

## Crusoe Project Teacher's Guide

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An *Expedition Class* adventure.

Pages 10-19 'Science Inquiries' by Philippa Clymo, SEO (Science) Learning Services South, Department of Education.

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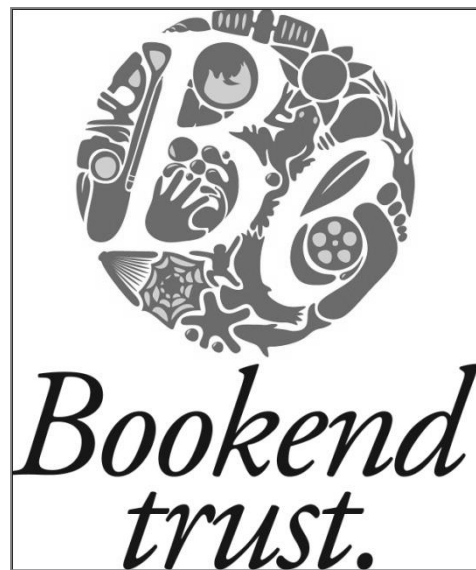
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Project sponsors



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## The Bookend Trust and Expedition Class



The Bookend Trust aims to inspire people of all ages to become involved in working towards positive and co-operative environmental solutions. This is achieved through a range of initiatives including documentaries, scholarships and school programs such as the Tasmanian Envirothon and Expedition Class. For more information on other Bookend activities please see:

**[www.bookendtrust.com](http://www.bookendtrust.com)**

*Expedition Class*, operating independently from 2006, came under the Bookend Trust banner in 2010/11 to meet the growing demands of an expanding school program. In addition to the online primary school program- this year called the Crusoe Project- the Bookend Trust received funding through the Innovative Flexible Education Grants offered by the Tasmanian Education Department to begin a 3 year pilot program working with four high schools around Tasmania.

