Science:
Natural and processed materials

Catalogue of digital curriculum resources

2011
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Introduction
This catalogue contains details about the Science: Natural and processed materials digital curriculum resources made available by The Learning Federation (TLF) to all schools in Australia and New Zealand. The content supports and enhances students' understanding of key scientific concepts in a range of contexts for the P–12 years.

The content includes:
- hundreds of interactive learning and assessment objects
- a large and diverse range of digitised items such as images, film clips, maps, songs, posters and documents, all with detailed teachers' notes.

Learning and assessment objects
The learning and assessment objects are based on current research findings in science education and pedagogy. The objects foster skills, such as scientific inquiry, data interpretation, analysis and synthesis that are transferable to daily life and to offline learning opportunities.

The objects promote scientific literacy and are organised around scientific concepts with real-life applications for students. They contain open-ended investigative tasks, tools, activities and processes that enable students to engage in 'real' science experiences and to construct and test their own scientific understandings.

Many of the objects also provide meaningful models, simulations and demonstrations of scientific concepts and practices. These objects provide teachers and students with experiences that are not universally available because, for example, they require expensive equipment or occur over extended periods of time.

Other objects are short activities that allow students to explore and practise a range of scientific concepts and skills.

Learning objects are generally published in series and some are also aggregated into single, larger learning objects. Aggregated learning objects are identified with the symbol.

An asterisk (*) on the series title indicates that not all the learning objects in that series have been released. The remaining learning objects will be released progressively.

Some learning objects contain non-TLF content. See the acknowledgements and conditions of use in the learning objects for details.

Digital resources
A remarkable range of digitised items licensed from leading Australian and New Zealand cultural and scientific institutions is also available. These items include:

- clips from documentaries, newsreels, television programs and feature films
- photographs, line drawings, maps and documents
- audio files of interviews, broadcasts and speeches.

With each item, TLF supplies an Educational value statement comprising a description and contextual information that enriches the value of the asset for the teacher.

This catalogue contains a representative sample of digital resources licensed from TLF’s partner institutions useful for the Science: Natural and processed materials strand.

Themes
This catalogue also includes examples of how teachers can draw on the extensive range of content to create thematic collections to challenge and engage students.
Other catalogues
You can download catalogues for each of the Science strands at: www.ndlrn.edu.au

A comprehensive Index of Science digital curriculum content is also available for download.

Accessing and viewing the content
Government and non-government education authorities in each Australian state and territory and in New Zealand have responsibility for facilitating access to the pool of digital content. Full details about how to access the content, including the necessary technical and software requirements for viewing it, can be found at:

www.ndlrn.edu.au
Learning objects

Kitchen chemistry series (Years 3–4)
In the 'Kitchen chemistry' series students observe and record changes that occur when common substances are added to water.

Features include:
- an introduction to the concepts of flotation, solubility and foaming properties
- simple experimental procedures for testing flotation, solubility and foaming properties
- data tables for recording results
- questions posed at two levels of difficulty.

Students:
- observe and record changes that occur when common substances are added to water
- use data tables to record and retrieve information.

Kitchen chemistry: experiment: level 1
L2367 – Years 3–4
Students are exposed to scientific methodology through testing the physical properties of kitchen substances such as pepper, detergent and butter. They look at experiments that determine whether substances float or sink, foam or dissolve in hot or cold water. They also examine if stirring makes a difference. The students create a table of data based on the results.

Kitchen chemistry: experiment: level 2
L2368 – Years 5–6

*Kitchen chemistry: experiment: level 2* is identical in functionality to *Kitchen chemistry: experiment 1* but the questions following the investigation stage are more complicated.

Kitchen chemistry: solve the mystery: level 1
L2369 – Years 3–4
Students test the physical properties of two unknown kitchen substances, such as cream or olive oil, to determine whether they float or sink, foam or dissolve in hot or cold water and the impact stirring makes. Then they refer to a data table of known properties and identify the unknown kitchen substances.

Kitchen chemistry: solve the mystery: level 2
L2370 – Years 5–6

*Kitchen chemistry: solve the mystery: level 2* is identical in functionality to *Kitchen chemistry: solve the mystery 1* but there are more substances to test to solve the mystery.
Kitchen chemistry: experiment and mystery: level 1
L2365 – Years 3–4

This is an aggregated learning object combining *Kitchen chemistry: experiment: level 1* and *Kitchen chemistry: solve the mystery: level 1*.

