EXPERIMENTING WITH LITTER ITEMS

In this activity, learners experiment with litter items and test some of their characteristics and effects on the environment. Learners investigate the degradation time of various materials and the role of weather conditions on the degradation process.

SUBJECTS

Science, Mathematics

LEARNERS' AGE

12-15 yrs

DURATION

Experiments A and B: 45 minutes
Experiment C: 8 weeks

OBJECTIVES

- To test properties of various marine litter materials.
- To examine how the characteristics of a litter item affect its fate in the environment.
- To match the properties of marine litter (e.g. expected lifetime) with their potential impact.
- To practise in making hypothesis, observing, collecting, analysing and presenting data.

INTERNET SOURCES

MOTE Marine Laboratory: Advancing the Science of the Sea: www.mote.org

Buoyant objects float in water. These objects are more likely to become marine litter than those that sink because they can easily be carried by water and wind. They can also be washed into the sea through heavy rainfall, rivers, streams and sewage, as well as storm water outlets and be swept even further by the wind, waves, tides and currents. As a result, floating litter can travel long distances, far from their original point of entry causing problems over a vast area.

Items **easily blown** by the wind very often find their way into the marine environment either by being blown directly into the sea or indirectly by a river or a stream. These objects can become marine litter even after having been originally disposed of in a proper manner. For example, a napkin that is thrown in a rubbish bin without a lid at the beach may be easily blown out of the bin.

There is a general correlation between an object's buoyancy and ability to be blown around. Lightweight objects tend to float as well as be easily carried by the wind. However, some lighter objects will sink once saturated with water or encrusted with living organisms that attach themselves to hard surfaces such as micro-organisms and larger creatures including barnacles. This is a process known as fouling.

Degradation refers to the process during which an object breaks down into smaller particles (or molecules) through any means, such as the action of wind and water (erosion or weathering), the action of the sun (especially UV radiation), and the action of heat. For example some plastics decompose when exposed to sunlight *(photodegradation)*.

During the **biodegradation** process, molecules break down through the action of bacteria, fungi, and other living microorganisms. Biodegradation takes place either in aerobic or anaerobic conditions and produces smaller molecules, some of which (such as carbon dioxide and methane) escape into the atmosphere, while other compounds (such as nutrients) are taken up by other organisms in the environment.

In general, higher temperatures, UV radiation and humidity accelerate biodegradation. Plastics, glass, synthetic rubber, synthetic fabrics, and metal are typically resistant to biodegradation. Natural rubber and cloth can biodegrade but it takes a relatively long time. Paper biodegrades easily unless it is coated with plastic or another non-degradable material.

What is the typical lifespan of a litter item once it enters the sea?

(Source: MARLISCO EXHIBITION, 2013)

Item	Approximate degradation time
Newspaper	6 weeks
Apple core	2 months
Cotton gloves	1-5 months
Wool gloves	1 year
Plywood	1-3 years
Painted wood	13 years
Tin can	50 years
Plastic bottle	100s of years
Aluminium can	80-200 years
Glass bottle and jars	undetermined

These are only estimated times because the lifespan of plastic especially depends on where an item ends up. For example, is it on a sunny Mediterranean shore or at the bottom of the dark, cold North Sea?

EXPERIMENT A:
Blown by the wind

Materials and Equipment

A fan and various litter items including plastic, paper and metal objects.

Instructions step by step

1. Set up the fan at one end of a table.
2. Place various litter items in front of the fan one at a time. Observe if it is blown away.
3. Reflect on the following questions:
   - Which items are easily blown around and which are not?
   - Is there a tendency for all items of the same material (plastic, paper, metal, etc.) to be blown around in a similar way?

EXPERIMENT B:
Floating or sinking?

Materials and Equipment

A bucket filled with water.Various litter items including plastic, paper and metal objects.

Instructions step by step

1. Fill a bucket with water.
2. Place each litter item on the surface, one at a time and wait a few minutes.
3. Reflect on the following questions:
   - Which items float and which sink?
   - What happens to buoyant items when they enter the water?
   - What happens to items that do not float when they enter the water?
   - Is there a tendency for all items of the same material to float or sink?

Extension Activity

To test the impact of wind on floating items: place the fan in front of a large, shallow container filled with water and floating litter items.
To test the impact of rain on litter items: place items on a slightly slanted surface (e.g. the slide in the school yard) and sprinkle them one at a time using a water spray can.

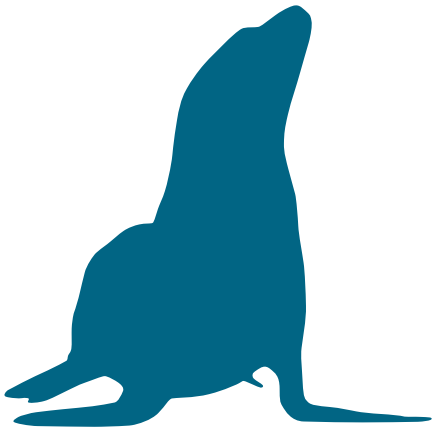
EXPERIMENT C:
Decomposing in nature

Materials and Equipment

A large bucket (preferably with a lid)
A box (paper or plastic, preferably with a lid)
Various litter items (2 of each kind)
A camera
Gloves

Instructions step by step

1. Fill two thirds of the bucket with sea-water (or pond water).
2. Place 1 litter item from each kind in the bucket (ideally next to each other, so that it can be seen from above without moving it). Cover the bucket with a lid.
3. Place the second set of litter items in the empty box. These will be used for comparison.
4. Keep both sets outdoors in a protected, roofed area where there is no risk of them getting wet or knocked over by wind, students or animals.
5. Observe the decomposition process on a weekly basis for a period of two months or longer. Record your observations on the worksheet. Take photos to monitor the changes as accurately as possible.
6. At the end of the experiment, using gloves, empty the containers on a large table. Compare each pair of items (shape, color, odor, durability, etc.), and record any differences.



MARLISCO
Stopping Marine Litter Together