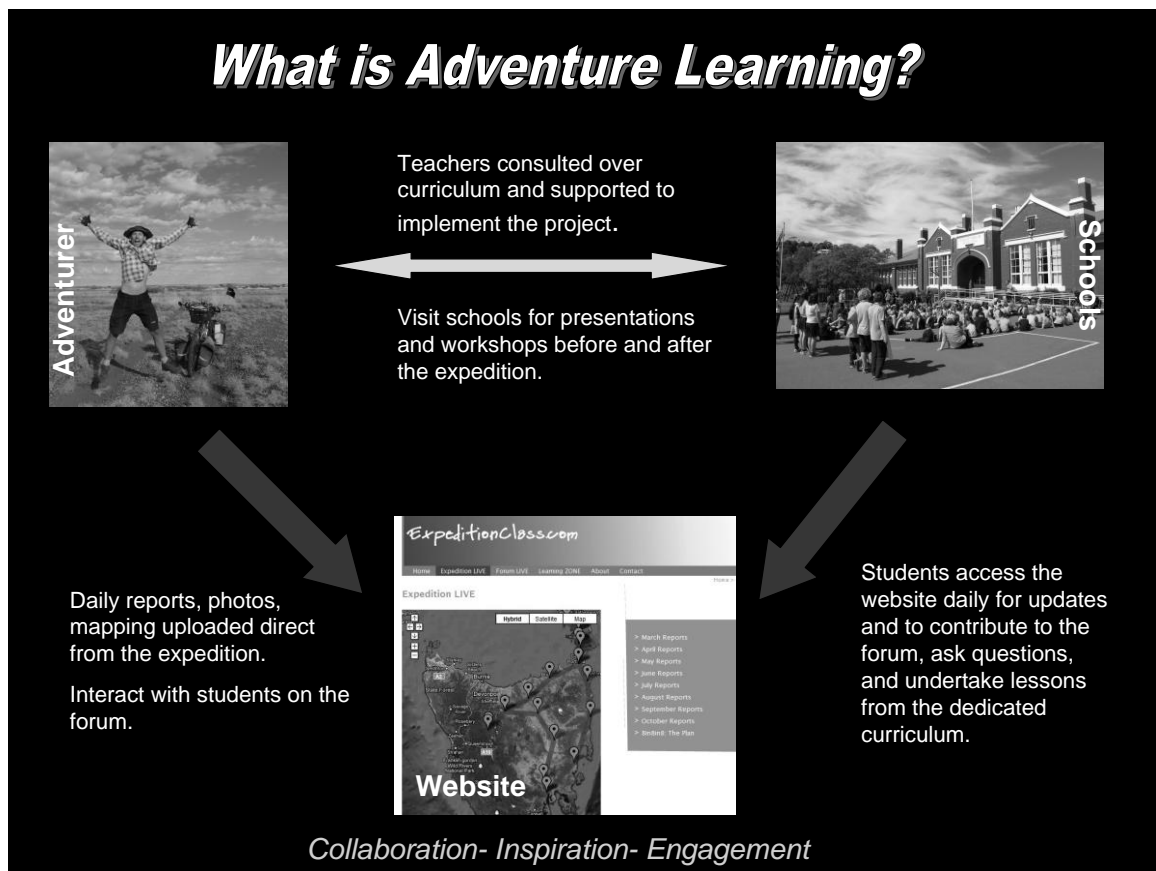


Jordan River Learning Federation, Ogilvie, Scottsdale and Ulverstone High Schools will participate in 'Skullbone' expeditions to wilderness areas in Tasmania in October and November. These expeditions will be documented online in real-time, just as other Expedition Class journeys are. The participating students will be the adventurers recording the expedition on the Skullbone website. This is set up as a sub-domain of Expedition Class and you will see the crossover in the forum and on the home page of the Expedition Class home page.

After the August Crusoe Project your class is also invited to watch and learn from the students on the Skullbone expeditions beginning October 10<sup>th</sup> 2011.

**<http://skullbone.expeditionclass.com>**

## Adventure Learning



“Adventure Learning (AL) provides students with opportunities to explore remote cultures and locations by fostering authentic learning experiences within a hybrid online environment. Moreover, AL allows learners separated by distance and time to connect with one another while providing them access to resources and opportunities for interaction with the real world.

AL is grounded in two major perspectives of learning - experiential learning and inquiry-based learning.” *Polarhusky.com*

The Bookend Trust through Expedition Class conducts online adventure learning projects. By collaborating with educational agencies and conducting small footprint journeys, we



provide a free adventure learning opportunity for teachers and students. In 2008 the journey was sea kayaking 2300km around PNG with a focus on **climate change and culture**. In 2009 the focus was **Australian geography** and the journey traversed 15000km of Australia by bike, kayak and foot. Last year we searched for a

Tasmanian tiger and delved into **Tasmanian biodiversity**. Archives from these projects can be found through the website. In 2011 the Crusoe Project tackles the theme of the **science of survival**. Teachers and students will undertake science inquiries that align with the Australian and Tasmanian Curriculum.

The main goal of the project is to deliver an educational product that motivates teachers and students in classroom situations. The nature of real-life, real-time expeditions engage students because they don't have scripted endings, answers can't be found in the back of a book, and some problems have no easy solutions. There are actual risks, real discoveries and deeply felt accomplishments. Expedition Class seeks to support and promote;

- Motivated, enthusiastic, positive and engaged students,
- Connectivity of students between each other, and to other cultures and places and
- Shared values of courage, honesty and peacefulness.

As well as the main theme of science inquiry on this journey there will be ongoing opportunities and challenge activities designed to get students self motivated and moving. The curriculum is aimed at students from 8-13 years old, but the adventure surrounding it is for everyone.



*"We should come home from adventures, and perils, and discoveries every day with new experience and character." --Henry David Thoreau*

## Crusoe Project in 2011

It could be a dream or it could be a nightmare. Stranded on a tropical island, far from home and with just a little bag full of equipment. There must be a way to survive because the alternative is simply too horrible to think about... stuck on the island forever.

This year our challenge is to investigate the science of survival, and I'll need your students help as I spend the month of August finding food, water and shelter. Use the workbook in conjunction with this teacher's guide and follow the daily reports online at [www.expeditionclass.com](http://www.expeditionclass.com).

The island is a mere speck off the south-east coast of Papua New Guinea. A little outcrop of sand and rock, surrounded by coral reef and warm tropical seas. The challenges of isolation and survival will be real and demanding, the learning should be the same.

## The Classroom

Expeditions are unsurprisingly full of rich learning opportunities. This journey will raise many topics that your class might like to explore, but this kit provides comprehensive resource support for the topic of the science of survival. Teachers can implement these science inquiries as the expedition is unfolding in real time during August 2011. Each day the website is updated with new information from experiences in the field that relate back to the topic under investigation. Specifically, Andrew will be conducting the four major science inquiries from the deserted island, using the same equipment as suggested for students. Each of the four weeks on the island will feature an inquiry. The discoveries from the classroom and the deserted island will be shared through the live forum each day.

**Inquiry 1, Escape Raft: August 1<sup>st</sup> – 5<sup>th</sup>**

**Inquiry 2, The Germinator: August 8<sup>th</sup> – 12<sup>th</sup>**

**Inquiry 3, Water Worries: August 15<sup>th</sup> – 19<sup>th</sup>**

**Inquiry 4, Solar Oven Extreme: August 22<sup>nd</sup> – 26<sup>th</sup>**

You might choose to do one, or all four experiments, depending on the time available. The same goes for the whole workbook, take a look through it well before the expedition gets underway and decide which parts will suit your class.

