

Teacher Notes

Themes

- Engagement
- Observation
- Creative thinking
- Scientific application

Key learning outcomes

- Physics helps us understand the things we observe in our everyday world.
- Scientific principles connect seemingly unrelated and distant phenomena.
- We can engage and experiment with scientific ideas by using simple items we might find in our home environments.

Key curriculum areas (years 5 to 9)

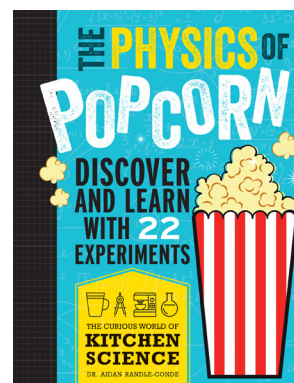
- **Science:** Science Understanding (Physical sciences, Chemical sciences); Science as a Human Endeavour; Science Investigation
- **English:** Language, Literature, Literacy
- **Mathematics:** Measurement and geometry

Publication details

The Physics of Popcorn
ISBN: 9781486313587

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The Physics of Popcorn

Discover and Learn with 22 Experiments
Aidan Randle-Conde

About the book

Get ready to play (and learn!) with your food!

Discover how electricity is made, learn about the inner workings of atoms and conduct experiments with making waves, and more. Become a kitchen scientist by grasping gases using a home-made hot air balloon, learning about light to recreate a rainbow and mastering momentum with model cars!

The Physics of Popcorn uses applied science for a fun and interactive approach to learning for the whole family.

Recommended for

Readers in years 5 to 9 (ages 10 to 14)



PUBLISHING

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About the author

Dr Aidan Randle-Conde has a PhD in particle physics from Brunel University, England, and was based at the SLAC laboratory in California. He held a postdoctoral position with SMU, Texas, and worked at CERN, Switzerland, where he helped to discover the Higgs boson. He then completed another postdoctoral position at ULB in Brussels and started a project called the Ministry of Sense, which performs in schools and public spaces to recreate the Higgs discovery.

Pre-reading activities

To prepare students for reading *The Physics of Popcorn*, ask them to discuss among themselves questions they have about observations in their immediately surrounds, such as school or home. Summarise the suggestions inside a circle on a sheet of paper or a white board, and label the circle 'near'.

Ask students to then discuss similar questions about experiences they've had further from home, located somewhere on Earth. Place these inside another circle surrounding the first, or a new circle next to it. Label this one 'on Earth'.

Encourage students to think of curiosities much further away, in space and beyond! Summarise these in a third circle and label it as 'Universe'. Discuss with the class whether there could be interesting science connecting any of these concepts between the three circles.

Return to the home environment and ask students to come up with a common appliance. Create a mind map about it, asking them to think of all scientific concepts that might be needed to understand how or why it works the way it does (it doesn't need to be deep or technical – so long as they're considering a relationship between science and technology). Divide them into groups and share more than one appliance. Which scientific concepts come up over and over again?

Discussion questions

Science

1. Ask students to discuss among themselves whether a bowling ball or a marble would hit the ground first when dropped from a plane. Instruct them to read the introduction to *The Physics of Popcorn* (pages 6–7), and discuss their thoughts.
2. The book's title, *The Physics of Popcorn*, refers to the science behind popcorn kernels expanding into tasty treats. Ask students to come up with an explanation for popcorn popping before reading Chapter 1 of the book and to write it on a slip of paper. Then ask them to write down an alternative explanation, instructing them it can be as weird and fantastic as they like. Collect all of the explanations and read them out, with students to vote on which sound likely (and which sound absurd).
3. Two important physicists are mentioned in *The Physics of Popcorn*: Sir Isaac Newton and Galileo Galilei. Ask students to read about their contributions, using the book's index to find their mentions. Ask them how their research and experimentation might be different to today's research into physics.
4. Tell students they're part of a research team that has to find a way to get to Mars within the next decade. Instruct them to browse through *The Physics of Popcorn*, paying attention to each of its chapters and contents. Ask them to discuss with the class which sections would be most instructive in coming up with a way to build technology that will help them get to Mars.
5. The activities throughout *The Physics of Popcorn* are intended to help readers connect with the reading material in a hands-on way. Ask students to find an activity they'd be keen to do. Discuss with them how they might improve the experiment if money and safety posed no limits.

English

1. Many things in science can be hard to describe accurately as a picture, because of their size, speed, or simply because their physics are rather strange. Ask students to find diagrams in *The Physics of Popcorn* depicting a concept. Discuss with them how accurate the picture might be in describing the phenomenon. Ask them how the real world might differ.
2. Science and technology rely heavily on acronyms, such as ISS (International Space Station), NASA (National Aeronautics and Space Administration), and symbols and simplifications, such as V for volt and 3D for three dimensional. Ask students why this is so common. Encourage them to make a list of science 'shorthand' they might find in *The Physics of Popcorn*.

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Mathematics

1. Many simple equations used in physics can be visualised using a triangle. Discuss with students how this triangle works mathematically. Check out the formula for density on page 10 as an example. Find similar equations throughout *The Physics of Popcorn* that follow the pattern of $A = B \times C$, or $C = A/B$, and apply the triangle method to show how they can be easily rearranged.
2. Many formulae in physics are made up of variables (values that change depending on where you find them) and constants (values that remain the same throughout time and space). Ask the students to find examples of each throughout *The Physics of Popcorn*, and discuss why they think a value in a formula is a constant or a variable.

