Simple and Beautiful Experiments II

by LADY CATS and Japanese Teachers

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LADY CATS (LADY Creators of Activities for Teaching Science) is science teacher's organization consisting of women ranging from primary school teachers to university researchers.

We are dedicated to exhibiting simple yet beautiful science experiments that demonstrate the principles of physics while striking students' interest. Examples of such visually appealing and effective experiments are Soap films, the "Dragonfly", the "Running Cats", Roget's jumping spiral, and Benham's top for folded paper.

The Science of Soap Films

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1. Soap Films and Minimum Surface Area

Due to the surface tension, a film of soap is formed within a shaped wire framework with a minimum surface area. Belgian physicist Joseph Plateau demonstrated this in 1873.

2. Soap Film Experiments

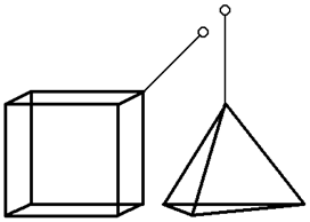

Fig.1

◆WIRE TETRAHEDRON

1st - Form a Tetrahedron with some wire (Fig.1).

2nd - Dip the frame into a solution of soap and water.

〈Questions〉

1) Pre-Experiment: Before you conduct the experiment, predict how the soap film will adhere to the tetrahedron frame.

2) Post-Experiment: How did the soap film actually form to the frame (Fig.2, 3)? Was your prediction correct? Why?

Fig.2

Fig.3

◆PARTITIONED RECTANGLE- A wire rectangle is separated by an another piece of wire (Fig. 4).

〈Question〉

1) Which direction will the wire move when one of the soap films is broken? Explain your reasoning.

Fig.4

◆FUNNEL

A funnel is dipped into a soapy solution (Fig. 5).

〈Questions〉

1) How high up the funnel will the soap film rise?

2) What is the scientific reasoning behind the outcome?

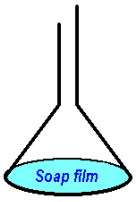

Fig.5

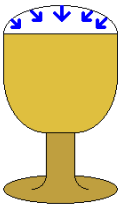

Fig.6

3. Educational Aim

Soap Film experiments strike students' interest in surface tension. The experiments are not only visually appealing, but the outcomes usually contradict the predictions.

Surface tension plays an important role in the way liquids behave. It allows water to be poured above the rim of a glass (Fig.6).

DRAGONFLY

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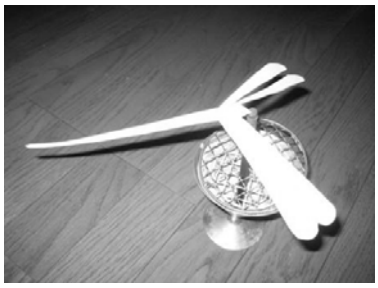


1. Let`s make a Dragonfly!

Stopping on a twig, with its nose top.

2. How to make a Dragonfly ?

1. You will need a cardboard or some thick paper.
2. Photocopy the shape of dragonfly body and wing.
3. Glue the body and wing.
4. Balance the Dragonfly on your finger or on the eraser of a pencil.