## Student Workbook

The Student Workbook is designed to be used in conjunction with this guide. Some activities will require teacher direction and full class participation (such as the science inquiries), but many can be completed independently by students with minimal or no direction from teachers. There are pages in the workbook, such as the glossary and the island map, which will be built progressively over the one month expedition. Please take the time to become familiar with the workbook before the expedition begins. Copies can be downloaded from the website at [www.expeditionclass.com](http://www.expeditionclass.com).

## Daily Updates

One of the engaging features of this project for students is the regular updates posted on the website. Each evening in August between 6pm and 9pm a short report will appear on the home page that includes a photograph, word of the day, question of the day and other points of interest. There will be a strong emphasis on topics that relate to the workbook. You might begin each day by having students read out the report as a tuning in exercise. These quick activities will build the level of interest and create a consistent thread between science inquiries and other activities in the workbook.

## Using the Forum

Collaboration is at the heart of Adventure Learning, and using the website forum is a key feature to getting the most from the project. The forum is a place where students and teachers can interact directly with personnel in the field, expert scientists and between each other. Students will need to register to use the forum. The forum is monitored daily for inappropriate content. Postings will be removed at the discretion of the website coordinator. Encourage students to contribute regularly. Many topics of interest will be raised here and it is a great place for students to build ownership of the expedition and share their own discoveries.

**Register as a class:** In the past some classes have registered as a group, i.e. Username: MrArcher's5/6. The password can be kept by the teacher and all postings will go through this username.

**Register individual students:** Students can register themselves with each having a unique username (they usually come up with some beauties!) and password (students

may forget their password- these can be retrieved through the email they supplied at the time of registration).

**Forum Experts:** Each of the four science inquiries will be supported by having an expert scientist available through the forum for question from students or teachers. You can see their profiles under the 'Forum Experts' tab under the 'Forum' heading on the website banner. These experts will receive questions and reply as soon as they can. This gives students a direct line to the best minds on the topics under investigations. USE THEM!

## Calendar of Events

1 July	PD opportunity- LSS*
4 - 22 July	State-wide school visits**
<b>1 – 30 August</b>	<b>EXPEDITION LIVE</b>
19 September – end of year	Follow-up school visits by appointment
19 September	Teacher and student surveys distributed
1 December	Announcement of 2012 expedition
TBA	Public presentation at UTAS

\* Professional development day at Learning Services South, please contact Andrew for details and bookings. Phone 0437668537

\*\* Contact Andrew for more information. Some schools are eligible for free visits; others cost \$250 per visit and include a resource pack.



# Science Inquiries

By Philippa Clymo



# Inquiry Overview

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The experiments prompted by Andrew's experiences will provide many opportunities for students to engage in scientific inquiry. This is central to learning to think and work as a scientist, and is integral to both the Tasmanian and Australian Curriculum:

Science aims to ensure that students develop...

- an understanding of the nature of scientific inquiry and the ability to use a range of scientific inquiry methods, including questioning; planning and conducting experiments and investigations based on ethical principles; collecting and analysing data; evaluating results; and drawing critical, evidence-based conclusions

Australian Curriculum, Aims

Scientific Inquiry ... focuses on the way in which scientists investigate and explain the world. Students use scientific inquiry processes to make observations, wonder why, post questions, predict, plan and conduct investigations, collect and analyse evidence, evaluate, draw valid conclusions and communicate their findings. They participate in investigations which include fair testing, controlled experiments, fieldwork, models and simulations, and examine existing data and information. They learn to incorporate creativity, insight, imagination and hunches into their work in a balanced way.

Students reflect on their investigations by questioning and evaluating data, drawing conclusions, identifying problems that occurred and avenues for further research, and considering the implications of their findings. They recognise that scientific explanations may be revised as new or different evidence is collected from investigations.

Tasmanian Curriculum

Depending on the age, abilities and previous experiences of the students, teachers will choose to offer them more, or less, support for their inquiries. The Student Workbook gives suggestions and proformas to support students, but it is recommended that a teacher goal is to aim for increasing student control of **all** stages of an inquiry. This includes asking and shaping initial questions, developing a hypothesis, designing a fair test, conducting the test, collecting and analysing data,

and drawing conclusions. This may mean that a teacher chooses not to use the suggested experiment procedure and/or proformas in the Student Workbook, and instead supports the students to design their own investigation.

Inquiry notes:	
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# The Escape Raft

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*Under Investigation: 1-5 August 2011*

In this investigation students are mainly investigating floating properties (absorbency), but the suggested experiment procedure also investigates other properties including colour and hardness. Students should also be encouraged to consider other properties that might affect a raft, such as buoyancy, flexibility, workability (ease of cutting, joining, carving), longevity when submerged in seawater, and so on. It would be easy to extend the suggested table to include these properties.