Kitchen chemistry: experiment and mystery: level 2
L2366 – Years 5–6

This is an aggregated learning object combining *Kitchen chemistry: experiment: level 2* and *Kitchen chemistry: solve the mystery: level 2*.
Mystery substance series (Years 3–6)

In the Mystery substance series, students carry out chemical tests on common substances, and observe and record changes that occur when common substances are heated or added to a range of liquid reagents.

Features include:
- a context of a police forensic laboratory
- an introduction to the chemical analysis of pure substances and mixtures
- demonstrations of simple experimental procedures for testing reactions with liquids and heat
- simulations of reactions of common substances with iodine, water, vinegar and the action of heat
- data tables for recording results
- a notebook in which to record experiment results.

Students:
- carry out chemical tests on common substances
- use chemical tests to identify unknown substances
- observe and record changes that occur when common substances are heated or added to a range of liquid reagents
- use data tables to record and retrieve information.

Mystery substances: training
L2360 – Years 3–6

Students carry out chemical tests on common substances such as salt, baking soda and sugar. They then observe and record how each substance reacts with a range of liquids and to heating. They then build a data table of chemical properties.

Mystery substances: your first case
L2361 – Years 3–4

Students are challenged to solve crimes (pampered cat, secret valentine, salty cake) by identifying a number of different pure substances.

Mystery substances: find the culprit
L2362 – Years 5–6

This object, targeted at years 5–6, is the same design as the Mystery substances: your first case learning object but with more complex cases (stolen diamond, treasure hunt, stolen cakes).

Mystery substances: emergency case
L2363 – Years 3–6

This learning object for years 3–6 further challenges students to see what are the smallest number of tests that can be performed to discover the mystery.
Mystery substances: mixed substances
L2364 – Years 5–6

Students then compare the chemical properties of unknown substances with a data table of known substances to discover what the mystery substance is and solve the crime.

Mystery substances: pure substances
L2358 – Years 3–6

This is an aggregated learning object combining Mystery substances: training, Mystery substances: your first case and Mystery substances: emergency case.

Mystery substances: pure and mixed substances
L2359 – Years 5–6

This is an aggregated learning object combining Mystery substances: training, Mystery substances: find the culprit, Mystery substances: emergency case and Mystery substances: mixed substances.
**Chemical science series** (Years 5–6)

Students explore the properties of materials and their uses in everyday life. As Science Officers in a virtual laboratory, students are equipped with materials and tools and are required to perform experiments.

**Features include:**
- a virtual laboratory to conduct ‘real-life’ tests

**Students:**
- use the 'predict, observe, explain' learning strategy prior to the experiment, and write a report after the process is completed.

<table>
<thead>
<tr>
<th>Activity</th>
<th>Grade</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Life without chemistry</td>
<td>L34 –</td>
<td>Students choose and test appropriate materials to construct everyday items in a virtual city.</td>
</tr>
<tr>
<td>Slime emergency</td>
<td>L35 –</td>
<td>A broken-down spaceship is drifting towards a gigantic glob of suffocating space slime. The engine needs four different liquid fuels to get it going. Students test materials at different temperatures to find out which can be turned into liquid fuels.</td>
</tr>
<tr>
<td>Mine rescue</td>
<td>L36 –</td>
<td>Three miners are trapped by fire. Students select and test gases to work out how to put out the fire, and then help the miners to breathe.</td>
</tr>
<tr>
<td>Metal munchers</td>
<td>L37 –</td>
<td>A spaceship has landed on the metal munchers' planet. Students are required to give each metal muncher a piece of metal. If a metal muncher is given a piece of non-metal it takes a bite out of the spaceship. Students test materials for the main properties of metals.</td>
</tr>
<tr>
<td>Save the lake</td>
<td>L38 –</td>
<td>Life in a lake is dying because of something in the water. Students work out possible sources of pollution</td>
</tr>
</tbody>
</table>
by using chemical tests. They then match the chemicals they have found with local industrial activities and suggest strategies to save the lake.

**Skateboard race**  
L39 – Years 5–6

It is the finals of the Super Skateboard Championship and someone has stolen the wheels from Noppy's skateboard. Students test materials for strength and hardness, and help to make new wheels.

**Grumpy in the desert**  
L40 – Years 5–6

Bruce has crashed his four-wheel drive in the desert. The supplies have spilt and are mixed together. He is upset, confused and desperate for a cup of tea. Students recover the necessary ingredients from the mixed-up supplies. They separate the mixtures by using common chemical techniques such as distillation, filtration, centrifugation or magnetism.

