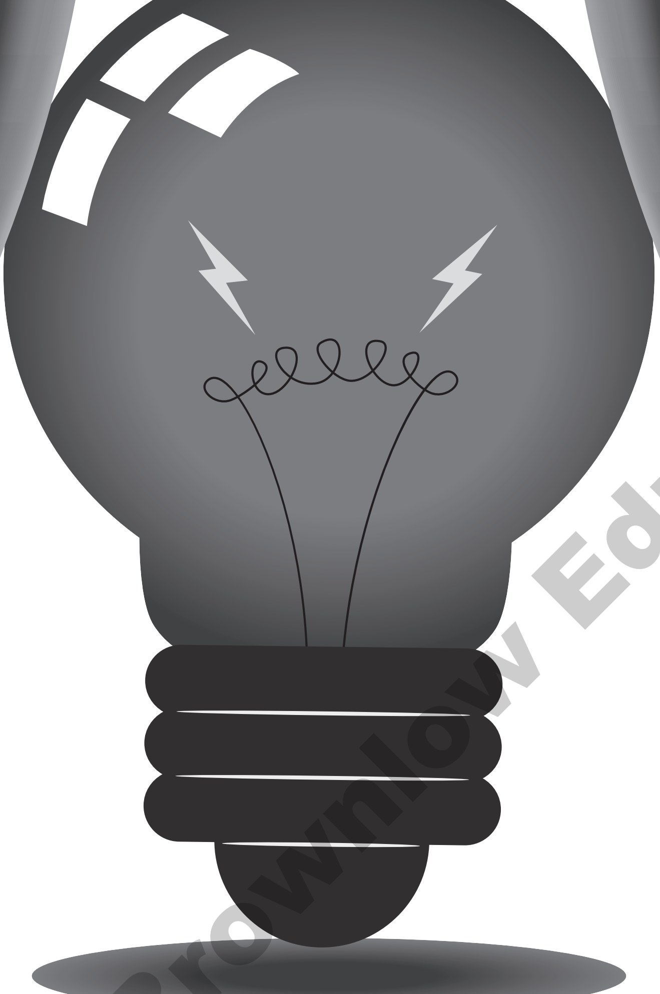

SCIENCE FAIR WARM-UP

» LEARNING THE PRACTICE OF SCIENTISTS «

Years 5–8

JOHN HAYSOM

Hawker Brownlow
EDUCATION

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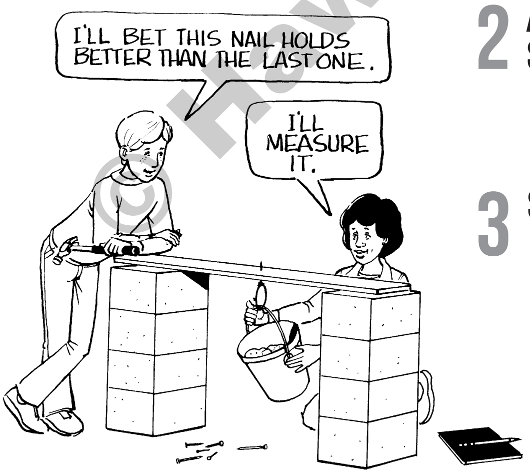
LET'S GET STARTED! WHICH PROJECT SHOULD WE CHOOSE?
HOW 'BOUT THE ONE ON NAILS? – YOU LIKE WOODWORKING TOO.



I'LL BET THIS NAIL HOLDS BETTER THAN THE LAST ONE.
I'LL MEASURE IT.

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CURRICULUM CONNECTIONS

Science Fair Warm-Up

In recent years, the Australian Federal Government has been working closely with state and territory educational offices in an effort to implement a national curriculum for all Australian schools. This Australian Curriculum sets consistent national standards, in an effort to improve learning outcomes for all students, as well as laying the foundations for future learning, growth and active participation in the community.

