CONSTRUCT YOUR OWN VEHICLE

Goal(s):

- The pupils know that every type of transport needs energy to move forward and that different sources of energy can be used for that purpose with different environmental impacts.
- The pupils understand the general physical terms 'Force', 'Friction', 'Gravity', 'Kinetic Energy', 'Mass' and 'Weight' (see Aid 2 below).

General description of the activity:

The pupils create vehicles of their choice from waste material that the pupils have brought from home and try to make them move. Their experiments are then used as a basis for a discussion of transport, energy use and environmental protection.

Required materials (examples only):

- **Bottle rocket:** Large coke bottle (1-2 litres), a cork from a wine bottle, an old bicycle inner tube (preferably with the thinner type of valve), a drill, and a bicycle pump.
- **Cotton reel racers:** Cotton reel (or 35mm film case), elastic-band, pencil, eraser, small piece of plasticine.
- Scissors, paper and colour pens/pencils.

Required child skills:

Ability to cut accurately and use a drill, measurement in cm & mm

How does this activity fit into the curriculum:

This activity is well suited for lessons in Design Technology, Science, Mathematics, Literacy, Art & Craft.

Safety:

Care should always be taken when using tools.

Ask a colleague or another adult to be present when you launch the rockets. Make sure the launches are done one launch at a time.

Individual steps of the activity:	Required time:
1. Explain the exercise to the children. Discuss with the pupils what can be used to construct the necessary vehicles and ask the pupils to bring waste materials from home that they might use for building a vehicle. 2. Inner bicycle tubes can be obtained from a local bicycle shop.	Introduction and preparation – 15 minutes of a lesson
3. Ask the pupils to build a vehicle of their choice. The pupils can be grouped in pairs of two. 4. If the pupils cannot come up with an idea of what to build then provide examples (see Aid 1 below). 5. Discuss with the pupils how they intend to make the vehicle move forward. 6. Classify the built vehicles depending on the type of source of energy/force that is used for making them move – wind (for example a boat), pressure air (a water rocket), gravity (if you put a car on a inclination), etc. 7. Test how far the vehicles can go. 8. What happened?	Experiment and analysis – 1 lesson
9. Discuss the different sources of energy for transport; which sources are renewable and which ones are limited. Are there alternative types of transport? Discuss whether a particular energy source is limited/environmentally friendly or not and what other means of transportation one could use. 10. Do we need transport in the first place?	Reflection – 1 lesson

Suggestions for combination with other AL activities:

"Mc Car" – Observing traffic behaviour and discussing saving potentials (only suited for older children).

"CO_2 footprint of the journey from home to school" – Illustration of how can we influence the level of CO2 emission through our choice of transport.

[The listed activities above may change when all the activity sheets have been finalised.]

Variations:

Increased complexity: The complexity of the vehicles built could be increased to suit more detailed investigation of propulsion.

Dissemination: Why not invite another class or the entire school to participate in a competition?

Available aids:

Aid 1 – Building instructions for a water rocket, a cotton reel racer, a boat, and a car.

Aid 2 – Energy resources and physical terms involved.

Building instructions

Below you find instructions on how to build a water rocket and a cotton reel racer. The ideas are from a websites called www.Things2Make.com. If you wish to see ideas on how to construct a boat or a car, then please visit the website.

Water rocket

Materials:

Large plastic bottle 1-2 litres, a cork from a wine bottle, an old bicycle inner tube (Preferably with the thinner type of valve), a drill, and a bicycle pump

Instructions:

Cut out the valve from a bicycle inner tube, leaving a small circle of rubber around the bottom. (Keep the rest of the inner tube to make a catapult another day). Check the length of your valve against the cork to make sure the valve pokes through enough so that the pump can be attached. If not, cut the cork down with a sharp kitchen knife.

Use a drill that has a diameter equal to your valve. Carefully and slowly drill through the centre of the cork. Insert the valve into the cork (A smear of Vaseline or cooking oil may help).

Fill a plastic bottle with 1/3 water and firmly insert your cork-valve assembly. Make a launching sled for the rocket. For example put pieces of wood into the mud and stabilise them with stones in a "V" shape to support the bottle. Stiff cardboard would also suffice.

Finally check that there are no aircrafts above and attach your pump. Keep pumping until it takes off.

The bottle will definitely go over the fence into your neighbours' garden or on a roof so make sure you have space available.