It is important to make sure the samples are the same size, to avoid introducing an extra variable that might make an unfair test.

Students may like to observe the structure of each material using a magnifying lens or microscope, and speculate or research about how their structure affects their properties. Wood can be grouped into two groups – hardwoods and softwoods. Hardwoods usually come from flowering plants (angiosperms) and softwoods are usually from conifers (gymnosperms). As the names suggest, softwoods are usually softer than hardwoods, but this is not always the case. For instance, balsa (a very soft wood from rainforest trees in Central and South America) and Tas Oak (much harder, from several species of *Eucalyptus* trees) are both classified as hardwoods.

Wood is the hard tissue beneath the bark of many plants. It is composed of water-conducting cells and gains its hardness and strength from deposits of lignin. The central wood in a branch or stem is called heartwood, and is generally darker and harder than the outer wood.

Polystyrene is a non-natural material made from petroleum. It is the most widely-used kind of plastic, and because it is non-biodegradable it is a very common source of pollution. Polystyrene can be used in its solid form for packaging and moulded objects like cutlery or CD cases, or it can be used in its expanded form, which is very lightweight and buoyant – and therefore likely to wash up on a deserted island.

## **Australian Curriculum links:**

Year 4: Natural and processed materials have a range of physical properties; these properties can influence their use. ACSSU074

## Tasmanian Curriculum links:

Stage 7: describe some of the ways common materials (e.g. water, wood, metals, fabrics) are used, and why those materials are used in preference to others.

Stage 9: explore some of the relationships that exist between materials' properties and how they behave e.g. foods that contain starch turn purple when you add iodine, things that are made from animal or plant matter will decay in a compost bin.

### What's Going On

"Each water molecule is made up of an oxygen atom and two hydrogen atoms. These are bonded in such a way that the oxygen tends to attract the electrons in the water molecule, so the oxygen becomes slightly negatively charged. As a result, the two hydrogen atoms become slightly positively charged. If a water molecule finds itself on a surface with lots of molecules with negative charge, the positively charged hydrogen atoms in the water molecules bond weakly with the surface and the water stays in place.

Materials which absorb a lot of water will tend to have lots of places where the water molecules can form these bonds. If a material is designed to be absorbent it usually will have a very large surface area so there is even more places for the water to stick.

Waterproof materials will tend to have a tighter weave, so fewer places for water to bond. They can also be coated in special substances which are hydrophobic: they hate water and repel it, so water runs off."

Text taken from [http://www.planet-scicast.com/experiment.cfm?cit\\_id=2882](http://www.planet-scicast.com/experiment.cfm?cit_id=2882) (Check out this site for an excellent variation on testing materials absorbency.

# The Germinator

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*Under Investigation: 8-12 August 2011*

This investigation looks at the conditions needed for seeds to germinate (sprout). It tests the variables water, oxygen, light and heat. It is important to control other variables such as number of seeds, type of seeds, age of seeds, position of seeds in the jar, shape/size of jar, and so on. Students should be encouraged to consider what variables might need to be kept constant (controlled) before carrying out the experiment.

It might be useful discussing with students (or it would prove a useful assessment tool to ask) why the jars are kept in a cupboard. The reason is to keep the amount of light constant for all four jars – since one jar needs to be kept in a fridge (which is dark once the door is shut) to test the effect of temperature, the other jars must also be kept in the dark to make a fair test.

Rusting is a fairly slow chemical reaction (called oxidation) which occurs when iron reacts with oxygen (in the air) and water. The iron and oxygen form a new substance called iron oxide, and the oxygen is no longer available in the air for seed germination. Other metals can also react with oxygen in a similar way, but they are said to corrode rather than rust. Once students have investigated germination of seeds, they may investigate seedling growth (using a different batch of seeds, because germinating conditions should be kept constant so they don't influence growing). While *germination* is not generally affected by light (since seeds tend to be under the soil where there is no light), the later *growth* of seedlings will be affected by light levels and quality (for instance colour).

Students may want to investigate further questions about seed growth, such as:

Do all types of seeds sprout at the same rate?

What is the best amount of water to give seeds to promote sprouting?

Do seeds need soil to germinate and/or grow?

Do substances (fertilizer, detergent) have an effect on seed germination?

Do seeds germinate better on tissues or paper towel?

Andrew will gain many important nutrients from eating sprouted seeds. Seeds contain many nutrients which are used by the growing plant until it is sufficiently developed to gain its own nutrients from the environment. The process of germination stimulates changes in the stored chemicals, generally making them more easily used by the

developing plant, and also by humans who eat them. They will provide Andrew with energy, protein, fibre and vitamins.