**Inter-galactic cook-off**  
L41 – Years 5–6

Set in a televised cookery show, students must pass the Kitchen Chemistry Test to become 'Grand Celebrity Chef'. They are asked to find five reactions between cooking ingredients that cause a chemical change, for example, acid–base reactions.

**Going down and burning up**  
L42 – Years 5–6

Students help the Hubble Telescope return to Earth for repairs. They are asked to build a heat shield to protect the space telescope from burning up when entering the Earth's atmosphere. They have to choose a material that does not easily burn, melt or transfer heat.

**Treasure puzzle**  
L43 – Years 5–6

A treasure map leads to a locked door. Students must find three acids to open the door and claim the treasure. They test everyday substances to identify
which are acids.

**Metal munchers: assessment**

L7557 – Years 5–6

Students protect a spaceship from metal-munching aliens by identifying metals to feed to them. They perform tests on a range of everyday materials to discover which are metal. They explain which tests are most useful by referring to the common properties of metals: reflectivity, malleability and conductivity.

**Metal munchers: assessment: teacher guide**

R9713
Matter: assessment series (Years 5–9)

Students show their understanding of the particle model by relating particle-level animations to observable physical changes.

Features include:
- multiple-choice questions requiring students to provide reasons for their answers
- model answers for students to compare their reasoning against
- a printable report of the student's performance.

Students:
- identify melting and boiling points of water
- use the particle model of matter to explain phenomena related to temperature and phase changes
- identify that temperature remains constant until a change of state is complete
- relate particle energy during temperature and phase changes to energy flows at the macro level.

Matter: evaporation: assessment
L9956 – Years 5–7

Students look at particle-level animations and relate them to the observable physical changes. They answer five multiple-choice questions and give reasons for each answer.

Matter: change of state: assessment
L9957 – Years 8–9

Students demonstrate their understanding of the particle model by explaining temperature changes, changes of state and energy flows. They look at particle-level animations and relate them to the observable physical changes.
Plastics series (Years 7–8)

Students explore and test the physical properties of a range of plastics and, in doing so, identify properties required in plastics used to make given products.

Features include:
- an introduction to the physical properties and manufacturing uses of a range of plastics
- definitions and explorations of melting point, tensile strength, flexibility and impact strength
- practical methods of testing physical properties of material samples
- automatic recording of test results in a data table.

Students:
- explore and test the physical properties of a range of plastics
- identify properties required in plastics used to make given products.

Plastics: electric kettle
L2527 – Years 7–8

Students identify properties needed for an electric kettle.

Plastics: helmet
L2528 – Years 7–8

Students identify properties needed for a helmet used in rock climbing.

Plastics: egg-lifter
L2529 – Years 7–8

Students identify properties needed for an egg-lifter.

Plastics: shoe soles
L2530 – Years 7–8

Students identify properties needed for shoe soles.
Plastics series [ESL] (Years 7–8)

Students investigate the physical properties and manufacturing uses of a range of plastics.

Features include:
- an interactive context in which students can investigate and test the physical properties of plastics
- modified language for English as a Second Language users
- a glossary of terms used in the activity
- a cloze activity in which students select the correct word form (verb, adjective or noun) to complete a short text about plastics.

Students:
- explore and test the physical properties of a range of plastics
- identify properties required in plastics used to make given products.

Plastics: electric kettle [ESL]
L10196 – Years 7–8

Students identify the properties of plastic needed for an electric kettle. They test a range of properties such as melting point, tensile strength and flexibility and find out which plastic is most suitable for the product.

Plastics: egg-lifter [ESL]
L10198 – Years 7–8

Students identify the properties of plastic needed for egg-lifters. They test a range of properties such as melting point, tensile strength and flexibility and find out which plastic is most suitable for the product.

Plastics: helmet [ESL]
L10197 – Years 7–8

Students identify the properties of plastic needed for a rock-climbing helmet. They test a range of properties such as melting point, tensile strength and flexibility and find out which plastic is most suitable for the helmet.

Plastics: shoe soles [ESL]
Students identify the properties of plastic needed for shoe soles. They test a range of properties such as melting point, tensile strength and flexibility and find out which plastic is most suitable for the product.

**The elements series (Years 7–8)**

Students learn to differentiate between elements and compounds, classify elements according to their properties and locate elements in a periodic table.