Hints:

Attach wings to the bottle to make the space shuttle challenger!

How it works:

The cycle inner tube valve is a 'One way' valve that lets air into the bottle but not out. When you pump, the bottle becomes pressurised - this is your energy being stored. Eventually the outward force of the pressure will overcome the retaining friction of the jammed cork and the bottle will be released. The water then regulates the release of the pressure and drives the bottle forward. To find out exactly why the bottle moves forward we refer to English scientist Sir Isaac Newton (1687). Newton's third law of motion states, "For every action there is an equal and opposite reaction." In the case of the rocket, the expulsion of the water from the bottle is the action, and the forward movement of the rocket is the reaction. Simple eh!

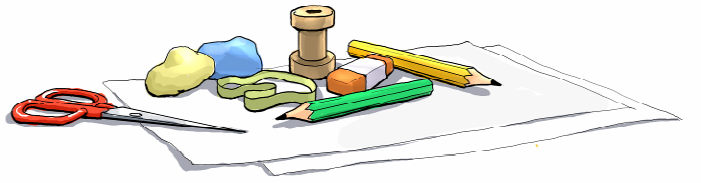
Cotton reel racers

Materials:

Cotton reel (or 35mm film case), elastic-band, pencil, eraser, and a small piece of plasticine.

Instructions:

Put the elastic band through the centre of the cotton reel. Loop one end around an eraser and put a pencil through the loop at the other end. Wind up the elastic band by rotating the pencil. Add the plasticine counterbalance to stop the pencil flipping. Place it on the floor and watch it go!



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Energy resources and physical terms involved

Energy resources

Some forms of energy are free of charge (nearly), like using your own muscles, wind energy etc. while others are not.

Some sources of energy are called renewables, which means that they can be reproduced in a fairly short time (like biomass) or that they are present at all times (like the wind and the sun). Other energy sources are not renewable (like oil and petrol, or at least not renewable within several hundred years).

Non renewable fuels have higher emissions of CO_2 than renewable fuels. Uranium is not renewable and is used in the nuclear electricity generating industry. Although uranium creates no emissions at the point of generation, it has to be mined which does. Radioactivity and the disposal of spent fuel rods are also a problem and a possible hazard.

Transport mainly relies on oil/petrol which produces a lot of greenhouse gases. In the case of bio-fuel, it may not be as 'green' as we think because it uses lots of non-renewable energy to produce in the first place (phosphate fertiliser, farm machinery burning fossil fuels, etc.).

Force

Force is an external agent that changes the motion or state of rest of an object. Throwing a football or pulling a kite are examples of applying force.

Friction

Friction is the opposing force between two objects in contact with each other. Friction can cause heat and even physical warping.

Gravity

Gravity is the force of attraction between two particles or objects that have mass. The larger an object, the more force it exerts on its surroundings.

This force is so small that until you get to objects the size of planets, it is difficult for human senses to notice.

Kinetic energy

Kinetic energy is energy that causes motion. When an object is in a state of movement, it is said to have kinetic energy. A bicyclist can use chemical energy from food to accelerate to a speed and gains kinetic energy; the bike will continue to move at speed until it is acted upon by outside elements (the bike will eventually be slowed by friction and wind resistance, converting the kinetic energy to heat).

Mass

Mass is the amount of matter (material) in an object; it is not affected by the type or how much force is exerted on an object. Mass and weight are different, because weight is affected by the gravitational force exerted on an object. A bowling ball and a basketball are about the same size, but a bowling ball contains more matter (it's solid and has more mass).

Motion

Motion is a change in position of an object from one place to another.

Potential energy

Potential energy is the capacity of an object to do work (or move) due to its position. For example, if you hold a ball above the floor, it has potential energy. If you drop it, it has kinetic energy as it falls. A compressed spring also has potential energy.

Weight

Weight is a measure of the earth's gravitational force on an object. Weight can change, depending on an object's position relative to the earth. For example, an object in space weighs less than the same object on the earth's surface. Also, an object weighs less on the moon, because the moon has a lower gravitational force.

Energy end-use	General topic	Educational subject	Age level
Transport	General sustainable development	**Mathematics**	**6-8 years**
Space heating & cooling	Renewable energy	History	**9-10 years**
Hot & cold water	Energy efficiency (saving)	**Social Science**	**11-12 years**
Lighting	**CO2 wise transport**	Etc.	
Electric appliances			