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ENVIRONMENTAL CHALLENGES

Investigative Challenge

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Introduction

This issue looks at different aspects of the environment through exciting group activities and challenges, some of which are outdoors. They make excellent extension activities to existing Earth Science or Environmental school projects as well as being very cross-curricular.

Geo Orienteering Challenge

This challenge has two options and takes some preparation on the part of the teacher. It could be used as a P.E. lesson during an Earth science day or as a stand-alone lesson at the end of term. The children must, of course, have some previous knowledge that will enable them to recognise or understand the features, e.g. at the end of a topic on rocks.

Option 1 Take a sketch map of the school grounds (the caretaker often has one or draw one yourself) and walk round marking on any interesting geological features. These could include unusual types of stone, signs of erosion, marshy areas, natural rock outcrops or areas of sand.

Option 2 Place samples of different types of known rocks, or building stones, at various points around the grounds. (Do this just before the lesson or the rock samples may disappear.)

Each point should be labelled with a number, preferably printed in large type on an A4 sheet and laminated so that they can be clearly seen and reused. You should then have a series of numbered points around the school grounds or building each marking a geological feature.

The Activity
Divide the class into teams. Give each team a different one of the numbers (so they don't all just follow the leader). They must find the number, observe the feature, return to base (the teacher) and report the correct feature, or correctly answer a question about it. When they have done this successfully they are given a sealed envelope with a letter inside and sent out again with another number to find. Each team is given each number in turn until they have found every feature and have a complete set of envelopes. As soon as a team has a full set they may open it and they then have to rearrange the letters to form a word. For example a seven point challenge might be GRANITE. Each team will have the same word when complete. The challenge is to be the first team to complete the word.

The challenge can be made easier by providing a sketch map or giving a clue as to what to look for. With key stage one pupils, photographs of all the features could be on the table for them to identify the one they have just found.

PEST Issue 75.indd 1 03/08/2011 09:10:51

Air Pollution and Acid Rain (background information)

Air pollution is mainly caused by burning coal, gas and oil, especially in large quantities such as in power stations, factories, also from cars and other transport systems. The smoke and fumes from burning these fossil fuels are made up of many different chemicals, some of which can be seen as clouds of minute particles (smoke and dust) and others, such as gases, which are invisible but are just as harmful if not more dangerous to the environment. The various polluting chemicals released by the chimneys and exhaust systems travel up into the atmosphere where they are circulated by the wind and dissolved by water droplets. The pollutants react with the water to form mild acid, especially sulphuric and nitric acids, which eventually falls as acid rain.

Rainwater is naturally very slightly acidic, on the pH scale this would be about 6; neutral (neither acid nor alkali) has a pH value of 7.

The pH scale shows how acidic, neutral or alkaline a solution is

Increasing Acidity ← → Increasing Alkalinity

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Battery Acid		*Lemon Juice*	*Vinegar*			*Normal Rain*	***Neutral***	*Sea water*	*Baking Soda*	*Milk of Magnesia*		*Soapy Water*	*Bleach*	
		Acid Rain												

Teacher's note: the pH scale is logarithmic which means that there is a 10 times difference between the values on the scale, so acid rain of pH 4 is 10 times more acidic than pH 5 and 100 times more acidic than normal rain at pH 6.

Acid rain causes serious problems for a number of environments. As it eventually ends up in streams, rivers, lakes, wetlands and other aquatic habitats it gradually increases the acidity of the water to levels that are toxic to the fish and other organisms living there. It also has a big impact on land plants. Trees can be directly affected by having their leaves or needles damaged by acid rain or by not receiving enough food because the acids dissolve and wash away the essential nutrients from the soil.

Acid Rain Challenges

Investigating the Effects of Acid Rain on Plants

This investigation can be done using cress, grass or with some established, quick growing plants such as summer annuals, which can be bought quite cheaply and will provide better results. It could be done in small groups which report back at the end, or as a whole class.

