OUR LADY OF THE ROSARY, THE ENTRANCE
SCIENCE & TECHNOLOGY PROGRAM

Stage:	2	Year:	3	Unit Name:	Energy As A Resource - Physical World	Term:	1 & 2	Duration:	20 Weeks

Unit Description

This unit focuses on light, heat and electrical energy and how contact forces affect the behaviour of objects. Students will develop their understanding of energy as a resource that can be generated and transferred. They investigate the interdependent relationship between energy and forces that affects the behaviour of objects. Students observe how energy and forces are used in the manufacture of products and systems.

Key Inquiry Questions

- How do light, heat and electrical energy make things happen?
- How can objects affect other objects with or without touching them?
- How can we use forces and energy in a product or system?

Outcomes & Content

ST2-8PW-ST - describes the characteristics and effects of common forms of energy, such as light and heat

- investigate the behaviour of light, for example:
  - light reflecting in a mirror and on a variety of different surfaces
  - shadows resulting from interruption of light by an object
- describe the effects of heat energy, for example:
  - melting,
  - expanding
- explore ways heat can be transferred due to conduction
- explore some common sources and uses of electrical energy and describe different ways electrical energy can be generated sustainably, for example:
  - solar cells,
  - hydroelectric power,
  - wind turbines,
  - geothermal power generation,
  - wave power

ST2-9PW-ST - describes how contact and non-contact forces affect an object's motion

- identify that both pushes and pulls can be classified as contact and noncontact forces
- observe how contact and non-contact forces cause changes in the motion of objects, for example
  - changes in speed
  - changes in direction
- investigate how forces and materials interact in a product or system to perform a function

Curriculum Links:
→ **Mathematics** - Length 1, Data 1, Mass 1
→ **English** - Spelling, Expressing Themselves, Writing & Representing 2

Skills Focus

Working Scientifically → **ST2-1WS-S**
questions, plans and conducts scientific investigations, collects and summarises data and communicates using scientific representations

Planning & Conducting Investigations

- plan scientific investigations with guidance
- conduct scientific investigations to find answers to questions
- use appropriate materials and equipment safely
- consider and apply the elements of fair tests
- collect and record accurate, honest observations using labelled observational drawings, basic formal measurements and digital technologies as appropriate
- reflect on investigations, including whether testing was fair or not
- participate individually and collaboratively with clear roles and goals

Processing & Analysing Data

- use a range of methods to represent data, including tables and column graphs
- identify patterns and trends in gathered data
- compare results with predictions
- suggest possible reasons for findings

Design & Production → **ST2-2DP-T**
selects and uses materials, tools and equipment to develop solutions for a need or opportunity

Identifying & Defining

- critique needs or opportunities for designing solutions through evaluating products and processes
- define a need or opportunity according to functional and aesthetic criteria
- consider potential resources in defining design needs and opportunities
- investigate and research materials, components, tools and techniques to produce design solutions
- define simple problems by determining and defining a process
- develop a sequence of steps and decisions (algorithms) to solve a problem

Testing & Evaluating

- develop a set of criteria for success with guidance, based on defined needs and opportunities
- develop criteria to evaluate the environmental impact of a design with guidance
- devise a fair process to test a designed solution with guidance
- evaluate design ideas, processes and solutions, based on criteria for success

Assessment: ***For*** **/** ***As*** **/** ***Of*** **Learning → Throughout this unit a range of assessment tasks and types will be used to gauge students' knowledge and understanding.**

- Shadow experiment and analysis (**Assessment For Learning**)
- Conduction & Insulation experiments (**Assessment For Learning**) and Reflection on learning (**Assessment As Learning**)
- Design & Produce Solar Oven Task (**Assessment Of Learning**) and Reflecting on the design & produce process (**Assessment As Learning**)
- Contact and Non-Contact Forces experiments (**Assessment For Learning**)
- Design and Produce Science Toy (**Assessment Of Learning**) and Reflecting on the design & produce process (**Assessment As Learning**)

THINKING SKILLS (Page 35)

Highlight the thinking skills this unit promotes.