Please note that the seeds sprouted in this experiment may not be very palatable and should not be eaten – seeds for eating are usually soaked first, and then rinsed several times during the sprouting process.

## Australian Curriculum links:

Year 6: The growth and survival of living things are affected by the physical conditions of their environment. (ACSSU094)

## Tasmanian Curriculum links:

Stage 7: Pose questions and seek explanations about the internal and external features of living things in order to better understand how they survive e.g. What happens to food in the stomach? What affects plant growth?

Stage 9: explore ways in which the health and survival of organisms is dependent on their environment e.g. diet, disease, climate

## What's Going On

“Seed germination depends on both internal and external conditions. The most important external factors include temperature, water, oxygen and sometimes light or darkness. Various plants require different variables for successful seed germination, often this depends on the individual seed variety and is closely linked to the ecological conditions of a plant's natural habitat. For some seeds, their future germination response is affected by environmental conditions during seed formation; most often these responses are types of seed dormancy.”

Text from, <http://en.wikipedia.org/wiki/Germination>. It is important to explore with students that concept that we are testing the germination requirements for **one** type of plant. For example seeds from another plant may not germinate *until* very cold temperatures are reached while others need the heat of a forest fire to germinate.

# Water Worries

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*Under Investigation: 15-19 August 2011*

This experiment gives another good opportunity to consider experiment design and fair testing. If only two plain cups were used, with one covered and the other uncovered, the experiment would be testing only the variable of 'surface area exposed'. The addition of the blackened cups allows students to also test the variable 'colour of container'. Because the 'surface area exposed' is also being tested, we need both possible options (covered and uncovered) also in the blackened cups.

The black cups use two science processes to affect the evaporation. First, black objects absorb more energy than colourless or white objects. Then, this energy is transformed into heat, which warms the water, which affects evaporation rate. If students have access to thermometers they could measure the temperature of the water in the cups.

Black looks black because it absorbs all colours of visible light, whereas white looks bright because it reflects all colours away. Since absorbed light is turned into heat, black objects become hotter than white or colourless objects when left in the sun. The absorbed heat energy is transferred to the water. Because of this, the experiment will work best if all the cups are left in a sunny position.

Evaporation is a process where a liquid turns into gas, and it can happen without its temperature reaching boiling point. Some water particles (molecules) have more energy than others. It may be that they have enough energy to leave the liquid and become gas. When this occurs the liquid now has less volume, which can be measured by students. When the water particles leave the liquid, the heat associated with them also goes, so the liquid becomes cooler. This is why the evaporation of sweat on a hot day has the effect of cooling us down.

Students often find it difficult to understand evaporation because they cannot see the liquid once it has become part of the air. They may believe that liquids simply 'disappear' when they evaporate, and they may not connect the process with the influence of heat.

They may also believe that evaporation happens only when a liquid boils.

Students may be interested to explore the 'surface area' idea more, investigating the evaporation of a fixed amount of water from a variety of shaped containers. They could also investigate how the material a container is made from affects evaporation (a variety of coffee cups are good for this); the effect of stirring; or the evaporation of other liquids.

The process of evaporation is reversible – gases can condense to form liquids. Students could investigate ways that Andrew can condense gaseous water from the air to obtain drinkable, liquid water. Students could research or explore designs for a solar still.

## **Australian Curriculum links:**

Year 5: Solids, liquids and gases have different observable properties and behave in different ways. ACSSU077

Year 5: Light from a source forms shadows, and can be absorbed, reflected and refracted. ACSSU080

Year 6: Changes to materials can be reversible, such as melting, freezing, evaporating; or irreversible, such as burning and rusting. ACSSU095

## **Tasmanian Curriculum links:**

Stage 9: identify patterns in the types of change that take place in materials e.g. some metals rust / others do not, foods deteriorate faster at higher temperatures, liquids evaporate / solids do not

Stage 10: investigate physical and chemical changes and the reversibility of the change

## **What's Going On**

“For molecules of a liquid to evaporate, they must be located near the surface, be moving in the proper direction, and have sufficient kinetic energy to overcome liquid-phase intermolecular forces. Only a small proportion of the molecules meet these criteria, so the rate of evaporation is limited. Since the kinetic energy of a molecule is proportional to its temperature, evaporation proceeds more quickly at higher temperatures. As the faster-moving molecules escape, the remaining molecules have lower average kinetic energy, and the temperature of the liquid, thus, decreases. This phenomenon is also called evaporative cooling. This is why evaporating sweat cools the human body. Evaporation also tends to proceed more quickly with higher flow rates between the gaseous and liquid phase and in liquids with higher vapor pressure. For example, laundry on a clothes line will dry (by evaporation) more rapidly on a windy day than on a still day. Three key parts to evaporation are heat, humidity, and air movement.”