**Features include:**
- a demonstration of how elements can be classified using properties
- a demonstration of the difference between elements and compounds
- a ‘deconstructor’ tool to break material down into elements or compounds
- an introduction to the periodic table.

**Students:**
- differentiate between elements and compounds
- classify elements according to their properties
- locate elements in the periodic table
- use the periodic table to find patterns in properties of elements
- use a table to classify imaginary elements.

**The elements: find the elements**

L2550 – Years 7–8

Students use a chemical analysis tool to sort elements from compounds. Substances include table salt, water, plaster of Paris and mercury from a thermometer.

**The elements: classify elements**

L2551 – Years 7–8

Set in the context of another universe where elements have different properties, students use a chemical analysis tool to test properties of the alien elements. Like the periodic table, students build a table of properties to classify the elements. Then, using the patterns of properties within the table, they identify where new elements belong.

**The elements: elements analyser**

L2552 – Years 7–8

Students use a chemical analysis tool to test properties of elements. They identify key properties of each element, such as melting point and boiling point, before sorting the elements into categories such as non-metal, metalloid, reactive gas or unreactive gas. Finally, the students position groups of elements in the periodic table.
periodic table according to their properties.

**The elements: mystery elements**  
L2553 – Years 7–8  

Students sort elements according to their properties into categories, such as non-metal, metalloid, reactive gas or unreactive gas, and position elements in the periodic table according to their properties.

**The elements: fill the gaps**  
L2554 – Years 7–8  

Students use the properties of known elements to classify others. They position elements in the periodic table and check properties, such as atomic number, boiling point and reactivity. Using the patterns of properties within the periodic table, they identify where other elements belong.

**The elements**  
L2293 – Years 7–8 🚭  

This is an aggregated learning object combining the five other learning objects in the series.
The elements: assessment series (Years 7–10)

Students are assessed on their understanding of elements and compounds, and the classification of elements.

**Features include:**
- assessment of student's ability to classify elements
- illustrations of the unique properties of chemical elements
- a printable report of the student's performance.

**Students:**
- identify that compounds are composed of elements combined together chemically
- describe properties of compounds that differ from those of their component elements
- classify elements according to their properties
- identify trends and use them to make predictions
- use the periodic table to find patterns in properties of elements.

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**The elements: elements and compounds: assessment**
L9669 – Years 7–8

Students deconstruct substances to see their component elements. They identify and label substances as elements or compounds and answer a series of nine questions on the nature of elements and compounds and the difference between them.

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**The elements: the periodic table: assessment**
L9670 – Years 9–10

Students examine the unique properties of each element. They identify trends in the periodic table and use them to locate elements within it. Students answer a series of ten questions on the patterns that form the basis of the periodic classification.
The elements series [ESL] (Years 7–8)

Students use analysis tools to examine the properties of elements.

Features include:
- an introduction to the periodic table
- a glossary of words used in the learning object
- modified language for English as a Second Language users.

Students:
- differentiate between elements and compounds
- identify components of compounds
- classify elements according to their properties
- locate elements in the periodic table and use the periodic table to find patterns in properties of elements.

The elements: mystery elements [ESL]  
L9133 – Years 7–8

Students sort elements according to their properties into categories such as non-metal, metalloid, reactive gas or unreactive gas, and then position elements in the periodic table according to their properties.

The elements: element analyser [ESL]  
L9132 – Years 7–8

Students use a chemical analysis tool to test properties of elements. They identify key properties of each element such as melting point and boiling point and sort the elements into categories such as non-metal, metalloid, reactive gas or unreactive gas.

The elements: find the elements [ESL]  
L9131 – Years 7–8

Students use a chemical analysis tool to help sort elements from compounds then break up compounds into their component elements. They sort substances such as table salt, water, plaster of Paris and mercury.

The elements: fill the gaps [ESL]  
L9134 – Years 7–8

Students use the properties of known elements to classify others by checking properties such as atomic number, boiling point and reactivity. They then use the patterns of properties within the periodic table to identify where other elements belong.
Types of matter series (Years 7–8)

Students are introduced to the particle theory of matter. Using a magnifying device that allows them to see the sub-microscopic structure of common household materials, students discover that all matter consists of particles, and that matter can be classified into different types depending on the structure (or arrangement) of those particles.

Features include:
- a magnifying glass tool to show atomic-level views of substances
- feedback to student input
- an option to print a fact sheet summarising the particle behaviour under investigation.