Computational thinking – ComT
Computational thinking is a process where a problem is analysed and solved so that a human, machine or computer can effectively implement the solution. It involves using strategies to organise data logically, break down problems into parts, interpret patterns and design and implement algorithms to solve problems.

Design thinking – DesT
Design thinking is a process where a need or opportunity is identified and a design solution is developed. The consideration of economic, environmental and social impacts that result from designed solutions are core to design thinking. Design thinking methods can be used when trying to understand a problem, generate ideas and refine a design based on evaluation and testing.

Scientific thinking – SciT
Scientific thinking is purposeful thinking that has the objective to enhance knowledge. A scientific thinker raises questions and problems, observes and gathers data, draws conclusions based on evidence, tests conclusions, thinks with an open mind and communicates research findings appropriately.

Systems thinking – SysT
Systems thinking is an understanding of how related objects or components interact to influence how a system functions. Students are provided with opportunities to recognise the connectedness of, and interactions between phenomena, people, places and events in local and wider contexts and consider the impact of their decisions. Understanding the complexity of systems and the interdependence of components is important for scientific research and for the creation of solutions to technical, economic and social issues.

CROSS CURRICULUM PRIORITIES AND GENERAL CAPABILITIES (Page 38)

Highlight the general capabilities this unit promotes.


Aboriginal and Torres Strait Islander histories and cultures


Asia and Australia's engagement with Asia


Sustainability

Highlight the cross-curriculum priorities this unit promotes.


Critical and creative thinking


Ethical understanding


Information and communication technology capability


Intercultural understanding


Literacy

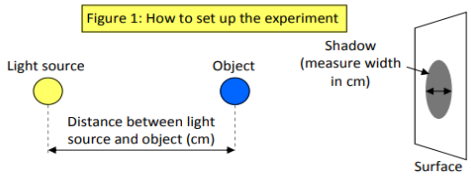

Numeracy


Personal and social capability


Civics and citizenship


Difference and diversity

Work and enterprise

CONTENT FOCUS	LEARNING & TEACHING SEQUENCE -1 *Light and Shadows*	EVALUATION	RESOURCES
How do heat, light and electrical energy make things happen? Students: ● investigate the behaviour of light ○ light reflecting in a mirror and on a variety of different surfaces ○ shadows resulting from interruption of light by an object Curriculum Links: **Mathematics** → Length 1 (MA2-9MG) → Data 1 (MA2-18SP)	**Tuning In:** ❏ Display a number of images and objects depicting a range of light sources, for example a lamp, image of a sun, a candle etc. Use the thinking routine See Think Wonder to stimulate a discussion about these items. ❏ What do you see, observe or notice? ❏ What do you think these items have in common? ❏ What do you wonder? ❏ Examine the You Tube clip Sources of Light and discuss further, recording student thinking as you tune in. **Shared Inquiry:** ❏ Investigate how shadows are formed with different light sources, e.g. the sun and a torch/lamp ❏ Using a lamp or torch students record the shadow formed by different objects ❏ Label image and begin developing reasons why shadows are formed in this way? ❏ Examine the nature of shadows created by the sun, recording shadows over a set period of time, in order to record changes. ❏ Explore what happens to shadows when a light source moves or the distance between the light source and an object changes. (**LINK: Mathematics**) (**Assessment For Learning**)  ❏ Measure the distance between the object and the light source (in cm) ❏ Measure how big the shadow is at its widest point (width in cm) ❏ Record the information in a table ❏ Move the light source different distances away from the object, recording the same two measurements each time ❏ Represent data in a graph ❏ Analyse the information using guiding questions: ❏ What happens to the size of the shadow if you move the light source away? ❏ What happens to the size of the shadow if you move the light closer to the object? ❏ Why do you think this might be? ❏ What do you still wonder?		You Tube clip Sources of Light lamp torches range of objects ruler/ tape measure flat surface object light source