Text from, <http://en.wikipedia.org/wiki/Evaporation>.

# Solar Oven Extreme

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*Under Investigation: 22-26 August 2011*

This experiment is less structured to encourage students to participate more in experiment design. However, there are a large number of variables that can affect the effectiveness of a solar oven, and students may be tempted to try to modify several variables at a time. They should be encouraged to focus on only one variable, keeping others constant, to ensure their test is fair.

Variables might include:

- Colour of construction materials
- Insulation type and amount
- Shape of reflective surfaces
- Shiny/dull side of aluminium foil exposed
- Lid or uncovered
- Angle towards the sun

See [www.kyrene.org/staff/dstelling/Energy/SOLAROVENS.ppt](http://www.kyrene.org/staff/dstelling/Energy/SOLAROVENS.ppt) for a PowerPoint with detailed instructions for an investigation using a pizza box solar oven.

In a solar oven, there are three processes at work. First, there is a reflective part that concentrates the sunlight into a small space. Then, the light energy is converted to heat, usually by absorbing the energy onto a black surface. To improve the efficiency of the cooker, a third process of trapping the heat may also be involved, using a transparent substance like plastic to trap the heat inside the cooker. This works because transparent plastic allows *light* to pass easily into a cooker, but *heat* is much less able to pass back out through it. This is a process similar to the trapping of heat by the atmosphere in the 'greenhouse effect' that causes climate change.

Solar ovens are widely used by humanitarian organizations in developing countries, because they use no fuel and are therefore free to run, and reduce deforestation from firewood collection. They can be extremely effective, and can be used to cook anything that could be prepared using a conventional oven.

If care is taken with hygiene, students should be able to eat the melted marshmallows from this experiment. Other pre-cooked foods such as chocolate can also be heated in a solar oven and eaten safely, but do not let students eat eggs cooked in a solar oven because the temperatures may not be sufficient to thoroughly cook the eggs.

## Australian Curriculum links:

Year 5: Light from a source forms shadows, and can be absorbed, reflected and refracted. ACSSU080

Year 8: Energy appears in different forms including movement (kinetic energy, heat and potential energy, and causes change within systems. ACSSU155

## Tasmanian Curriculum links:

Stage 5: describe how the properties of an object affect how it absorbs and/or emits energy e.g. different coloured objects heat up differently, different length strings affect the sound of a musical note

Stage 6: explore a number of different forms of energy (e.g. heat, sound) and the way they are used in their everyday lives, using intuitive ideas of energy being needed to get things done

Stage 8: investigate how some different forms of energy (e.g. heat, sound, light, electricity) are transferred e.g. electrical energy via the wires in an electrical circuit

Stage 10: explore how forms of energy differ in the way they can be transferred or stored e.g. electric circuits, batteries, heat by radiation/convection/conduction

## Background

“Solar cookers use sunlight for cooking, drying and pasteurization. They can be grouped into three broad categories: box cookers, panel cookers and reflector cookers. The simplest solar cooker is the box cooker first built by Horace de Saussure in 1767. A basic box cooker consists of an insulated container with a transparent lid. It can be used effectively with partially overcast skies and will typically reach temperatures of 90–150 °C. Panel cookers use a reflective panel to direct sunlight onto an insulated container and reach temperatures comparable to box cookers. Reflector cookers use various concentrating geometries (dish, trough, Fresnel mirrors) to focus light on a cooking container. These cookers reach temperatures of 315 °C and above but require direct light to function properly and must be repositioned to track the Sun.”

Taken from, [http://en.wikipedia.org/wiki/Solar\\_energy](http://en.wikipedia.org/wiki/Solar_energy).

## Other student workbook activities

### Mapping the island (page 3-4)

While on the island Andrew will refer to geographic features, plants and animals in the daily updates. These will sometimes include a grid reference that relates to the map on page 3 of the student workbook. For example,

*'Found the dead carcass of a dolphin washed up on the beach (map reference- D2) today. Tried to eat it and became very ill (G2).*

Students can keep a plot of these features on the map with symbols and fill in the keys on page 4 progressively. It might be useful to enlarge a copy of the map for whole class use also.

Your notes:	
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### Expedition Backpack (page 6)

The backpack activity is great for getting students to justify their choices. There are no right or wrong answers but there are better and worse choices. This activity works well with students in groups where they must come to agreement and argue persuasively for their decisions.

### Raft Challenge (page 10)

This is a group activity where students must design a raft out of marshmallows, toothpicks and a sheet of cardboard that will carry the most weight. There is a time limit on the design and construction phase to encourage students to work under pressure in a controlled competitive environment. Take time to conduct the testing (final) stage

carefully so you can demonstrate a fair test to the students. I.e. testing one raft while the water is sloshing around in the tub is not comparable to testing another raft in perfectly still water.

