DESIGN AND MAKE A CATAPULT

SENIOR

Equipment:	  **1. For 5th/6th classes:** For each catapult: 14 lollipop sticks, 1 rubber band, sellotape, 1small piece of paper (*approximately one quarter A4 sheet*).   **2. For 3rd/4th classes:** For each catapult: 1 bulldog clip, 1 short ruler (15 cms.), 1 thick rubber band, 1 small piece of paper (*approximately one quarter of an A4 sheet*) 
Suggested Class Level:	Senior classes
Preparation:	Ideally, the DPS activity 'Amazing Triangles' should have been carried out previously, in order for the children to have learned about the strength of the triangle.
Background information:	• When a force acts on an object that cannot move, it may change its size or shape. • Some things (*e.g. plasticine/ modelling clay*) stay in the new shape when the force is removed. But some substances, like rubber, return to their original form when the force is removed. The latter are called ELASTIC substances. • Elastic materials store energy when they are stretched, and release the energy when the force is removed. So energy is stored in stretched rubber bands (*this is the energy which you have put into it to stretch it*). This energy is released when the rubber band is let go and it goes back to its original size. • Elastic things will not stretch forever! They will snap if you stretch them too far. • This activity also shows the strength of the triangle. The triangle is a shape often used in architecture because of its strength. (*See Discover Primary Science activity 'Amazing Triangles'*).

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Trigger questions:

What do you use rubber bands for?

What is the advantage of rubber bands over a piece of string? (*They stretch*).

When you stretch a rubber band what does it do? (*It gets longer*).

When you let it go again what does it do? (*It goes back to its original size*).

Do you think a trampoline is elastic? (*Yes!*)

What happens to a trampoline when you jump on it? (*It stretches downwards*).

Then what happens? (*It goes back to its original shape, releasing the stored energy and pushes you up in the air*)

Content:

SCIENCE: Energy and forces: stored energy

MATHS: Number: operations
Shape and Space: 3-D shapes, lines and angles
Measures: length
Data: represent data

Skills:

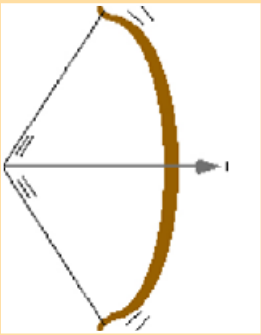
Predicting, experimenting, measuring;

Designing and making (*i.e. exploring, planning, making, evaluating*)

Cross-curricular Links:

History: Catapults were used for a long time in warfare: the Romans used catapults as siege weapons. Later on, the Normans used them also; and in the twentieth century catapults were used in the First World War to fire hand grenades into the enemy's trenches.

Bows and arrows also use stored energy – used from very early times for hunting and in war.



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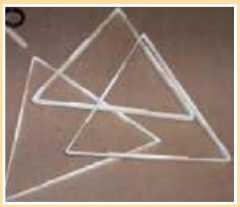
Activity:

The children should be given some rubber bands to play with and explore their properties carefully. (Thickness, stretchiness, etc.)



5th/6th classes:
Make a triangular-based pyramid using the lollipop sticks.
Then make the arm of the catapult, using 2 lollipop sticks.

Attach the arm to the pyramid as follows:
Wrap one end of the rubber band around one end of the catapult arm about 1 or 2 cms. from the end.

Then attach the other end of the arm to the base where the three triangles meet. Secure this firmly with tape (*which acts as a kind of hinge*).

Lastly, attach the other end of the rubber band to the top of the catapult.

Now roll up the piece of paper into a tight ball and fire!
(*by placing the paper on the arm just above the rubber band, pulling back and then letting go. You will need to hold the base with the other hand.*)

Measure the distance the paper travelled.

This can be done a number of times, the distances recorded and the average distance taken.

More Maths:

Various distances and heights of the paper bullets can be measured.

Can the children experiment with various angles of the arm to see how to get the longest distance?

The length of the arm, the length and strength of the rubber band can be varied, data should be recorded and any conclusions drawn.

3rd/4th classes:
A ruler catapult can be made by attaching the bulldog clip to the end of the ruler and then attaching the rubber band to the clip.

Pulling back the rubber band puts energy into it; putting a tightly-rolled ball of paper into the end of the rubber band, and then letting it go, releases this energy very quickly, and the paper may go shooting off.

This should be tried a few times, investigating at which angle the ruler was held, how far the band was pulled, what length rubber band gave the longest distance etc.

The distance the paper travelled should be measured and recorded. This should be done a number of times and the average taken.

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Safety:	**Although paper is soft do not aim the 'bullets' at children as it could frighten them.**
Follow-up activity:	There are a large number of ways in which the principle of stored energy is used to make catapults. The children should be encouraged to design and make their own catapults. They could try using a piece of eggbox as a holder for the paper ball. They could try using rolled-up kitchen foil instead of the paper ball. For 'Design and Make' remember the 4 stages: 1. Explore 2. Plan 3. Make 4. Evaluate