2D



long cardboard tube

shorter 1/2 card tubes

polythene bag

12 plastic bottle tops each side

very small balloon

empty gel pen case

3D

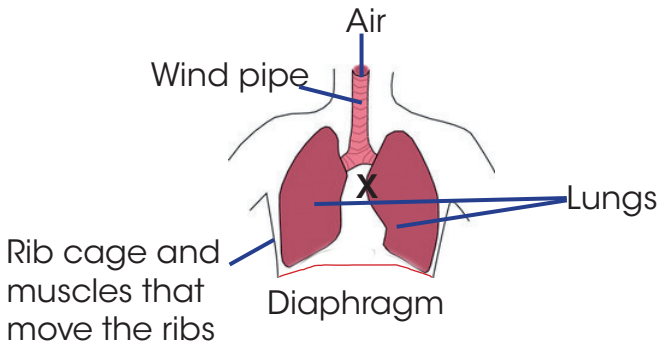
A double sheet stout plastic carrier. Dome and secure with strong elastic bands.
Push up and balloon empties

3 types of muscle

Muscles are made out of special cells that can shorten. When a muscle is working it changes shape and becomes shorter and fatter (it bulges).

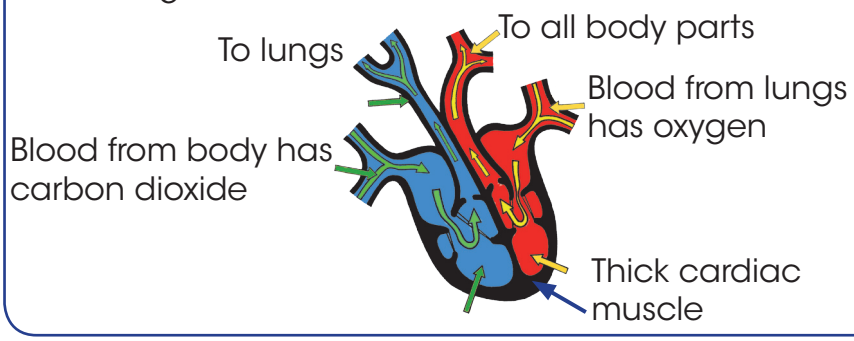
1. Muscles work in pairs across a joint, e.g. biceps raises lower arm, triceps straightens lower arm again, at the same time pulling the biceps, lengthening it ready for its next contraction.
2. The muscles in the intestine walls move food from the throat, through the stomach and along the intestines.
3. The heart muscle beats non-stop to pump blood round the body and keep us alive.

The LUNGS - the breathing movements are made by the muscular sheet called the diaphragm and the muscles which move the 12 pairs of ribs.



X is where the heart is

The HEART is made of cardiac muscle which beats all life long.



1. Make a model lung in 2D on cardboard, or 3D using bits from the recycle box.
   a. 2D lung model - need 2 x 12 small bottle tops for ribs, cardboard tubes for the windpipe and branched tubes. A food bag, I used a cauliflower on my model sheet, for each lung attached to the tube with sellotape, colour in red between the ribs to represent muscle.
   b. 3D lung model - using a compass, poke some little holes in a circle at the base of a large clear yoghurt pot (ask an adult). Insert closed scissors into the hole and twist to make it large enough for an empty biro case. From inside, put a balloon over the other end of the biro case. Using strong elastic bands, cover the base of the pot with strong polythene. see photos
2. Heart beat, breathing rate and muscles all work together during exercise.
   a. Count heart beat at rest for 30 seconds.
   b. Exercise in the best way, safely for you. Measure heart beat and breathing rate straight after.
   c. To count heart beat, place middle finger of right hand gently on the pulse of the left wrist.
3. Breathing rate. Count the number of inhalations over 30 seconds.

Results:

Measurements made over 30 seconds

Person	Heart rate at rest beats/30 seconds	Heart rate after exercise beats/30 seconds	Increase	Breathing at rest inhalations over 30 seconds	Breathing after exercise inhalations over 30 seconds	Increase
Me						
?						
?						
?						
?						

(10)

I made a ____D model.

Here are some notes on what I used to make the model and how I put the pieces together.

(10)

Conclusion:

Many muscles in the body work together during exercise.
The heart rate _ _creases to pump blood which is carrying g_ _cose and o_ _ _ _ _ to the muscles. The muscle cells carry out faster r_ _p_ _ _tion to release e_ _rgy. The blood carries the waste c_ _bon _ _o_ide back to the l_ng_. The breathing r_ _ _ increases to take in more ox_ _ _n and exhale more CO_2. The muscles in the walls of the intestines slowly move the f_ _d along so it can be d_g_s_ _d to supply the glucose to the b_o_d.