Effective science instruction is crucial to all students, as the skills they learn and cultivate in the science classroom are not only important tools for use in other subject areas, but also in everyday life. The Australian Curriculum: Science emphasises the need for students to apply their scientific thinking in all aspects of their studies, encouraging exploration, investigation, observation and problem solving. The curriculum also prompts students to look back at the influence science has had on their own lives, as well as society as a whole. Ultimately, the Australian Curriculum: Science is designed to provide students with the knowledge, skills and reasoning abilities to make informed decisions not only about their own lives, but about global issues and concerns.

Science Fair Warm-Up emphasises the need for students to understand where early scientific discoveries originated, linking the experiments they are conducting in the 21st century with discoveries made by prominent scientists hundreds of years ago. In this way, it fulfils an important cross-curriculum priority in the Australian Curriculum framework, placing students' science studies in an historical context: It is important that students learn that science and technology have grown through the gradual accumulation of knowledge over many centuries; that all sorts of people, including people like themselves, use and contribute to science. Historical studies of science and technology in the early Egyptian, Greek, Chinese, Arabic and Aboriginal and Torres Strait Islander cultures extending to modern times will help students understand the contributions of people from around the world. (ACARA 2015)

This revised Australian edition of *Science Fair Warm-Up* strongly correlates with two of the three strands – Science as a Human Endeavour and Science Inquiry Skills – of the Australian Curriculum: Science, featuring comprehensive practice in making predictions, conducting experiments and reporting results in every activity. While the concepts in certain activities in this book specifically correlate with multiple content descriptions in the physical and chemical science sub-strands, every activity is underpinned by the Science as a Human Endeavour and Science Inquiry Skills content of the Australian Curriculum: Science.

While the content in *Science Fair Warm-Up* focuses on Years 5–8, it should always be assumed that students engage in appropriate prerequisite work prior to those year levels and meaningful review and extensions subsequent to those year levels.

While it is recommended that teachers use the science activities in this book with their Australian Curriculum: Science instruction, the activities featured in *Science Fair Warm-Up* can just as easily be used with other educational frameworks at the state or institutional level. For a full overview of the Australian Curriculum please visit *http://www.australiancurriculum.edu.au/*.

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Chapter 2:
An Overview of the Nature of Scientific Inquiry

*BEGINNER SCIENTISTS AND EXPERIENCED SCIENTISTS

When it rains heavily, puddles form. We know big puddles take longer to dry up than smaller ones. We also know that puddles usually dry up quickly on a sunny day. Did anyone tell you these facts about puddles drying up, or did you figure them out yourself? If you figured this out yourself, you were doing the same sort of thing that scientists do. Or, Instead of doing experiments yourself, you waited until something interesting happened. And, of course, waiting until something happens may not be as useful as an experiment you could have devised.

Even though you know a lot about puddles, you might not be able to say whether small, deep puddles dry up faster than large, shallow ones; whether they dry up faster on cold, dry days or humid days; and whether puddles on concrete dry up faster than those on asphalt.

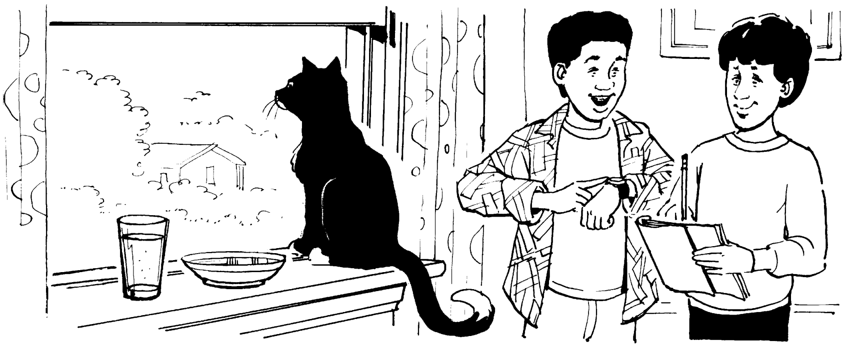
Exploration: Puddle Science

To answer all your puddle questions, you would have to spend a lifetime observing puddles, waiting for something interesting to happen. What could you do right now to answer these questions?