### **Robinson Crusoe (page 11)**

The whole concept of the expedition is based on the fictional autobiography by Daniel Defoe of Robinson Crusoe. Although supposed to be inspired by a real life event, it was the first notable work of literature where the story was independent of mythology, history, legends, or previous literature. There are interpretations of the book for younger readers but the original version is a difficult slog for students!

### **Insect safari/ diary of a naturalist (pages 14/15)**

The focus of the expedition is on science inquiries which are, among other things, developing student's skills of observation. This can be extended individually by encouraging students to make observations of nature through the insect safari and diary of a naturalist.

### **Food chain detective (page 18) and Daily menu plan (page 21)**

Nutrition will be a prominent topic as Andrew explores the island for food sources. Use the food chain detective activity to promote an understanding of where processed and packaged food actually comes from. This can turn into a larger discussion of healthy food choices and include formulation of a daily menu plan. Each student can contribute a daily menu that can form a class booklet of menus.

Your notes:	
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### **Crossword answers (page 19)**

Across: 1. dolphin 5. water 7. coconut 8. canoe 9. solar 10. shipwrecked

Down: 2. investigate 3. hammock 4. Defoe 6. alone

### **Weather watch/ cloud key (pages 24/25)**

While on the island Andrew will have basic weather observing equipment to record temperature and wind direction. This will be posted in the daily report to the website. Students can compare these observations with their own from school on the same day and time. Choose random days over the month of August or make one week 'Weather Week'. The cloud identification key can be accessed online with colour photos at; [http://wvscience.org/clouds/Cloud\\_Key.pdf](http://wvscience.org/clouds/Cloud_Key.pdf)

### **Tok Pisin translator (pages 26/27)**

The island is situated not far from the mainland of Papua New Guinea and has an occasional inhabitant (an old man named Kaukauli who has lived there alone for years). It is very likely that local Papua New Guineans will visit the island and there will be an opportunity to learn more about their culture and way of life. Students will find Tok Pisin a fun and engaging language as it has a strong connection with English.

### **Build a glossary (pages 38/39)**

Each day with the report to the website there will be a 'word of the day', usually with a question for students to ponder. Students can collate these words in a glossary at the back of the workbook.

### **Design the next expedition (page 40)**

Students can have a real influence on where Expedition Class goes and what is investigated in 2012. Have students design an expedition (this can be a simple suggestion or a complete expedition plan) and communicate the plan through the forum to Andrew and other students.

## Scientific Inquiry strand rubric for Tasmanian Curriculum

*Note: It should be assumed that each stage also encompasses the descriptors for all preceding stages.*

Developed at Bridport Primary School, October 2009.

Reproduced with permission from Denise Devitt.

<b>Main idea</b>	<b>Stage 1</b>	<b>Stage 2</b>	<b>Stage 3</b>	<b>Stage 4</b>	<b>Stage 5</b>
<i>Scientific inquiries are generated from observations, questions and predictions</i>	<b>Make statements</b> about scientific phenomena from first hand experience	<b>Ask questions</b> about scientific phenomena from first hand experience to find out how and why things happen	Contribute to class discussions and <b>make guess type predictions</b> about scientific questions that are being discussed	Ask questions and, <b>with teacher help, change them</b> so they can be investigated using scientific inquiry	<b>Suggest questions</b> that can be investigated scientifically and <b>give reasons</b> for their predicted answers
<i>Scientists plan and conduct investigations in particular ways</i>	<b>Make observations</b> about science experiences that that the teacher has set up	<b>With adult help, follow instructions given one step at a time</b> to complete a class investigation	Follow instructions given one step at a time to complete a class investigation <b>that involves measuring and recording</b>	Follow instructions given as a <b>short series</b> to complete an investigation, including measuring and recording	<b>Suggest the reasons that the teacher has chosen a particular method</b> to carry out a scientific investigation
<i>Scientists draw conclusions after considering various interpretations of their data</i>	<b>Identify some ways in which things are similar and different</b>	<b>Suggest obvious causes for some of the science related effects they observe</b>	Begin to interpret data and draw obvious conclusions <b>when presented with simple alternative options</b>	Interpret data and draw simple conclusions <b>when asked leading questions</b>	<ul style="list-style-type: none"> <li>Recognise <b>obvious patterns and trends</b> in their data</li> <li>Suggest <b>reasons why their results differ from others</b></li> </ul>