10

Analysis:

<u>Carefully draw a copy of the diagram of heart and lung</u>

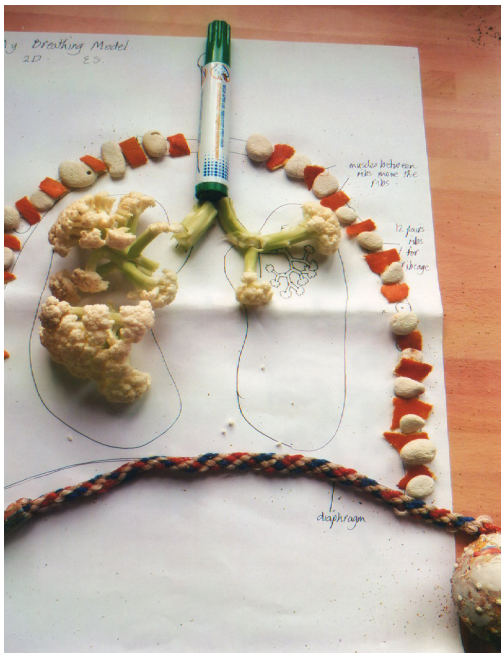
10

Marks 40

1. Making holes in a circle

2. Making hole larger for plastic tube

3. Insert tube then attach balloon and lastly thick plastic sheet as diaphragm



5. Larger view of 2D moedl lungs

4. Pull sheet down, air enters the balloon

Rubbish Science

A guide to teaching students PHYSICS and CHEMISTRY using ONLY items from the recycling bin

PHYSICS AND CHEMISTRY FORWARD

My second Rubbish Science Book. Chemistry with Physics

This book is to inspire teachers of pupils who are an age that has a strong sense of inquisitiveness and still love learning by experiments.

All the tasks can be done in just a room with tables. The equipment is basically used containers, dishes, scraps of materials, paper, magazines and cardboard from the recycle bins. Please ensure they are clean. There is no cost for experimental containers, but there are a few consumables (see list).

I would like young scientists, anywhere in the world, to be able to understand some basic science experiments without needing to buy costly apparatus. Great scientists like 'Robert Hooke working with springs', 'Isaac Newton watching apples fall' are examples that deep concepts can be discovered using simple materials. It is the 'thinking' that leads to discovery.

Faraday loved giving lectures to young scientists at the Royal Institute of Science in London. He famously started a childrens science lecture 'I am just like you. I am here to learn about the world'. He did not like the exploitation of science to commercialism.

My book has been written for young scientists to attain a high level of thinking science, but a very low level of commercialism. Hopefully schools in very poor areas of the world can access science without the need for expensive resource. This is a great way to learn about the fragility of the world's resources, by using recycled and cast-off materials in all schools.

The overall message is to encourage, future generations, at a young age to think about a **cleaner, greener, happier planet**.

Technophilic Homo Sapiens share this planet with thousands of species of plants and animals..... however are we behaving like 'spoilt kids' ***wanting*** everything, ***taking*** everything and ignoring the problems for future generations. Generations of ***all*** life forms..... **SO ENJOY THE LESSONS.**

The Author

Fruity electricity!

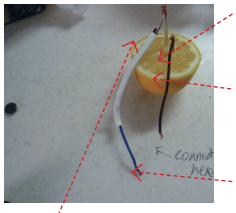
A. Static electricity.

1.  20 pieces of paper

2. 
Test object rubbed by test cloth

3. 
Test object attracting pieces of paper

B. Fruit battery



Types of electricity:

Static electricity. When 2 surfaces are rubbed together electric charge can build up. This can be a positive (+ve) or a negative (-ve) charge. If we touch a charged surface the charge will transfer to us to give an electric shock. Planes, in flight, build up static on the outer metal parts and this is discharged on landing. Sparks can be seen between different layers of clothing and sometimes crackles are heard (when undressing) from static build up from synthetic fibres.

Current electricity. You can produce a small amount of electricity using chemicals found in fruit and vegetables and their reaction with 2 different metals placed in them. This current will flow round a simple circuit by connecting the 2 metals with copper wire. Copper is a good conductor of electricity. A component that has low energy usage (e.g. a watch) could be connected into the circuit.

The best metals to use are a piece of copper and a piece of aluminium in the fruit (or vegetable) as these will give a higher POTENTIAL DIFFERENCE so more charge!

