LEARNING RESOURCE

MAGNETIC DANCER

MAGNETISM RESOURCE 1

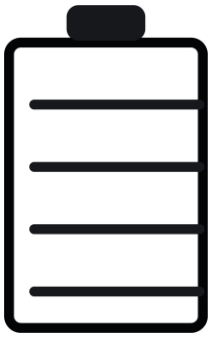
MATERIALS

- Small neodymium magnets, approx. 5mm (1 per child)
- 1 x large paperclip per child
- 1 x small paperclip per child
- 20cm piece of thread per child
- Sewing needles
- Mathematical compass
- Rubber or blue tac
- Scissors
- Tape
- Strong glue (glue gun or multi-purpose glue)
- Tissue paper
- Squared 5 litre water bottles or A3 card (plus some corrugated or thick card)
- Pencils
- Rulers
- Set squares optional

PREPARATION

The key to this activity is to have a thin yet rigid frame for each child to work with.

The best way to do this is to get some 5 litre water bottles (squared in shape) and cut along the ridges.



cut here

This provides a strong framework relatively easily, however it does require some preparation.

The other option is to allow the children to create their own framework.

For this you will need some A3 card. Cut lengthways in 5cm strips. You should be able to get approx. 6 strips per sheet; it doesn't matter if some are slightly shy of 5cm.

Give each child a strip of card and get them to measure 10cm intervals along the length. At each 10cm mark they should draw a line straight across the strip. They should have approx. 2cm left over at the end.

Once they have drawn the lines, they will need to fold along those lines; all folds must go the same way so that the strip folds around to become a square frame. The 2cm tab, will allow you to attach the ends together. Children may need to help each other put the tape in place.

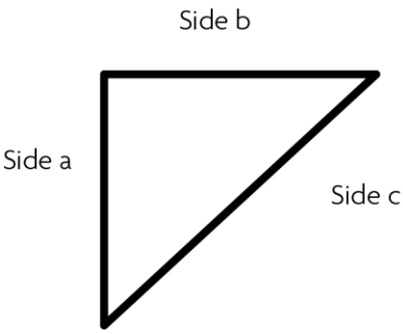
Each child should now have a square frame, but will notice that it is not able to maintain its shape, if they try to stand it on its end. In order to get it to stand up and stay square children will need to brace the corners, using the corrugated, or thicker card.

If there is time you could base a maths activity around the angles and lengths required, or could just have a go.

Should you wish to try with your class the equation for finding the hypotenuse (longest side of a right angle triangle) is side a2 + side b2 = c2.

So in our case that is: side a (3x3) + side b (3x3) = side c2
Side a = 9 (+) Side b = 9 (=) Side c = square root of 18 (=4.242)

Can either do some estimates to work out square root, or just use the function on calculators.



We would recommend using strips of thicker/corrugated card, approx. 13cm x 5cm.

For speed you can get children to measure 3cm and draw across strip, then measure approx. 4.25cm and draw a line, then another 3cm and draw a line.

Fold along all marker lines.

Using tape attach the first 3cm section to inside of the frame, starting from the corner (fig.1).

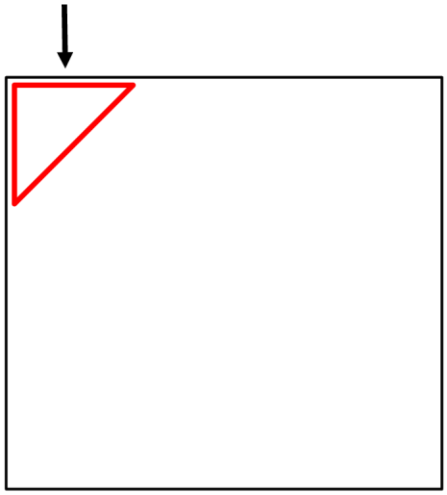
Fold around and attach other 3cm length, so that the final fold of the strip is tucked in tight to the corner and tape in place (fig.2).

Tape the additional tab of card in place and make sure that there is tape fixing the brace to the frame at;

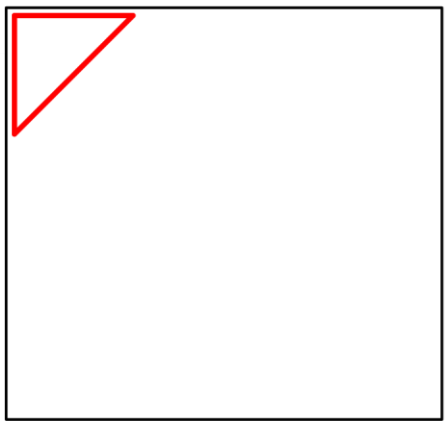
- The corner of frame
- Next to each fold (fig.3)

(fig.1)