3. Physics in a Dragonfly.

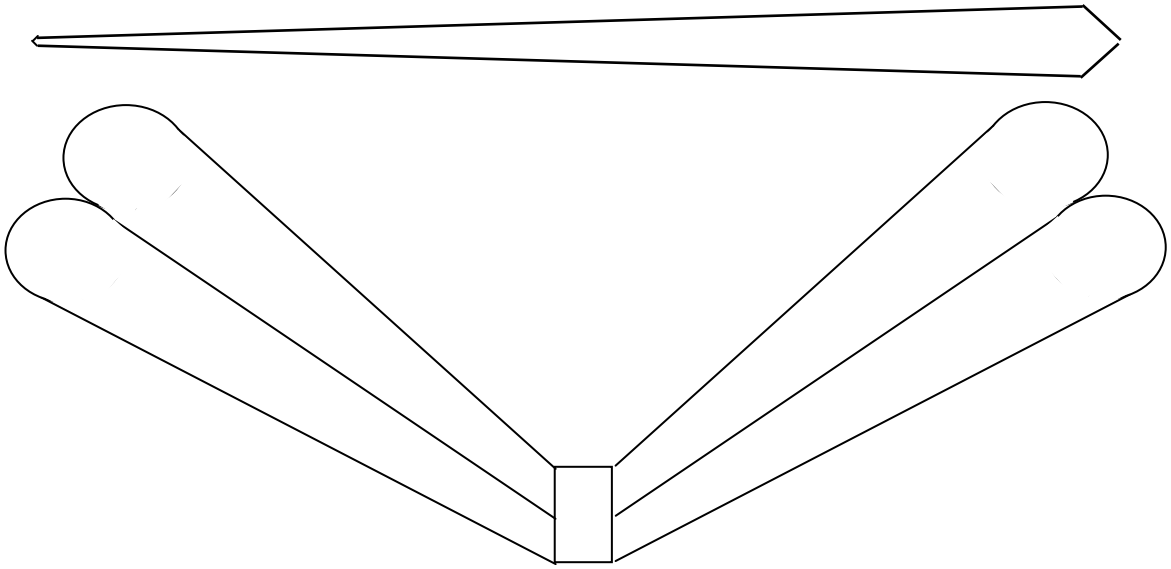
When the wing is bent to forward, it balances.

It is good to think about gravity. Center of gravity moves ahead when the wing is bent to forward.

4. Try more

Can you make Dragonfly with thinner paper, foil, or other paper?

We have Bamboo Gragonfly Toy in Niigata, Japan.



This is originally invented by Yuichi Tsugawa, Tanoshii jugyou, 1994.

FINGER COBRA

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1. What is a Finger Cobra?

Finger Cobra is originally made of Bamboo leaves in Okinawa which is the most beautiful southern island in Japan. There are dangerous Cobras named “HABU” in Okinawa. Once “HABU” bites your finger, you cannot pull it out. The Finger cobra is a good tool to know how dangerous the HABU is, and it also is good tool to learn about friction.

2. How to make a Finger Cobra.

Preparation: Paper ribbon, rubber band, recycle paper, glue, scissors, tape

(1) Cut 4 ribbons that are 60cm long each.

(2) Put 1 ribbon on another ribbon. Fold by 60 degrees like fig.1.

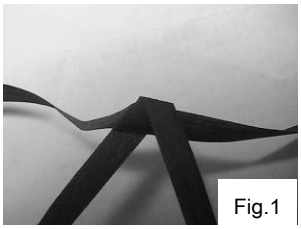
Fig.1

(3) Fold the back ribbon to forward by 60 degrees like fig.2. Make 2 sets.

(4) Take the right strand and weave it over and under the other 2 strand like fig.3.

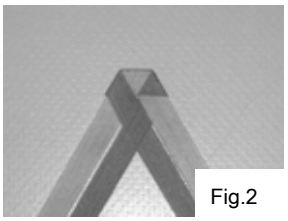
Fig.2

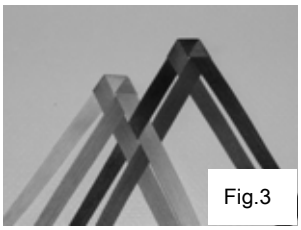
Fig.3

(5) Turn and connect the other side the same way.

It is easy to use a bar and a rubber band like fig.4.

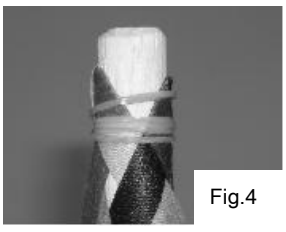
Fig.4

(6) Take the new right-most strand and do exactly the same thing.

(7) Braid four-strands as a round Cobra.