Mick and Jo decided to investigate the differences between small, deep puddles and large, shallow ones. They tipped one small jar of water into a shallow dish and the same amount (to have a fair test) into a tall drinking glass. They set both dishes on a windowsill. The puddle in the shallow dish dried up in a few days, but the one in the drinking glass took much longer. Mick and Jo were beginner scientists.

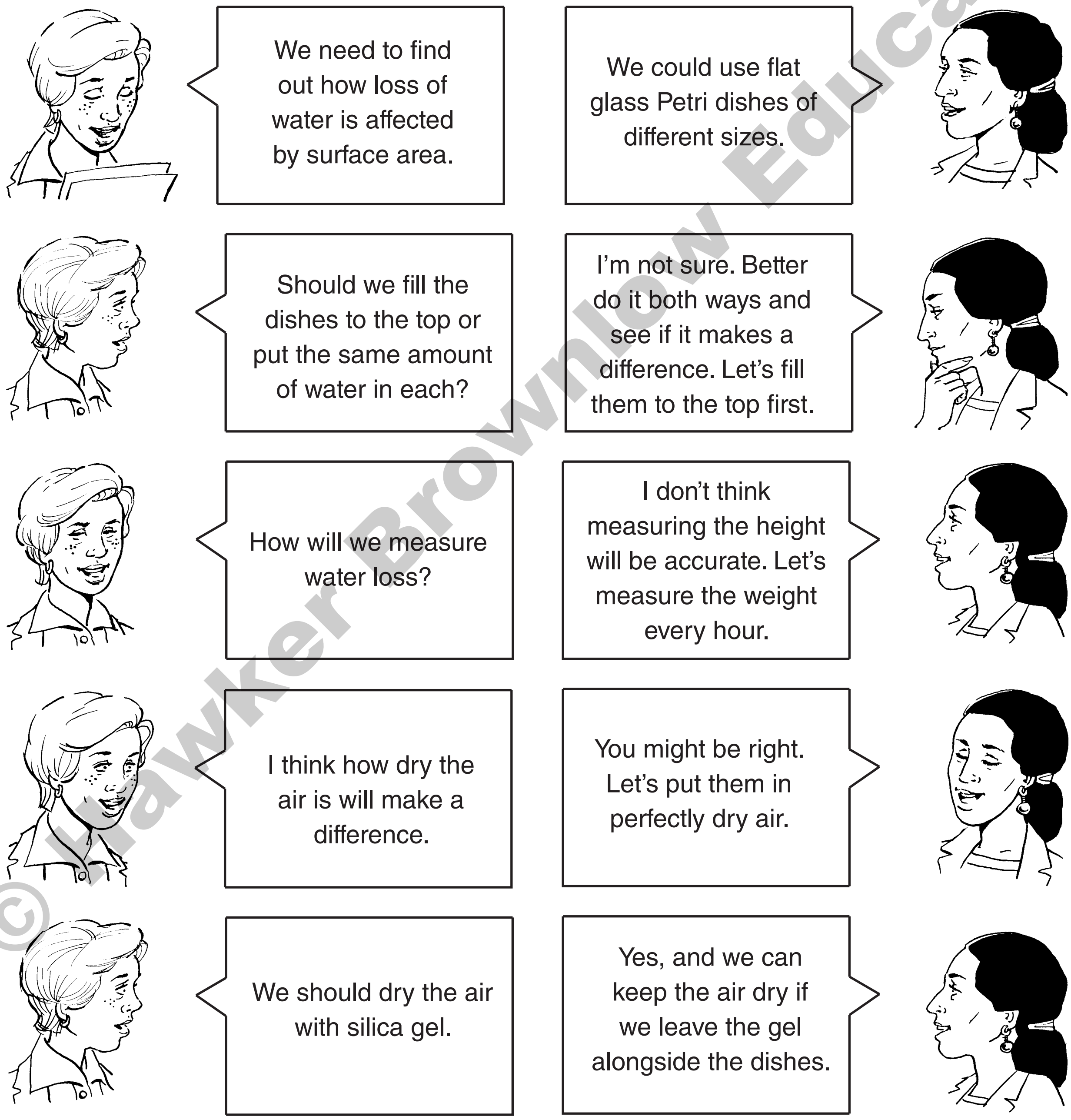
Your Assignment

Put yourself in Mick's and Jo's shoes. What other puddle problems could you investigate? Can you devise some experiments to find out the answers?



Two Experienced Scientists Investigate

How would two scientists have investigated Mick and Jo's problem? Let us join Michelle and Joanne as they talk about the problem.



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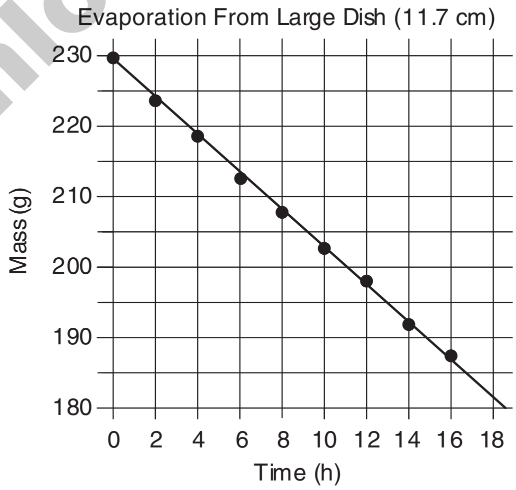
We should record the temperature of the room. Anything else we should note?

How about if it's light or dark in the room?

OK. Here are our results.

Let's plot them on a graph!

Time (hrs)	Mass of Dish Plus Water (g)		
	11.7 cm Dish	9.3 cm Dish	8.5 cm Dish
0	229.2	137.4	110.4
2	223.9	134.1	107.6
4	218.7	130.9	104.9
6	213.3	127.5	102.0
8	208.0	124.2	99.3
10	202.7	120.9	96.6
12	197.5	117.7	93.8
14	192.2	114.4	91.1
16	186.9	111.1	88.4



OK. But we should have plotted mass loss against time.

You're right! And then we should do a plot to show how the area of the dish affects the rate of mass loss.

Questions for Discussion

1. Look at each of the parts of the conversation between Michelle and Joanne. What differences do you notice between these experienced scientists and the beginners (Mick and Jo)?
2. Review the experiment you devised. Can you improve on it in any way?

What Have Scientists Discovered About Puddles?

Scientists like Michelle and Joanne have been working on problems of water (and other liquids) evaporating (from puddles and other surfaces) for hundreds of years. They have been trying to understand more about evaporation and the way nature behaves.

Over the years, scientists have learned a lot. Scientists have made important contributions and have had many discoveries, such as how the rate of evaporation is affected by the size of the surface area, the temperature of the room, the humidity (wetness) of the air and the amount of light, among other variables. *Would any of your experiments have provided information about these factors?*

As years went by, scientists became convinced that water and all other substances are made up of tiny moving particles. This concept fit nicely with what they already knew about evaporation; indeed, the concept helped tie all the ideas together. They were able to explain why evaporation occurred more quickly in larger surface areas, at higher temperatures or in dryer air. As a result, they gained a deeper understanding of evaporation. As you study science more, you will learn about this process.

These ideas about how evaporation works are useful because they help us explain what we see happening in the world around us: why clothes dry better if we lay them flat rather than leave them in a heap and why they dry better on a windy day. These ideas also help us predict potential outcomes based on certain actions. Scientists' experiments provide information that helps us explain how the world around us works.

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