There are 2 types of electricity. Static electricity builds up on surfaces but does not move. It can give you an electric shock when you touch it e.g. static builds up on a TV screen and clouds too (to produce lightening).

Current electricity 'flows' along metal wires and through components that make up a circuit. In fact the charge moves, but the metal atoms stay still. The solutions of chemicals in many fruits and vegtables will react with metals placed in them to produce a small quantity of electricity that can flow in one direction round a circuit. The best 2 metals to produce a useful charge are copper and aluminium, but these two electrodes must not touch, inside the fruit, so there should be a small gap (about 5-10 mm) between them.

Instructions:

A. Static electricity.

1. Cut up about 20 tiny pieces of paper
2. Leave on a dark surface. Now choose some thin (plastic) objects to try to charge e.g. plastic ruler, biro case, polythene bottle.
3. Select some different materials about 20 cm square. Try each material one at a time on each test object to see which produces the most static. Rub the object vigorously with the material, then hold object near the paper pieces and count how many are attracted.

B. *Fruit battery -* Try different fruit and vegtables. Oranges, lemons and potatoes are good.

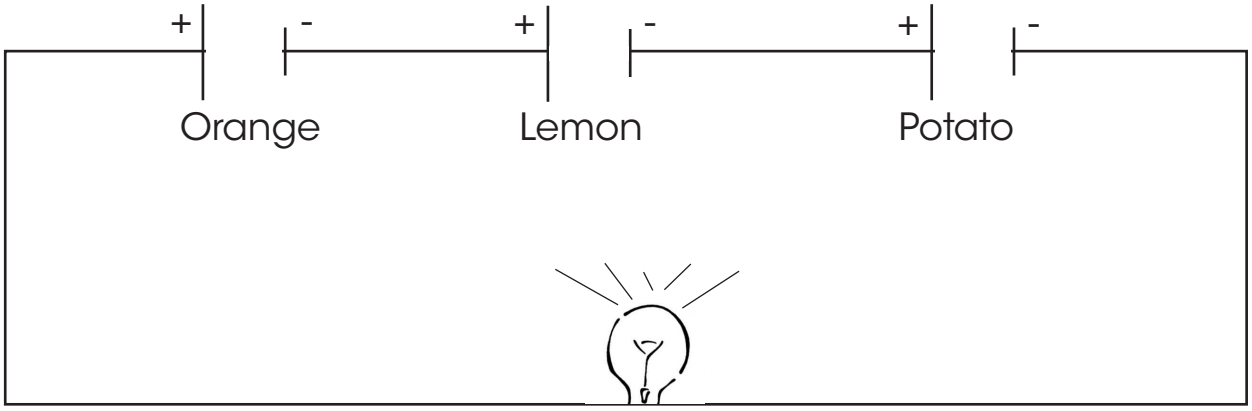
1. Cut fruit in half
2. Push copper and aluminium electrodes into fruit leaving a gap of 5-10 mm between.
3. Remove the battery from the component* used. (A travel clock is less fiddly than a watch).
4. Connect the +ve and -ve terminals of the component to the electrodes using copper wire. If nothing happens re-connect to electrodes the other way round.
5. Repeat using different fruits and vegtables.

**** Could use a low amp bulb instead***

Three fruit/vegtable batteries in series

You can increase the voltage by wiring the batteries together.

The current produced is <u>direct current.</u>



Activity A **Static Electricity Results**

Test object	Cloth type	Electrostatic charge. (number of pieces of paper attracted)

Activity B

Fruit Battery Results

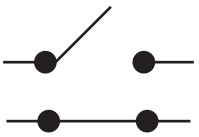
I tested the following metals and fruit/veg _____

_____

I found out that _____

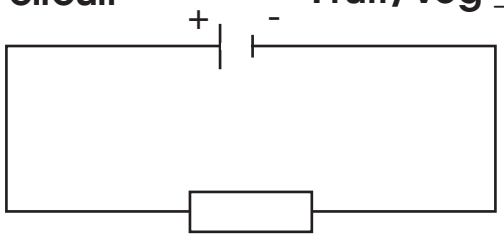
_____

Circuit diagrams

	Battery (or cell)	We used a fruit battery
	Connecting leads	Made of metal to conduct electricity
	Switch open Switch closed	Controls flow of electricity in circuit