(8) Make the tail with one strand.

3. Physics in a Finger Cobra

When you try to pull out, the friction becomes strong.

If you push, the friction becomes weak. Why?????

Original of this guide : http://www.ichinoseki.ac.jp/gijutsu/dk_txt_pdf/yubihabu-text.pdf

Running Cat

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Preparation: Paper Cup, Straw (thin×1 and thick×1), Soft wire(15cm), Drawing paper, Sticky tape, Scissors

How to make?

1. Pass the wire through the paper cup. Bend the soft wire as shown in Fig.1.
2. Cut the straws as shown in Fig.2.
3. Make the hole in the bottom in the paper cup. Pass the thin straw through there and fix it to the wire (Fig.3).

Fig.1

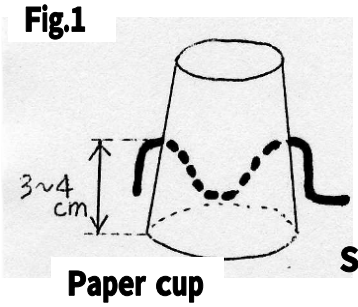


Fig.2

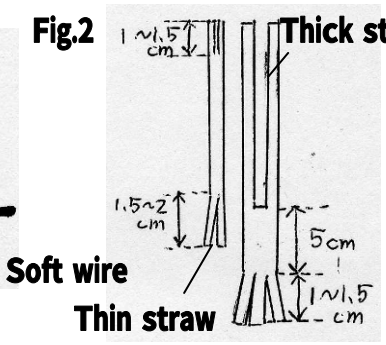
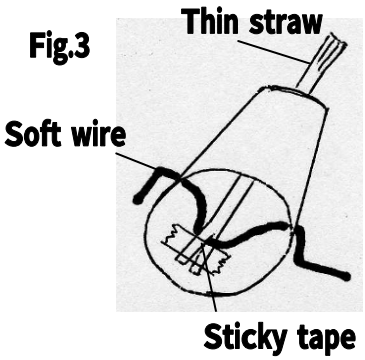


Fig.3



4. The bottom in the paper cup is taped up. Pass the thick straw through the thin straw, out side the cup. Fix the thick straw to the paper cup with the sticky tape (Fig.4).
5. Draw the Cat's face on the paper. Connect A and A' from Fig.5 with the sticky tape.
6. Fix the Cat's body to the thin straw with the sticky tape. The Cat's head and tail are put on the thick straw with the sticky tape (Fig.6).
7. When the wire is turned, the paper cat will move like a cat running.

Fig.4

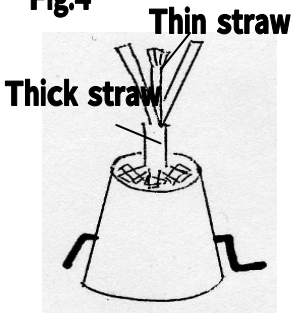


Fig.5

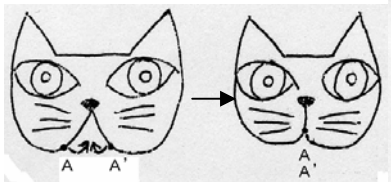
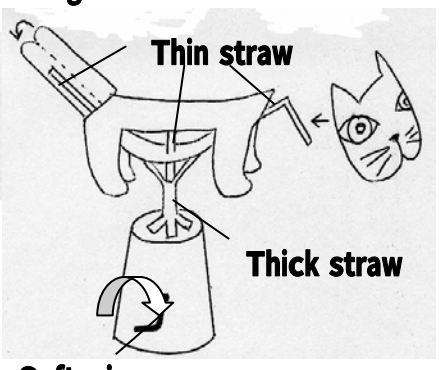


Fig.6



Reference: http://www.flying-pig.co.jp/

Roget's Jumping Spiral

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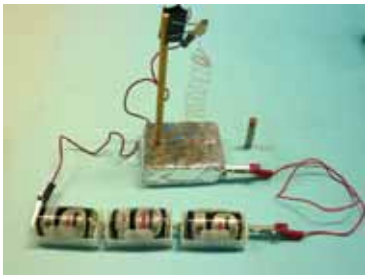
1. What is a Roget's Spiral?