Students:
- interpret atomic-level views of substances
- classify substances on the basis of the arrangement and motion of their particles.

Types of matter: particles
L5820 – Years 7–8

Students sort and classify substances into two categories: particles of an element which contain only one type of atom or those of a compound that contain more than one.

Types of matter: solids, liquids, gases
L5821 – Years 7–8

Students sort and classify substances as solids, liquids or gases, based on the arrangement and motion of their particles.

Types of matter: elements and compounds
L5823 – Years 7–8

Students sort and classify substances as elements or compounds based on the arrangement of their particles. They use particle theory to explain why compounds can be broken down, and elements cannot.

Types of matter: compounds and mixtures
L5824 – Years 7–8

Students sort and classify substances as having only one type of molecule or more than one. They then classify these substances as pure compounds or mixtures. Students can print out a summary of their findings.

Types of matter: pure substances and mixtures
L5822 – Years 7–8
Students sort and classify substances into mixtures, which contain particles of different types and pure substances, which contain only one type.

**Types of matter: quiz**  
L5825 – Years 7–8  
In game format, students apply their understandings from the other learning objects in the series to identify and classify new substances.

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**Types of matter series [ESL] (Years 7–8)**

Students select samples from an outdoor setting and magnify the substances to atomic level so the particles they consist of can be seen.

**Features include:**
- modified language for English as a Second Language use
- a glossary of words used in the learning object
- atomic-level views of substances
- feedback to user input
- an option to print a fact sheet.

**Students:**
- interpret atomic-level views of substances
- apply a particle model to substances.

**Types of matter: particles [ESL]**  
L9388 – Years 7–8  
Students decide whether all substances consist of particles.

**Types of matter: solids, liquids and gases [ESL]**  
L9389 – Years 7–8  
Students identify differences in the particle arrangements of different states of matter.
Types of matter: assessment series (Years 7–10)

This series assesses student understanding of the different particle arrangements of various types of matter.

Features include:
- a sequence of questions, each requiring students to select the appropriate particle model and then choose a statement describing the reason for their choice
- atomic-level views of types of matter
- a printable report of the student's performance
- a mechanism for the student to record their knowledge of matter before and after completion of the objects.

Students:
- identify types of matter based on differences in their particle arrangements
- use the arrangement of the particles of a substance to classify it as: solid, liquid or gas; pure substance or mixture; element or compound; compound or mixture.

Types of matter: solids, liquids and gases: assessment
L8970 – Years 7–8

Students relate the arrangement of the particles of a solid, liquid or gas to their particular properties.

Types of matter: using particle model: assessment
L8486 – Years 9–10

Students use the arrangement of the particles of a substance to describe phase changes and thermal expansion.
**pH series** (Years 7–9)

Students develop their understanding that the pH scale is used to measure the degree of acidity of solutions; that acids and bases can be distinguished by their properties; that the properties of acids can be neutralised by bases and vice versa, and that the degree of acidity of a solution depends on the concentration of hydrogen ions.

**Features include:**
- illustration of how acids and bases can be distinguished using different chemical tests
- an introduction to the use of acid–base indicators
- visual as well as structured feedback to user input.

**Students:**
- use the pH scale to indicate the degree of acidity
- use the pH scale and universal indicators to distinguish acidic, basic and neutral solutions
- predict the outcomes of their actions.

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**pH: what is pH?**

L5815 – Years 7–9

Students are introduced to the key concepts associated with pH. They use four different chemical tests to distinguish acids and bases in everyday household items and rank solutions in order of acidity. Students use the pH scale, a pH meter and a universal indicator to distinguish acidic, basic and neutral solutions and to identify mystery solutions. Includes an option to explore the mathematical basis of the pH scale.

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**pH: acids and bases**

L5814 – Years 7–9

Students perform a series of tests on substances labelled as ‘acid’, ‘neutral’ and ‘base’. These results are automatically entered into a properties table. They perform similar tests on a number of ordinary household products. Students then identify whether each substance is acidic, basic or neutral, based on their observations.

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**pH: noughts and crosses**

L5816 – Years 7–9

Students consolidate what they know about pH by playing a game of ‘noughts and crosses’. Using a pH scale, students determine pH values of common household substances based on their descriptive properties.