My circuit

Fruit/Veg _____

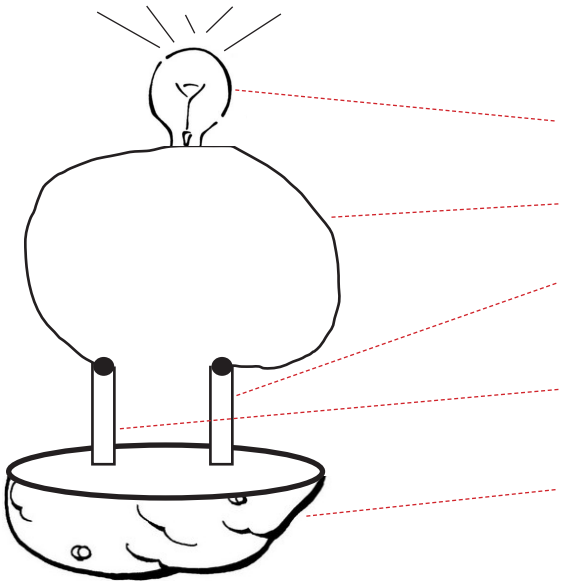


A circuit is a loop made by conducting wires and components for electical current to pass

Component _____

5

Label this diagram of a potato battery

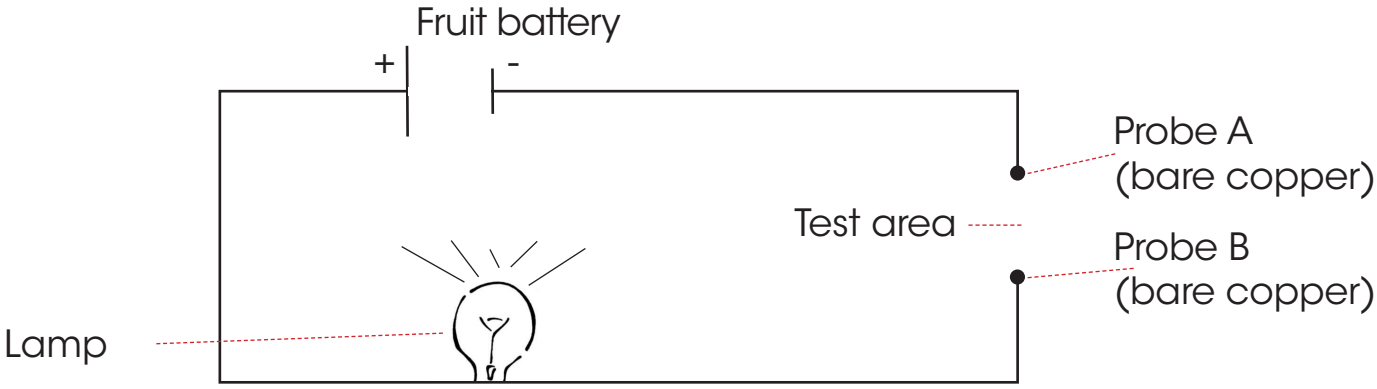


Name of part	Purpose
Potato	

5

Activity A - Testing for insulators of electricity

Homes have electrical copper wires covered with plastic, so that the metal parts do not touch and short circuit. This would cause heat (a spark), sound (a bang) so the plastic could melt giving a house fire. Plastic is an insulator and cannot conduct electricity. Insulators are really important in all circuits.
Set up your fruit battery but with a 3rd lead as shown.
Place items between probes A and B. If the lamp lights the item is a conductor of electricity. If it does not light the item is an insulator of electricity.



DO NOT USE MAINS ELECTRICITY - DANGEROUS

Test item	Lamp lights?	Electrical conductor or insulator

Conclusion

The lamp lights when the material the 2 p_ _b_s touch is a c_ _ _ _ _tor of electricity. These are mainly m_ _ _ls. 2 examples are _____ and _____.