It is a device showing that the electric current of the same direction attracts it with parallelism each other by each magnetic field. This apparatus was devised by Peter Mark Roget(1789-1868), who was a physician. Though Mercury was used in those days, I will substitute it for aluminum foil this time. This was devised by Aichi general education center.

(1) When it is electrified, the spiral shrinks by gravitation between the parallelism.

(2) The spiral tip is separated from the aluminum foil, and the electric current stops.

(3) When a spiral is restored, an electric current flows again because the tip touches the aluminum foil. By this repetition, the spiral vibrates up and down.

2. How to make

<Preparations thing>

enamel wire (140cm), bar magnet, glass paper, aluminum foil, clip, wooden board, wooden stick , three dry cells, two leads, three battery holders

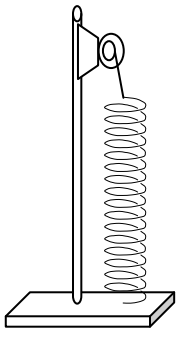
<How to make>

(1) Sharpen both ends of the enamel wire on glass paper.

(2) Wind enamel wire on a pen of about a diameter of 2cm.

(3) Wind aluminum foil on wooden board, and stop it with tape.

(4) Install a spiral of the (2) in a clip, and catch it in the wooden stick.



(5) Install the stick in wooden board, and adjust the spiral tip to touch the aluminum foil.

(6) Set dry cells at holders, and connect the holders to the aluminum foil with a lead wire. Connect a clip to holders likewise.

(7) Insert a bar magnet in a spiral, and then the spiral vibrates up and down.

Caleido cycle

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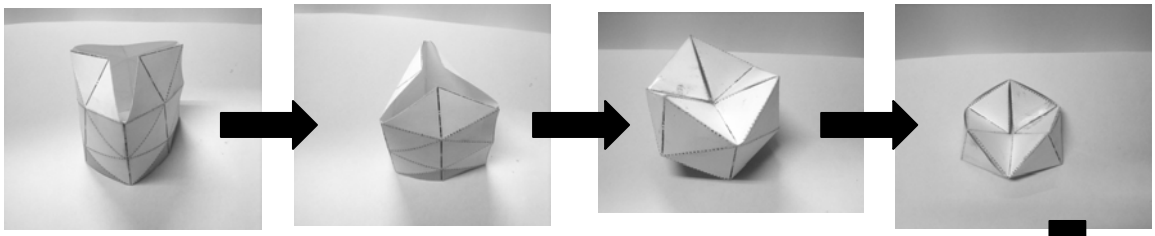
Let`s make a Caleido cycle!

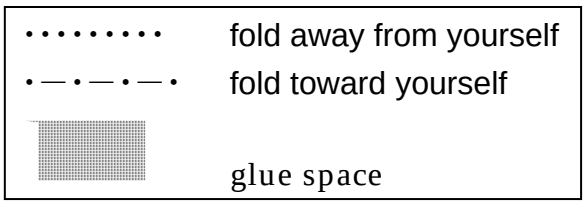
Let's make the toy of the paper. It is what connects a triangular pyramid and forms a ring.