CONTENT FOCUS	LEARNING & TEACHING SEQUENCE - 2 *Heat Energy*	EVALUATION	RESOURCES
How do heat, light and electrical energy make things happen? Students: ● describe the effects of heat energy ○ melting ○ expanding ● explore ways that heat can be transferred due to conduction Curriculum Links: **English** → Spelling (EN2-5A) **Mathematics** → Data 1 (MA2-18SP)	**Tuning In:** ❏ Set up an experiment for students to observe 'heat energy' ❏ Display two clear containers. One filled with warm water and the other with cold water. ❏ Place a drop of red food colouring into the centre of the container with warm water and a drop of blue food colouring in the centre of the container with cold water ❏ Record the experiment so that it can be observed again. ❏ Use the thinking routine See Think Wonder to help students make observations, preliminary predictions and develop wonderings. Discuss observations and record student thinking. ❏ Teacher Notes: Things do not need to feel hot to have heat energy. The heat energy is present in both the warm and cold water because the food colouring is moving throughout the water. The warm water has more heat energy so the food colouring moved faster in warm water than cold water. Heat energy is transferred in different ways. ❏ Draw a diagram that illustrates what occurred in the experiment. **Shared Inquiry:** ❏ Examine the You Tube clip Heat Energy and discuss the different items they know that have heat energy. ❏ Use the thinking routine Chalk Talk to explore how a thermometer can be used to measure the changes in heat energy of an object. ❏ Place an image of a thermometer in the centre of a page. ❏ Students record thinking about its purpose and how it functions. ❏ Teacher Notes: heat is transferred from a system (or an object) of higher temperature to an object of lower temperature. ❏ **(LINK: English)** - Explore the meaning and etymology of the word thermometer. How can our understanding of the word thermometer be used to spell other words related to heat energy? ❏ Experiment with using a thermometer to measure temperature and changes in heat energy (**LINK: Mathematics**) ❏ Pairs have a cup of warm water (37°C and a cup of cold water. ❏ Make predictions about what will happen to the temperature of each cup over a half hour period. ❏ Record the temperature of each cup every 10 minutes for half an hour ❏ Graph the results gathered through the experiment		clear containers x2 warm water cool water food colouring -red & blue Digital device IWB or Apple TV paper thermometer image set of thermometers cold water warm water clear cups

	❑ Share results with another group making comparisons between data - similarities and differences ❑ Draw conclusions and build an explanation about why the temperature in each cup of water changed. ❑ Discuss how heat can be transferred from object to object/ place to place in a variety of ways, with one of these being conduction ❑ Heat Transfer (WISC Learning Object) ❑ Investigate conduction as a method of heat transfer by conducting an experiment in small groups (groups of 3) (**Assessment For Learning**) ❑ Conduction Experiment: (heat transferred from one object to another when they are in contact) ❑ Using a stopwatch and an ice cube in a zip lock bag, measure the time it takes for the ice cube to melt whilst being held in a hand. Record observations, including diagrams. ❑ Use guided questioning to support the development of understanding ❑ Why did the ice melt? ❑ Where was heat energy present? ❑ How does this experiment show us conduction as a heat method? ❑ How many other examples of conduction can you think of? ❑ Conduction & Insulation Experiments: (exploring that energy can move from one place to another (conduction), and that some materials help to prevent energy transfer (insulation). ❑ Testing Conductors: Using a container filled with ice cubes and tap water, place a metal, wooden and plastic spoon in the container. At set intervals, feel the end of each spoon to determine which is the coldest, which is still warm and the temperature of the water. ❑ Make predictions about which spoon will be the coldest and why. ❑ What does this tell us about which material is the best conductor and which is a good insulator? ❑ Testing Insulators of Heat: Using 4 aluminium cans, wrap 3 different types of material around them leaving one unwrapped. Fill each can ½ way with tap water and place on a solid surface under a lamp or in the sun. Cover the tops with cardboard to prevent heat escaping. ❑ Make predictions about temperatures after 10-15 mins ❑ Record beginning temperature and every few minutes for a set time frame, e.g. every 10 minutes for an hour. ❑ Reflect on learning using the thinking routine I used to think, now I think (**Assessment As Learning**)		Heat Transfer (WISC Learning Object) stopwatches ice cubes zip lock bags ice cubes clear container metal spoon plastic spoon wooden spoon thermometer aluminium cans 3 different types of material cardboard squares