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**pH: changing pH**

L5819 – Years 7–9

Students are presented with two solutions, one acidic and the other basic. They then measure the pH and predict the effect of adding base to acid and vice versa. Multiple-choice questions with feedback provide a chance to test students’ understanding.
pH: aquarium
L5817 – Years 7–9

Students are presented with a real-world scenario: maintaining the pH level of an aquarium. They measure pH while carrying out various neutralisation reactions. They also choose appropriate substances to raise or lower the pH in the aquarium to help keep the fish healthy.

pH: pool
L5818 – Years 7–9

Similar to pH: aquarium, students maintain the pH level of a swimming pool. Each day brings with it new challenges for the student who must make decisions about what effect various substances will have on the pH level.

pH scale: assessment
L8489 – Years 7–9

Students test their understanding of the pH scale by classifying solutions as one of the following: acid, neutral or base. They then play a game to match a solution, chosen from a group of nine common household substances, to a pH value. Finally, students answer a series of multiple-choice questions and true/false statements.
Chemical reactions series (Years 9–10)

Students investigate the conservation of atoms and energy during chemical reactions and relate this to balancing equations.

Features include:
- a demonstration of the conservation of atoms and energy in chemical reactions and how this relates to balancing equations
- simulation of molecular collisions resulting in chemical reactions
- facility to enable students to dissemble reactant molecules and reassemble the atoms into product molecules
- a tool to track and adjust the relative numbers of reactant and product molecules
- a tool to determine whether a chemical reaction is exothermic or endothermic
- an explanation of why the ranking of fuels is based on energy released per kilogram rather than energy released per mole
- opportunities to balance a range of chemical equations.

Students:
- interpret chemical equations at a molecular level
- balance chemical equations and relate them to the conservation of atoms in chemical reactions
- explain chemical reactions in terms of the collision theory
- relate energy flow in chemical reactions to the making and breaking of chemical bonds
- rank fuels based on energy released per mole and per unit mass.

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Chemical reactions: combustion
L2568 – Years 9–10

The focus of this learning object is for students to balance combustion reactions.

Chemical reactions: non-combustion
L2569 – Years 9–10

The focus of this learning object is for students to balance non-combustion reactions.

Chemical reactions: balancing equations
L2570 – Years 9–10

Students use a balancing equation tool whereby reactant and product atoms are clearly shown as students increase the reaction molecules.

Chemical reactions: energy
L2571 – Years 9–10
As students break bonds and create new products the energy bar displays the resultant energy.

**Chemical reactions: energy released by fuel**  
L2572 – Years 9–10

As students break bonds and create new products the energy bar displays the resultant energy. Finally, they rank the fuels according to the amount of energy they release. Explains why the ranking of fuels is based on energy released per kilogram rather than energy released per mole.

**Chemical reactions: reaction reshuffle**  
L2573 – Years 9–10

Students investigate the chemistry of reactions at a molecular level by examining collisions between molecules of two reactants. Students adjust the ratios of the reactants and compare the outcomes, as well as identify the ratio of molecules involved in a balanced equation.

**Chemical reactions**  
L2296 – Years 9–10

This is an aggregated learning object combining the six other learning objects in the series.

All learning objects in this series except 'Chemical reactions: reaction reshuffle' contain non-TLF content. See Acknowledgements in the learning objects.
Sunscreens (Years 9–10)

Students investigate the impact of sunscreen on different skin types.

Features include:
- various SPF strength sunscreens, skin types and UV exposure to experiment with
- a multiple-choice quiz

Students:
- carry out controlled experiments to test the relationship between the sun protection factor and time of exposure to ultraviolet light.

Sunscreens: what's the fuss about 30+?
L703 – Years 9–10

Students examine the impact of ultraviolet light and levels of sunburn over different exposure times and use experimental data to confirm the relationship between Sun protection factor (SPF) and UV exposure time. They can also work out the SPF of some sunscreens and calculate safe exposure times for a range of skin types and sunscreens.
UV index series (Years 9–10)

Students interact with UV simulators to gain an understanding of ultraviolet (UV) radiation. Features include:

- an introduction to the UV index as a commonly used indicator of exposure to ultraviolet radiation
- animations to show direct and reflected UV rays to enable their relative importance to be judged
- facility to enable students to manipulate the Sun’s position relative to the Earth to simulate daily and seasonal variations
- multiple-choice questions used to test understanding of concepts.