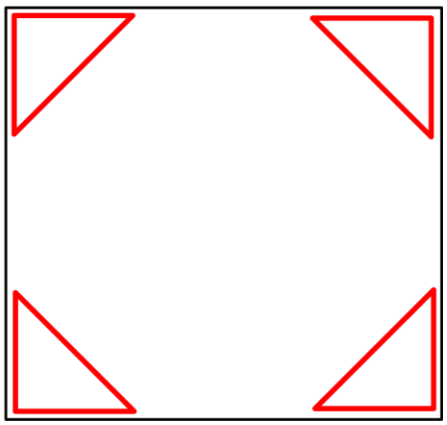
(fig.2)



(fig.3)



(fig.4)



- Repeat with all 4 corners (fig.4)
- If time permits there are various maths/science experiments that can take place in the build up to making this frame:
  - Seeing if there is an optimum length to the sides of a triangle for greater strength;
  - Does it matter what order and where you start attaching the corner braces?

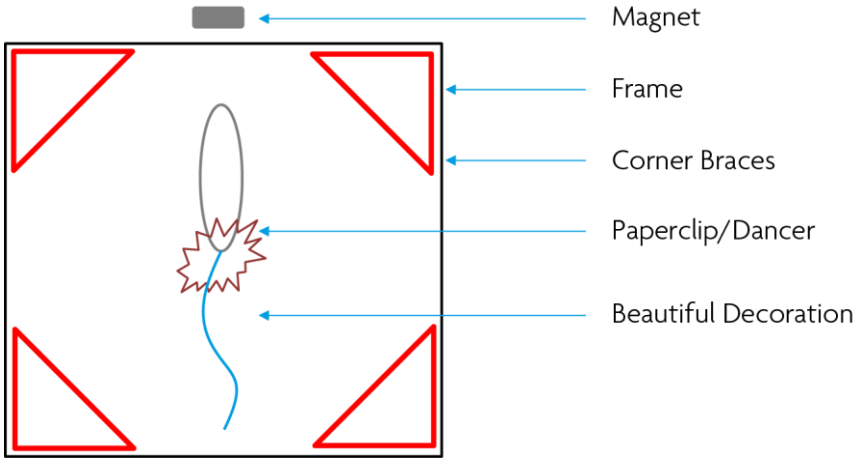
- What is the best type of card to use?
- Does it matter which way around the lines of corrugation run?
- What happens if we make the whole frame bigger or smaller?
- Does this effect what we need to do to stabilise the structure?
- Can we find better materials to build this structure from?

ACTIVITY INSTRUCTIONS

1. Get your frame and stand it up in front of you.
2. Using a ruler and pencil find the exact middle of the bottom edge of the frame and mark the spot.
3. Using a mathematical compass make a hole through the frame on that spot (you may need to put rubber or piece of blue tac underneath while doing this).
4. Repeat steps 1 and 2 with the top edge of the frame.
5. Get the piece of thread and tie one end to the small paperclip; double knot it.
6. Get the other end of your piece of thread, lay your frame down, and push your thread through the hole you just made at the bottom edge, from the outside of the frame (you may need to use needles for this)
7. Pull the thread all the way through the hole until the paperclip is flush along the underside of your frame, then tape paperclip in place. Stand the frame upright.
8. Get the large paperclip and tie to other end of thread, making sure that when it is pulled straight up, there is a finger space between the top of the paper clip and the top edge of the frame. Double knot the thread.
9. Get strong glue and put a small blob on the hole in the top edge of the frame. Push neodymium magnet into glue and leave to dry.
10. Using small bits tissue paper and tape decorate large paper clip to look like a figure/person/animal – not too much or it will be too heavy. If you are very careful, you can bend the ends of the paperclip out to look like arms.

11. Gently pull large paper clip towards the top of the frame until the thread is as tight as it will go, without stretching and gently let go. You will need clean dry hands for this. Once the paperclip is within the magnetic field it should stay in place, “floating”. It should look something similar to the diagram below. If you gently blow towards one side of your figure it will start to spin and dance.

12. If time allows you could decorate your frame, to look like a stage.



Suggested Extensions

You could;

- Use digital scales to weigh the paperclip figures and see how much weight the magnetic field can hold up. Can you devise a way of adding more weight to your figure?
- Can you make the magnetic field bigger?
- What is the maximum distance you can have between your paperclip dancer and the magnet, before it falls?
- Does this distance change if you use a plain paperclip that has not been decorated? How could you make this design better?
- Can you find a way to allow more than one “dancer” to perform at a time? Could you make a bigger version of this?
- Do you have to use neodymium magnets for this?

- Can you think of any uses for this item, outside of the classroom? (If used on a larger scale, can it be applied to everyday life? Could it be used to solve any engineering problems? If you could make a giant version of this, what would you use it for and why would other people want to use it?).