CONTENT FOCUS	LEARNING & TEACHING SEQUENCE - 3 *Electrical Energy*	EVALUATION	RESOURCES
How do heat, light and electrical energy make things happen? Students: ● explore some common sources and uses of electrical energy and describe different ways electrical energy can be generated sustainably, for example: ○ solar cells ○ hydroelectric power ○ wind turbines ○ geothermal power generation ○ wave power Curriculum Links: **English** → Writing & Representing 2 (EN2-7B)	**Tuning In:** ❏ Use the thinking routine Chalk Talk to determine prior knowledge of students around electrical energy. ❏ What everyday items use electricity? ❏ Do all of these items require the same amount of electrical energy? ❏ What are some ways we can generate electricity or electrical energy? **Shared Inquiry:** ❏ Watch the You Tube clip Different Sources of Energy ❏ Use the thinking routine Plus One to support students in taking notes of key information and building on the thinking of others through additions, elaborations and connections. ❏ Engage in a Tug-Of-War to examine some of the forces that tug at either side of the argument for renewable vs. non-renewable energy. (**LINK: English**) ❏ Renewable Energy 101 - National Geographic ❏ Explore further the use of electrical energy generated by solar power. **Design & Produce Task: (Assessment Of Learning)** ❏ Investigate ways we can harness the power of the sun through researching, designing, creating and testing a solar power oven ❏ Pairs research and design a solar power oven using a variety of recycled objects. Students use knowledge of conduction and insulation of heat energy from previous learning to support the development of their product. ❏ Draw labelled diagrams to show key features, including reasons why they have chosen a specific recycled object. ❏ Build and test their product, making changes as necessary. ❏ Record the building process through images or video. ❏ Write a procedure for building their solar powered oven that includes images and diagrams (**LINK: English**) ❏ Use the solar power oven to cook something like cookie dough. ❏ Reflect on the design and produce task through guided questioning. (**Assessment As Learning**) ❏ How well did your solar oven cook food? Do you think it could have cooked the food better? Explain why. ❏ What challenges did the group face? How were these overcome? ❏ How do you think your solar oven could be improved? ❏ How did your solar oven work?		You Tube clip Different Sources of Energy Renewable & Non-Renewable Energy Posters Solar Schools Energy Sources

CONTENT FOCUS	LEARNING & TEACHING SEQUENCE - 4 *Contact & Non-Contact Forces*	EVALUATION	RESOURCES
How can objects affect other objects with or without touching them? Students: ● identify that both pushes and pulls can be classified as contact and non-contact forces ● observe how contact and non-contact forces cause changes in the motion of objects, for example: ○ changes in speed ○ changes in direction Curriculum Links: **Mathematics** → Data 1 (MA2-18SP) → Length 1 (MA2-9MG) → Mass 1 (MA2-12MG)	**Tuning In:** ❏ Imagine holding a slinky by the top end, with the bottom end dangling in mid-air. What do you think would happen when you let it go? ❏ Make predictions about what will happen, including a diagram to support their initial thinking. ❏ Record a video of the slinky dropping, using slow motion to help students see what happens. Recording new thinking. ❏ Examine the ABC Education video The physics of a slinky drop **Shared Inquiry:** ❏ Examine the video What is a Force? (3:37) ❏ Engage in a discussion about the video using guiding prompts, recording student thinking. ❏ What is a force? ❏ How can we categorise forces? ❏ What examples of forces can we see in the world around us? ❏ Investigate contact and non-contact forces through a series of experiments to help students explore and explain forces. (**Assessment For Learning**) The thinking routine PG & E would be a useful scaffold for students during these experiments. ❏ Balloon Rocket: ***How do different forces affect the movement of the balloon?*** ❏ Equipment: balloons, masking tape, straws, string ❏ Discuss the scientific variables: ❏ Control: What stays the same across all tests ❏ Dependent: The change we measure because of changing the independent variable ❏ Independent: One thing you will changes, e.g. length of straw, shape of balloon, amount of air, colour of balloon, position of masking tape, angle of string, type of string, position of straw etc. ❏ Small groups record their variables, make a hypothesis and conduct their experiment. Record and represent data gathered (**LINK: Mathematics**) Report findings back to the class, explaining the kind of forces at play, e.g. gravity, air resistance and friction. ❏ Weight & Forces: ***How does an object's weight affect the force required to move it?*** ❏ Equipment: string, weights, table, cup, car/bike (using meccano or knex)		Slinky Video The physics of a slinky drop video What is a Force? balloons masking tape straws string string weights