Students:

- test the varying amount of UV light present according to the time of day, season and reflectivity of their surroundings
- verify that the Sun’s elevation determines both how far its rays travel through the atmosphere and the area they spread over when they reach the Earth’s surface
- construct and interpret tables and graphs

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**UV index: simulator**

L1138 – Years 9–10

Students investigate the amount of UV light that reaches a person in typical daily situations. They can experiment with levels of reflectivity and construct a table showing UV index measurements under a range of environmental conditions, including cloud, shade and ground surfaces (grass, sand, water, and snow).

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**UV index: the highs and lows**

L1139 – Years 9–10

Students use a simulator to test the level of ultraviolet (UV) rays that reach the Earth at different times of the day. Students also construct and interpret graphs of relationships between UV index, time of day and seasons. Students answer a series of questions to demonstrate their understanding.

This series contains non-TLF content. See Acknowledgements in the learning objects.
Content from other sources

Making water drinkable series (Years 5–9)

Students look at the differences between elements, compounds and mixtures and explore solvents, solutions and the effects of temperature on solubility. Students also explore the water cycle and see how rainwater is treated to remove unwanted substances.

Features include:
- worksheets outlining a series of experiments for students to test properties of mixtures
- worksheets and a virtual jigsaw activity for self-assessment.

Students:
- explore the formation of solutions and methods of separating them
- compare methods of separating suspensions and colloids
- relate temperature changes to solubility in aqueous solutions
- explore the water cycle
- examine the stages of treatment for drinking water.

Making water drinkable: mixtures
L3100 – Years 5–9

Students distinguish between pure elements, compounds and mixtures and relate temperature changes to solubility in aqueous solutions. Students see that drinking water is typically obtained by separating water from other substances.

Making water drinkable: water and us
L3102 – Years 5–9

Students explore the water cycle. They observe that drinking water contains dissolved gases and minerals, and impure water must be treated before humans drink it.

Making water drinkable: water treatment
L3103 – Years 5–9

Students explore a water treatment plant and look at how water can be treated to remove unwanted substances. They examine processes such as filtration, evaporation, distillation and flocculation.

Making water drinkable: colloids
L3104 – Years 5–9

Students compare the composition of a range of colloids and explore the process of flocculation of clay particles in muddy water.
Making water drinkable: water cycle jigsaw
L3105 – Years 5–9
Students answer multiple-choice questions about water and the water cycle, including facts about Australian rivers and catchments. They score points and earn pieces of a jigsaw.

Making water drinkable
L3198 – Years 5–9
This learning object is a combination of five objects in the same series.
What the world is made of series (Years 5–9)

Students identify the three states of matter and use the particle model to explain phase changes and properties of different states of matter.

Features include:
- a particle model to explain how temperature affects the arrangement and movement of particles
- a range of models to illustrate the physical changes involved in phase transformation
- instructions for experiments where students explore and measure phase changes and physical properties.

Students:
- explore physical changes in phase transformations
- identify the three states of matter
- relate energy flows to phase changes.

What the world is made of: states of matter
L3249 – Years 5–9

Students classify matter into three states or phases: solid, liquid and gas and explore physical changes in phase transformations. Students identify the three states of water.

What the world is made of: sorting matter
L3250 – Years 5–9

Students compare the physical appearance of solids, liquids and gases and identify the phase of a range of substances such as dust, honey and ozone.

What the world is made of: modelling matter
L3251 – Years 5–9

Students use the particle model to compare the arrangement and movement of particles in solids, liquids and gases. They explain the physical properties of solids, liquids and gases.

What the world is made of: changes of state
L3252 – Years 5–9

Students explore how substances can change between the three phases of matter: solids, liquids and gases. They look at what happens when water and chocolate change state through a physical process such as melting or freezing then compare the heat flow in melting and freezing.
What the world is made of: properties of liquids
L3253 – Years 5–9

Students relate the expansion of water as it freezes to the fact that ice floats in water. They also explore and measure the viscosity of a range of liquids such as honey and water.

What the world is made of: particles, heat and movement
L3254 – Years 5–9

Students explore how substances are affected by temperature and see that particles vibrate more as temperature rises. Students use a particle model to explain how heat travels in solids and explore thermal expansion in materials.

What the world is made of
L3070 – Years 5–9

This learning object is a combination of six objects in the series.
Chemical tests (Years 7–8)
These are short digital activities that enable students to virtually perform a number of different chemical experiments and observe the results.

Features include:
• test questions to sum up findings.

Students:
• explore and identify the relationships between different substances.

