TUMUT PUBLIC SCHOOL
SCIENCE & TECHNOLOGY PROGRAM

Stage:	2	Year:	3 & 4	Unit Name:	Forces - Physical World	Term:	2	Duration:	10 Weeks

Unit Description

This unit focuses on 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 can objects affect other objects with or without touching them?
- How can we use forces and energy in a product or system?

Outcomes & Content

ST2-9PW-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, Data, Mass

→ **English** - 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.**

- 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)	CROSS CURRICULUM PRIORITIES AND GENERAL CAPABILITIES (Page 38)
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.	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 *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?***		Slinky Video The physics of a slinky drop video What is a Force? balloons masking tape straws string string weights

	❑ Equipment: string, weights, table, cup, car/bike (using meccano or knex) ❑ 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.		table cup meccano/knex to build a model car/bike magnets x6 balance scales weights tape video Earth Space Banumbirr Morning Star Powerpoint
English → Expressing Themselves (EN2-11D)			

	❑ Connect with Aboriginal Education Officer to explore how forces were manipulated for the Wiradjuri and Wolgalu people.		

CONTENT FOCUS	LEARNING & TEACHING SEQUENCE - 2 *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