English → Expressing Themselves (EN2-11D)	❑ Small groups record their independent, dependent and control variables, build their model, make a hypothesis and conduct their experiment exploring how many weights need to be placed at the end of the string in order for the car to move along the table. Record and represent data gathered (**LINK: Mathematics**) Report findings back to the class, explaining the kind of forces at play. ❑ Measuring Magnetic Pull: ***How do magnets act as a non-contact force?*** ❑ Small groups use weights to determine magnetic force (**LINK: Mathematics**) ❑ Tape a magnet (A) to a desk and place another magnet (B) in the balance basket, so they are "attached". Gently place weights in the other basket to determine the number required in order to separate them. Check that the force of placing in the weight has not affected the pull. ❑ Compare and record the strength of different magnets. How could you find out whether 2 magnets are stronger than one? What other things do you notice? ❑ Record data and observations. ❑ Investigate the physical sciences from a Aboriginal and Torres Strait Islander perspective ❑ Examine the video Earth Space Banumbirr and use discussion to talk about the ideas in the video (**LINK: English**) ❑ How did Aboriginal and Torres Strait Islander people understand the force of gravity? ❑ How did they communicate their understanding through dreamtime stories? ❑ Why are dreamtime stories important? ❑ How does this connect to what we already know about forces? ❑ Explore ways Aboriginal and Torres Strait Islander Peoples manipulated forces ❑ Read Manipulating Forces on the Morning Star Powerpoint (Teach Starter) ❑ Draw an illustration to show the activity, labelling the image with the kind of force at play. ❑ Connect with Aboriginal Education Officer to explore how forces were manipulated for the Darkinjung people.		table cup meccano/knex to build a model car/bike magnets x6 balance scales weights tape video Earth Space Banumbirr Morning Star Powerpoint

CONTENT FOCUS	LEARNING & TEACHING SEQUENCE - 5 *Forces & Energy In Products & Systems*	EVALUATION	RESOURCES
How can we use forces and energy in a product or system? Students: ● investigate how forces and materials interact in a product or system to perform a function Curriculum Links: **English** → Writing & Representing 2 (EN2-7B)	**Tuning In:** ❏ Pose the question: ***How can Science be applied to creating toys?*** ❏ Use the thinking routine I used to think, Now I think adding on 'So next I will' to lead into an investigation and design and produce task. **Shared Inquiry:** ❏ Design and Produce Task: (**Assessment Of Learning**) ❏ Independent, Pairs or Small Groups design and create their own science toy and investigate the specific forces used in their toy or to make the toy move. ❏ Research and design a functional toy using a variety of materials ❏ Make predictions about the kind of forces the toy will use or make the toy move. ❏ Create and test the toy ❏ Create an iMovie that highlights the process, finished product and forces applied, including ❏ pictures of design plan ❏ photos of the build process ❏ a video of the toy being used and moving ❏ explanation of the kinds of forces at work and what makes them say that ❏ Design an advertising poster that includes a diagram of the forces involved in their toy. (**LINK: English**) ❏ Engage with the thinking routine Red Light, Yellow Light to help students reflect on the design and produce task (**Assessment As Learning**) ❏ **Red Light:** ❏ What challenged you during the design and produce task? ❏ **Yellow Light:** ❏ How did you overcome the obstacles during the task? ❏ **Green Light:** ❏ In what ways were you successful in this task?		variety of materials