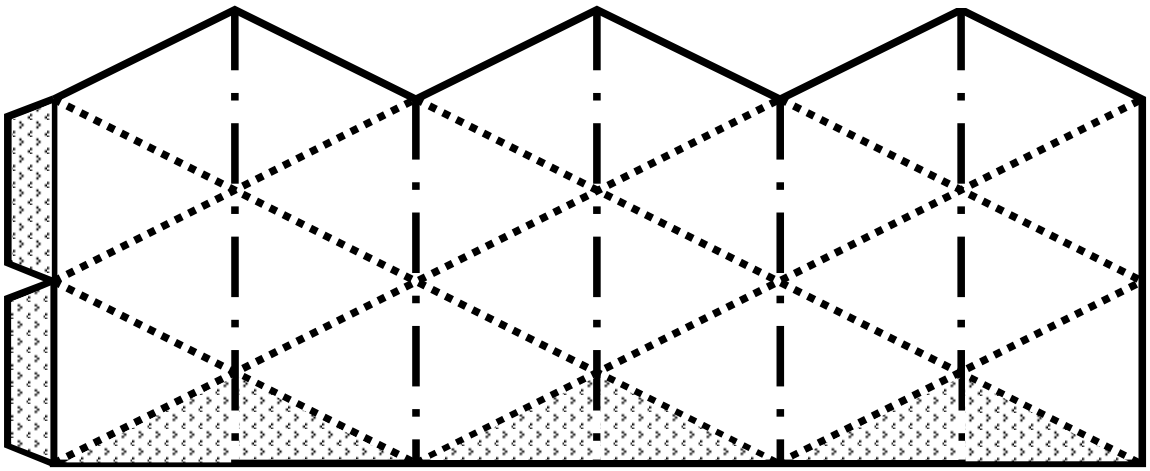
The picture changes round and round when it is upset.

How to make

1. It cuts it along the line.
2. It folds with the crease.
3. This ties with the paste, and made the circle.
4. tucks it in from above to the inside.







Reference: “ Oyatokono Wakuwaku Kagaku Hiroba No.13 (Japanese)”

Benham's Top for folded paper

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2) Marugame Senior High School, JAPAN
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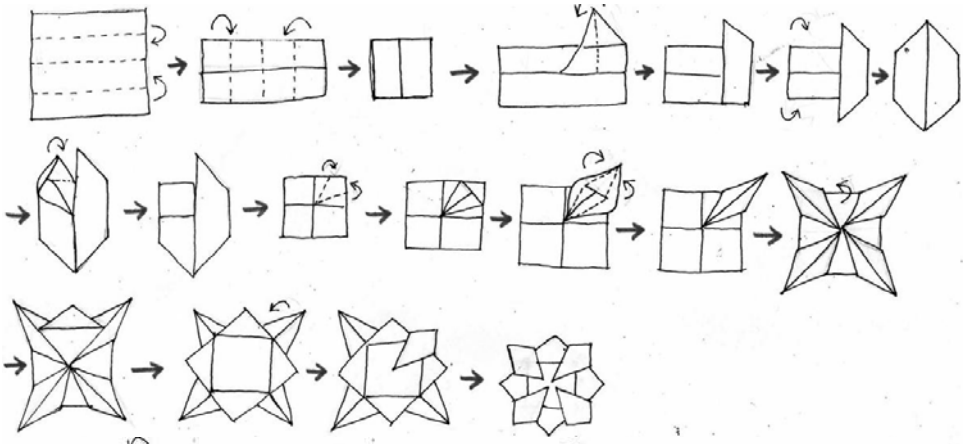
Preparation: News Paper or Miss Print Paper
(10cm×10cm)

How to make?

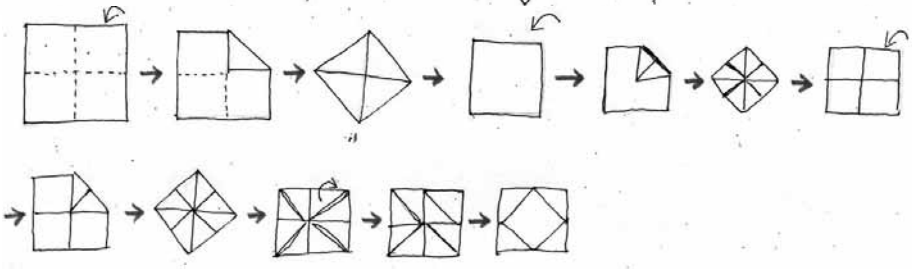
This top is made up of three parts.
Fold papers in the following way.