Australian curriculum links

Year level	Learning area: science	Other learning areas
Years 5 and 6	Science understanding: Physical sciences • Light from a source forms shadows and can be absorbed, reflected and refracted (ACSSU080) • Electrical energy can be transferred and transformed in electrical circuits and can be generated from a range of sources (ACSSU097) Science understanding: Chemical sciences • Solids, liquids and gases have different observable properties and behave in different ways (ACSSU077) Science as a Human Endeavour • Science involves testing predictions by gathering data and using evidence to develop explanations of events and phenomena and reflects historical and cultural contributions (ACSHE081 and ACSHE098) • Scientific knowledge is used to solve problems and inform personal and community decisions (ACSHE083 and ACSHE100) Science Inquiry Skills • With guidance, pose clarifying questions and make predictions about scientific investigations (ACSIS231 and ACSIS232) • Construct and use a range of representations, including tables and graphs, to represent and describe observations, patterns or relationships in data using digital technologies as appropriate (ACSIS090 and ACSIS107)	English • Investigate how the organisation of texts into chapters, headings, subheadings, home pages and sub pages for online texts and according to chronology or topic can be used to predict content and assist navigation (ACELA1797) • Identify and explain how analytical images like figures, tables, diagrams, maps and graphs contribute to our understanding of verbal information in factual and persuasive texts (ACELA1524) Mathematics • Find unknown quantities in number sentences involving multiplication and division and identify equivalent number sentences involving multiplication and division (ACMNA121) • Choose appropriate units of measurement for length, area, volume, capacity and mass (ACMMG108) • Solve problems involving the comparison of lengths and areas using appropriate units (ACMMG137) • Connect volume and capacity and their units of measurement (ACMMG138)

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Year level	Learning area: science	Other learning areas
Year 7	Science understanding: Physical sciences - Change to an object's motion is caused by unbalanced forces, including Earth's gravitational attraction, acting on the object (ACSSU117) Science as a Human Endeavour - Scientific knowledge has changed peoples' understanding of the world and is refined as new evidence becomes available (ACSHE119) - Solutions to contemporary issues that are found using science and technology, may impact on other areas of society and may involve ethical considerations (ACSHE120) Science Inquiry Skills - Identify questions and problems that can be investigated scientifically and make predictions based on scientific knowledge (AC SIS124) - Measure and control variables, select equipment appropriate to the task and collect data with accuracy (AC SIS126)	English - Understand and explain how the text structures and language features of texts become more complex in informative and persuasive texts and identify underlying structures such as taxonomies, cause and effect, and extended metaphors (ACELA1531) - Understand how modality is achieved through discriminating choices in modal verbs, adverbs, adjectives and nouns (ACELA1536) - Understand how to use spelling rules and word origins, for example Greek and Latin roots, base words, suffixes, prefixes, spelling patterns and generalisations to learn new words and how to spell them (ACELA1539) Mathematics - Apply the associative, commutative and distributive laws to aid mental and written computation (ACMNA151) - Recognise and solve problems involving simple ratios (ACMNA173) - Introduce the concept of variables as a way of representing numbers using letters (ACMNA175) - Investigate, interpret and analyse graphs from authentic data (ACMNA180)
Year 8	Science understanding: Physical sciences - Energy appears in different forms, including movement (kinetic energy), heat and potential energy, and energy transformations and transfers cause change within systems (ACSSU155) Science understanding: Chemical sciences - Properties of the different states of matter can be explained in terms of the motion and arrangement of particles (ACSSU151) Science as a Human Endeavour - Scientific knowledge has changed peoples' understanding of the world and is refined as new evidence becomes available (ACSHE134) - Solutions to contemporary issues that are found using science and technology, may impact on other areas of society and may involve ethical considerations (ACSHE135) Science Inquiry Skills - Identify questions and problems that can be investigated scientifically and make predictions based on scientific knowledge (AC SIS139) - Measure and control variables, select equipment appropriate to the task and collect data with accuracy (AC SIS141)	English - Understand how cohesion in texts is improved by strengthening the internal structure of paragraphs through the use of examples, quotations and substantiation of claims (ACELA1766) - Investigate how visual and multimodal texts allude to or draw on other texts or images to enhance and layer meaning (ACELA1548)

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Year level	Learning area: science	Other learning areas
Year 9	Science understanding: Physical sciences - Energy transfer through different mediums can be explained using wave and particle models (ACSSU182) Science understanding: Chemical sciences - All matter is made of atoms that are composed of protons, neutrons and electrons; natural radioactivity arises from the decay of nuclei in atoms (ACSSU177) Science as a Human Endeavour - Scientific understanding, including models and theories, is contestable and is refined over time through a process of review by the scientific community (ACSHE157) - Values and needs of contemporary society can influence the focus of scientific research (ACSHE228) Science Inquiry Skills - Use knowledge of scientific concepts to draw conclusions that are consistent with evidence (ACSYS170) - Critically analyse the validity of information in primary and secondary sources and evaluate the approaches used to solve problems (ACSYS172)	English - Investigate how evaluation can be expressed directly and indirectly using devices, for example allusion, evocative vocabulary and metaphor (ACELA1552) - Identify how vocabulary choices contribute to specificity, abstraction and stylistic effectiveness (ACELA1561) Mathematics - Solve problems involving direct proportion. Explore the relationship between graphs and equations corresponding to simple rate problems (ACMNA208)

Related books from CSIRO Publishing

Hands-On Science (2016)

More Hands-On Science (2020)

The Biology of Bananas (2020)

The Chemistry of Cola (2020)

The Maths of Milkshakes (2020)