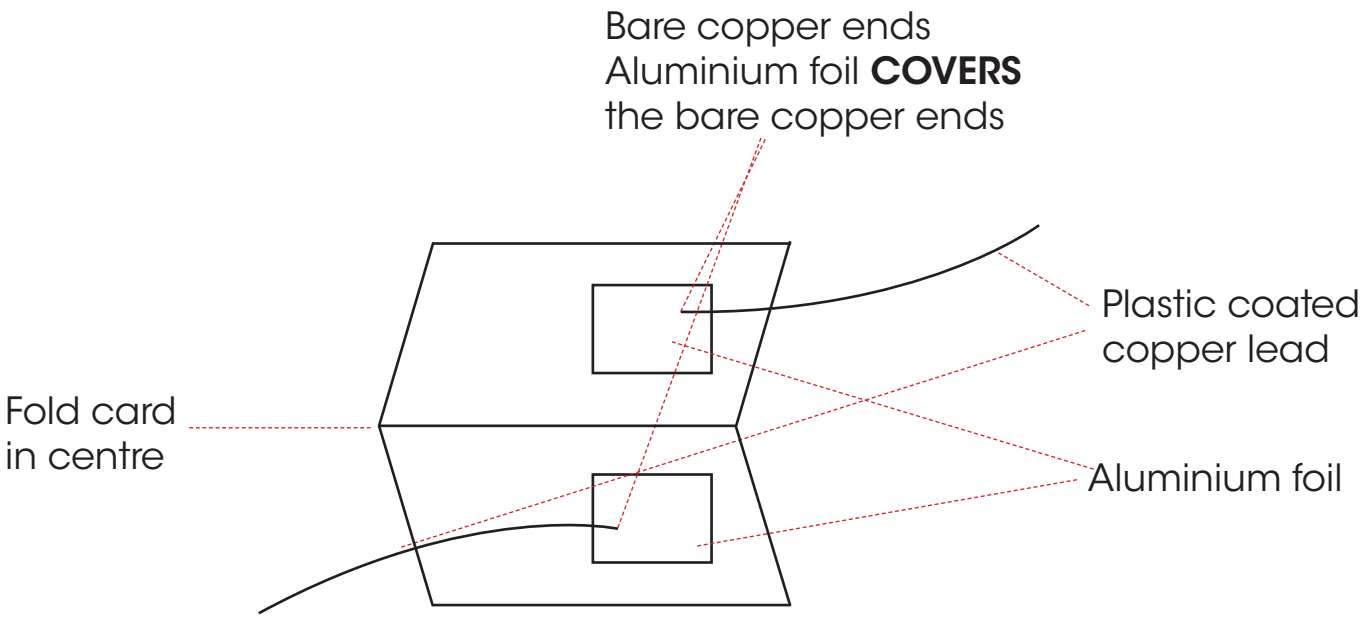
Insulators of electricity cannot c____ current.

Conclusion:

The chemicals in some fruits and vegetables can be used as environmentally friendly producers of _le_tr_ _ _ _y. One fruit can be cut into segments, each holding 2 electrodes to increase the v_ _ _age in the circuit.
A sw_ _ch makes a circuit safer.

Making a simple switch for a fruit battery circuit

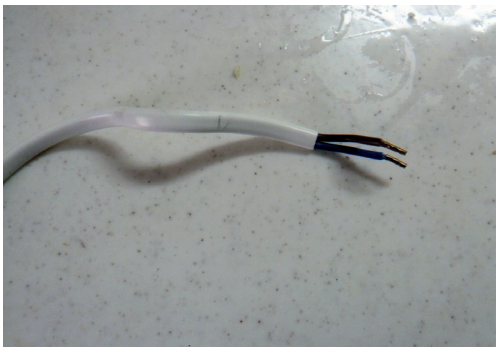
Make a switch from 10 cm x 10 cm piece of card, a small piece of aluminium foil 2 cm^2 and 2 leads with insulation but bare copper ends.



This switch is shown open: When folded together, the aluminium contacts meet and the switch is closed to allow the flow of electricty.

5

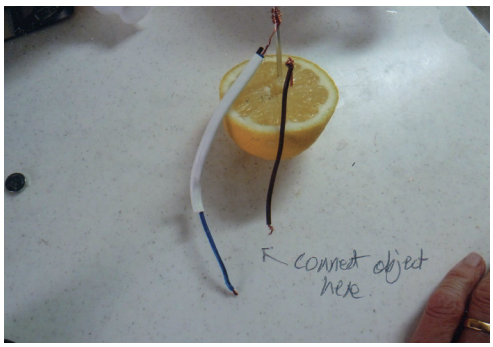
Marks
35



Take an unwanted cable and remove the plastic insulation to expose some of the copper.

Exposing the copper wire. Cut this to make a piece about 12cm long. Stick this into half a lemon or other fruit/veg.

Cut a piece of aluminium (cans are made from this , but be careful of sharp edges) and push this into the fruit, leaving a gap between the copper an aluminium.



Using bits of copper wire complete the circuit as shown. Use the 2 bare ends to connect to a device that will show whether you are making electricity.

For example an egg timer

Timer with battery removed. Connect one of the copper wires to the positive terminal and the other end to the negative terminal. Ensure the wires do not touch each other. If the appliance shows no change it could be you need to swap round the electrodes to get the current flowing in the right direction