- Prepare 3 matching pots or trays of plants, labelled 1 (control), 2 and 3, and place in the same location but not too close to each other.
- Prepare 3 spray bottles (well washed recycled ones will suffice) with watering/spray solution, one for each plant pot (labelled 1, 2 and 3 to match the pots). Bottle 1 should contain distilled water (tap water is very slightly acidic); bottle 2 acidic water (add 1 part vinegar to 5 parts water); bottle 3 a stronger acid solution - neat vinegar would give a solution of about pH 3 and represent the stronger, more acidic end of the acid rain range.
- Spray the plants daily with their own solution, being careful not to affect the other plants.
- Record the plants' growth or decline over the experimental period (about 2 weeks depending on plants used). Regular photographs would form a good record and could be viewed as a slide show to highlight any changes in the health of the plants.

Investigating the Effects of Acid Rain on Buildings

Acid reacts with calcite by dissolving it. As calcite is a major component of rocks such as limestone and marble, which is often used as building stones and for monuments, its dissolution can cause a lot of damage or chemical erosion. As cement is also made from limestone it too contains a large proportion of calcite, so even our brick buildings can be prone to attack from acid rain, especially older buildings that have the softer, more porous lime mortar. As vinegar is both safe and has a similar pH value to strong acid rain it is ideal to use in our experiment. (See overleaf for experiment equipment and method.)

Investigation into the Effects of Acid Rain on Buildings			
Investigation	**Results**		
	Limestone in vinegar	**Cement in vinegar**	**Control Samples in pure water**
What did you notice when the samples were first covered with the liquid?			
After 1-2 hours. Is there any change in the appearance of the samples?			
Is there any change in the appearance of the liquid?			
Can you see anything else in the bottom of the jar apart from the rock sample?			
After 2 or 3 days Is there any change in the appearance of the samples?			
Is there any change in the appearance of the liquid?			
Can you see anything else in the bottom of the jar apart from the rock sample?			
Day 5 Drain each jar through a filter paper. Record and photograph your findings.			

Extension Research

Look at local buildings, especially old churches and headstones if you can.

What evidence is there of chemical erosion? _____

On your way to school, look at the walls close to roads.

Does the most erosion occur at the top, bottom or middle? _____

Why might this be? _____

The Investigation.

Equipment: 3 clear beakers or jars (preferably plastic for safety)
2 small pieces of limestone
2 small pieces of cement (often found at the base of old walls or on paths)
Vinegar (preferably white vinegar as it is easier to see the results)
Filter paper (coffee filters are adequate)
Pure/distilled water

Method:

1) Take photographs of the rock and cement samples for later comparison.
2) Make a control jar by placing one piece each of limestone and cement in the bottom of one of the jars and cover with distilled water to a depth of at least 2cm.
3) Place the other pieces of limestone and cement in separate jars and cover with vinegar to the same depth as the control jar.
4) Ask the children to predict what might happen.
5) Regularly observe and record any reaction. Two or three times on day 1 then daily.
6) Leave for 3-5 days.
7) Drain each jar through separate filter papers.
8) Observe and record any changes or discoveries and photograph the results.

Geo Design Challenge

This is an ideal challenge to do with the year 5/6 groups whilst studying coasts or rivers as they will have some knowledge of flooding. The children should work in pairs or small teams. The challenge is to design and model a house to be built in a location liable to flooding.

Judging the First Round

The teams should present the finished models to their peers. Each team describes their plans, choice of materials and structure etc to the rest of the class who would use criteria such as suitability for purpose, appearance and special features (The X factor) to judge each model. Points out of ten could be awarded for each aspect, giving a grand total.

The second round

Test the models using a coastal simulator (large, deep seed tray, available from garden centres) to discover which of the models withstands flooding the best. Use compacted sand for the land and clean water for the flood (Hint: good ideas may not necessarily be those that depend on innovative building designs but simply the sensible use of the rooms to minimise damage.) Award points again to get an overall winner. Each team can then trial various coastal or flood defence methods (e.g. groins, stone walls, pebbles or flat stones on the beach etc) to see how they can offer their houses protection.

Forthcoming Event. Full information is available on the website.

ESTA Primary Team Members will be providing practical workshops, resources and information at:-

ASE Conference, Liverpool. 4th - 7th January 2012. Saturday 7th January 2012 - Workshop and drop in session.

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