<b>Main idea</b>	<b>Stage 6</b>	<b>Stage 7</b>	<b>Stage 8</b>	<b>Stage 9</b>	<b>Stage 10</b>
<i>Scientific inquiries are generated from observations, questions and predictions</i>	Suggest questions that can be investigated and give reasons for their predicted answers <b>in a variety of contexts</b>	<i>Suggest questions that can be investigated and give reasons for their predicted answers <b>which have some scientific basis</b></i>	Suggest, <b>from their interests and experiences</b> , questions that can be investigated and give reasons for their predicted answers	Suggest, from their interests and experiences, questions that can be investigated and give reasons for their predicted answers <b>which have some scientific basis</b>	<b>Refine a big picture question</b> to something that it is possible for them to investigate and predict what the outcome will be (e.g. Refine the question <i>Is salinity a problem in Tasmania?</i> To <i>What is the effect of different salt concentrations on broad bean germination?</i> )
<i>Scientist plan and conduct investigations in particular ways</i>	<b>Plan and carry out investigations</b> that involve a small number of steps, with teacher assistance to collect, record and present data	<b>With scaffolding</b> , plan and carry out <b>fair investigations</b> (i.e. change one variable and keep everything else the same)	<ul style="list-style-type: none"> <li>Recognise fair and unfair conditions in <b>a variety of investigations</b></li> <li><b>Check and repeat observations for accuracy</b></li> </ul>	<b>Suggest alternative methods</b> which may improve or add to an investigation to increase fairness	Plan and conduct fair investigations that <b>include a control, explaining how they have minimised error</b> (e.g. conduct a number of trials and average)
Scientists draw conclusions after considering various interpretations of their data	<ul style="list-style-type: none"> <li><b>Compare their results with their predictions</b></li> <li>Discuss any <b>ways in which their method should or could be changed</b>, including ways to make it fairer or collect extra information</li> </ul>	<ul style="list-style-type: none"> <li><b>Identify ways in which various investigations are fair and unfair</b></li> <li><b>Rearrange data</b> so that patterns are easier to see</li> </ul>	<b>In a variety of contexts</b> , suggest improvements and select appropriate ways to present data so that they can identify patterns, compare their results with their predictions and draw conclusions	Draw reasonable conclusions and <b>discuss obvious implications</b> of their findings	<ul style="list-style-type: none"> <li>Explain <b>what might have caused</b> the patterns they see in their data</li> <li><b>Review their investigation</b> after considering their own and others' findings</li> </ul>

<b>Main idea</b>	<b>Stage 11</b>	<b>Stage 12</b>	<b>Stage 13</b>	<b>Stage 14</b>	<b>Stage 15</b>
Scientific inquiries are generated from observations, questions and predictions	Recognise some <b>questions that cannot or should not be investigated</b> scientifically	<b>Write scientific hypotheses</b> in an appropriate format, showing an understanding that a hypothesis should link two variables	<b>Write scientific hypotheses</b> in an appropriate format, showing an understanding that a hypothesis should link two variables and <b>allow generalisations to be made</b>	<b>Identify a number of related research questions or hypotheses</b> that could be investigated in a given situation	<b>Routinely formulate hypotheses and make predications, showing an understanding of relevant scientific concepts</b>
Scientists plan and conduct investigations in particular ways	<b>Compare alternative possibilities</b> about how to carry out a particular investigation and <b>justify</b> which they think is preferable	Plan and conduct a variety of investigations, <b>routinely making the investigations fair and reliable</b>	Plan and conduct investigations that involve <b>working with more complex data</b>	Plan and conduct investigations that <b>consider more than one aspect of a research problem</b> and collect <b>data from multiple sources</b> in a discerning manner	Plan and conduct ethical investigations that <b>involve less easily controlled variables</b> or call for <b>imaginative, creative approaches</b>
Scientists draw conclusions after considering various interpretations of their data	<ul style="list-style-type: none"> <li>• <b>Recognise anomalies</b> in their data and <b>suggest reasons for them</b></li> <li>• <b>Identify science concepts</b> that are relevant to their investigation.</li> </ul>	<ul style="list-style-type: none"> <li>• Draw conclusions <b>in situations that involve using more than one set of data</b></li> <li>• Identify investigations that would <b>provide additional useful data to use when drawing conclusions</b></li> </ul>	<ul style="list-style-type: none"> <li>• <b>Use science concepts and ideas when interpreting and explaining</b> their data</li> <li>• Identify <b>discrepancies and suggest changes</b> that would reduce uncertainty / increase the reliability of their conclusions</li> </ul>	<ul style="list-style-type: none"> <li>• Recognise <b>whether their results are in agreement with current scientific knowledge</b>, and <b>suggest plausible reasons for any discrepancies</b></li> <li>• Comment on the <b>implications their findings have for society.</b></li> </ul>	<ul style="list-style-type: none"> <li>• Critically evaluate results and conclusions, including <b>identifying alternative interpretations</b> (if any) and <b>recommending the next research</b> that should be conducted</li> <li>• Critically analyse the implications of their findings, <b>considering social, environmental and economic perspectives</b>, as appropriate</li> </ul>