・・・・・・・・・	fold away from yourself
・—・—・—・	fold toward yourself

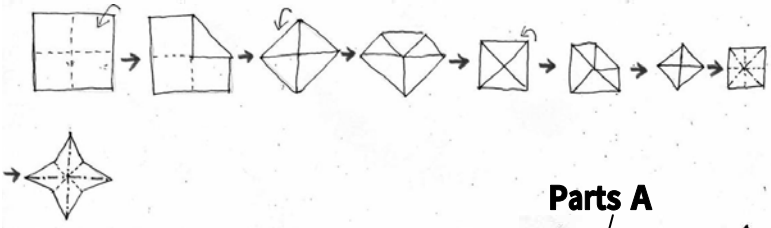
Part A



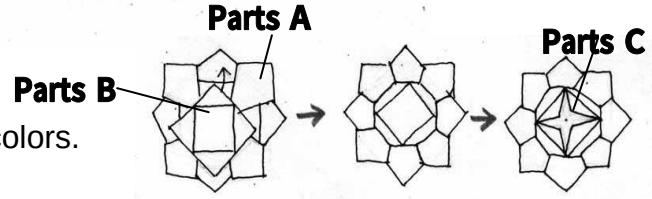
Part B



Part C



Put the three parts together.
Spin the top, you can see different colors.



Reference: " Oyatokono Wakuwaku Kagaku Hiroba No.15 (Japanese)"

FOLDED PAPER CRAFT CRANE

Takashi HOSHINO

Meijo University, NAGOYA, AICHI 468-8502, JAPAN

[INTRODUCTION]

I introduce the most popular “ORIGAMI” in “FOLDED PAPER CRAFT CRANE”. Japanese people can make it easily. But, the “FOLDED PAPER CRAFT CRANE” can’t fly like a paper airplane.

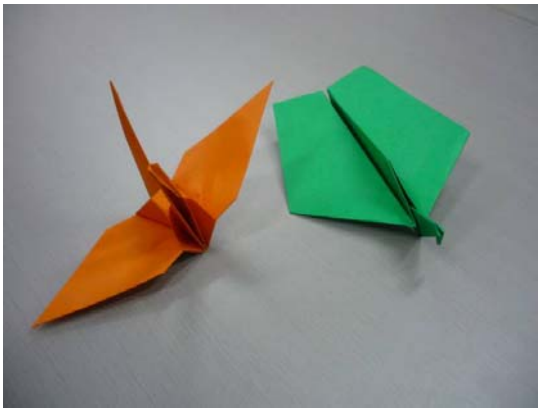
Therefore now I introduce you the “FOLDED PAPER CRAFT CRANE” which can fly.

[ORIGAMI (PAPER CRAFT)]

Will you know "ORIGAMI"? The “ORIGAMI” is Japanese Traditional play and art.

The “ORIGAMI” is a good teaching material in the school education. Because there are the three reasons.

1. The “ORIGAMI” develops hands-on-skill of students early.
2. The “ORIGAMI” brings up student’s sensibility of color, creativity, the concentration.
3. The “ORIGAMI” use only daily life paper. So, it does not take so mach cost.



Left; FOLDED PAPER CRANE
Right; FOLDED PAPER CRANE AIRPLANE
「PAPER AIRPLANE」
ISBN4-576-95204-8
the publisher：Futami Shobo

[PAPER CRANE AIRPLANE]

It is suitable to study physics with “ORIGAMI”. Paper airplane can fly with same kind of forces. There are invisible. It is difficult for students to understand them. But paper airplane can understand these easily.

Please refer under the sample.

Reference:「PAPER AIRPLANE」 ISBN4-576-95204-8
the publisher：Futami Shobo http://www.futami.co.jp