



'The Science Of (Nearly) Everything'

G.A.T.E.WAYS is an independent organisation offering challenging and enriching activities and experiences to develop and extend highly able children. Established in 1994, G.A.T.E.WAYS runs a range of stimulating school programs as well as the Saturday *Brainwaves Club*.

This *JOURNEY* for both girls and boys will run over four sessions. Over the past century, scientists have sought to explain the character of the matter and energy in our universe, to show how the basic forces of nature and the building blocks of matter come about, and to explore the fabric of space and time. Although the concepts of matter, space, time and energy can be explored separately, as we journey deeper into the laws of physics, we find they are intricately connected. Did you know that matter and energy create space-time curvature? What does this mean and would you like to find out? Come and join us on this very hands-on Journey. We'll complete one or two experiments each week; as well, we'll participate in lots of interesting class demonstrations and discussions.

Requirements:

An exercise book for writing up experiments, a well-stocked pencil case, a calculator, a snack (no nuts)

Week One: A see-through glass jar, such as a 250g honey jar.

Week Two: A small bar magnet (about 10cm long), a metal baking tray.

Week Three: A board game such as chess or checkers, a torch, a ball about the size of a soccer ball.

Week Four: A clock, a watch, or anything else that measures time.

Session One: What's The Matter Einstein?

focus Chemistry

What is matter? Once scientists thought that the atom was the smallest particle. But we can now identify the subatomic particles that make up atoms. What are subatomic particles made of? How can quarks have flavours? Today we explore the concept of matter, at a very small scale, and through some dynamic chemical reactions involving starch, sugars, gelatine and yeast. These experiments will be carried out and written up using the scientific method. What are the elements that make up a human body? How is this composition different from say, a tree, or plastic? We'll explore these questions and also examine the importance of hydrocarbons, and the five states of matter.

Session Two: Energy: It Really is Rocket Science

focus Physics

What is energy? Where did it come from? How do we harness energy for our survival? In this session we explore the four fundamental forces of energy, tying this in to our knowledge of matter from the previous week. We'll perform experiments to help with our understanding of different types of energy such as magnetic, kinetic, potential, thermal and sound. We'll make magnets and a compass, and create some hair raising static electricity! We'll also demonstrate the effects of gravity and take a closer look at light and sound waves. You'll also practise the scientific method, including a detailed write up of our experiments.

Session Three: The Great Space Supernova

focus Astronomy

What is space? Is it changing? How is the Universe expanding? In this session we see how scientific ideas begin to merge with philosophical ideas, as we reach the very edges of our understanding of the Universe. Beginning with what we do know, we'll create a chart on stellar formation, looking in detail at the chemical reactions that occur, and how differences in matter and energy will lead to different types of stars and reactions, including supernovas

and black holes. What is dark matter, and dark energy? Will our sun supernova? After today, you will be able to answer these and many more questions.

Session Four: Time – It's Time For Time

focus Astrophysics

What is time? If it is the 'fourth dimension' why can we only travel in one direction on it? There are many philosophical questions that the concept of time raises, as well as the most exciting scientific one regarding time travel. Is it possible? How would we do it? What would the consequences of time travel be for us? Today we'll create a time line, from 14 billion years ago up to now, highlighting some of the most significant events along the way. We'll also explore more concrete concepts of time, such as how it is measured, and how these measurements have changed over....er.... over time.

Homework Requirements & Assessment

Homework will be set after each session to give students extra time to explore the new concepts. At the end of the program a short, written report will be completed on each student and forwarded home to parents. A copy should be made and forwarded to the school.

ABOUT THE PRESENTER

Anne Eastaugh is passionate about teaching students the magic and wonders of mathematics. She is currently teaching first and second year maths at Monash University. She holds a Bachelor of Science and recently completed her Honours in Mathematics. She has taught G.A.T.E.WAYS programs for many years, focussing on maths and physics. She believes that creativity and imagination are essential tools for learning. Anne is the author of a book of mathematical adventures for middle year students (Years 5-8), *The Peculiar Puzzles of Professor Fibbernacho*, published by G.A.T.E.WAYS Publications. In her spare time she writes and reads science fantasy stories, and plays Celtic violin.