Mixing two compounds
L7568 – Years 7–8

Students discover that combining two chemicals can produce a third chemical of a different colour. Students perform a chemical reaction using two common compounds: lead nitrate and potassium iodide solution. They observe and record the colour of the precipitate formed as well as the colour of the solution.

Test for oxygen, carbon dioxide and water
L7570 – Years 7–8

Students identify the chemical tests that can be used to test for the presence of oxygen, carbon dioxide and water. Students perform five chemical tests on each of the compounds. They identify which tests are best for identifying the presence of oxygen, carbon dioxide and water.

Solubility and temperature
L7569 – Years 7–8

Students find out how water temperature affects the solubility of a solid. Students progressively add potassium nitrate to water until no more will dissolve. Once a saturated solution is obtained, they record the water temperature and the maximum amount of solvent added. Students repeat the experiment using a range of water temperatures to discover whether it makes a difference to the quantity of salt that dissolves.
Digital resources

Australian Children's Television Foundation

The Australian Children's Television Foundation is committed to developing and producing high-quality, innovative, entertaining and educational television programs for children. TLF has licensed clips from various ACTF productions for inclusion in the national digital curriculum content pool. The productions that the clips are drawn from include: 'I Think …', 'Kaboodle', 'Lift Off', 'Noah and Saskia', 'Round the Twist' and 'Yolngu Boy'.

Refer to the Index of Science digital curriculum content for a complete list of clips available for Science. You can use the search options in your educational jurisdiction's gateway to TLF to view the content.

Alphonse the Independent ATOM

The structure of matter and the role of atoms are presented in a simple and amusing way. The clip suggests that atoms are the basis of everything on Earth but that atomic power can be used destructively. An animated diagram of an atom with its nucleus and orbiting electrons is shown. It is these particles that determine the stability of the atom, which a nuclear reaction (such as in a nuclear bomb) disrupts.

TLF ID: R7804

Alphonse the Independent ATOM

Description

Alphonse the independent ATOM introduces the concept of matter, molecules and atoms and the role of atoms in the stability of matter. The clip features an animated illustration of an atom with its nucleus and orbiting electrons. This is followed by a discussion of the importance of atoms in determining the stability of matter, which can be disrupted by nuclear reactions.

Educational value

- Introduces the concept of atoms and their role in determining the stability of matter.
- Highlights the potential for destructive use of atomic power.
- Provides an engaging and simple explanation of the role of atoms.

Acknowledgements

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Animation by Jollification/Anne Jolliffe.
australianscreen online

Created by the Australian Film Commission and now managed by the National Film and Sound Archive, australianscreen online (ASO) is an innovative website with more than 2,000 moving-image clips from Australian feature films, documentaries, newsreels, short films, home movies and animations. As the education partner in this major project, TLF has selected hundreds of clips and provided accompanying teachers’ notes.

Refer to the Index of Science digital curriculum content for a complete list of ASO clips available for Science. You can use the search options in your educational jurisdiction’s gateway to TLF to view the content.

From the Bush to the Bungalow, 1920: Chopping down a tree
This silent clip shows two lumberjacks in the 1920s cutting down a mature eucalypt. The eucalypt is being felled for logging purposes. In the 1920s, eucalypts were the main hardwoods harvested in Australia and included jarrah, mountain ash, blackbutt, messmate, spotted gum, alpine ash, karri, river red gum and some ironbarks. Most of these eucalypts were larger and had denser wood than European trees.

Four Corners – Blue Death, 1988: It could have been avoided
This clip shows the dangers of asbestos exposure and that asbestos-related illness and death could have been avoided in Australia. The early scenes show the covers of medical reports from 1898, 1930 and 1955, superimposed on images of workers at the asbestos mill at Wittenoom Gorge in Western Australia, as the narrator reveals when the links between asbestos and health risks first became known. Professor Eric Saint then speaks about asbestos and the knowledge of its dangers.

Sheep to Shop – Hosiery and Knitted Goods, 1924: From fleece to yarn
This black-and-white silent clip from a promotional film combines detailed intertitles and film footage to depict the process of converting the fleece of sheep to yarn. The film shows wool sorters, machines processing the wool and the workings of the machines with occasional glimpses of the workers who attend them.

Images reproduced courtesy of australianscreen online.
CSIRO

The Commonwealth Scientific and Industrial Research Organisation (CSIRO) is Australia's national science agency. TLF makes available hundreds of CSIRO's scientific still and moving images in the pool of digital curriculum content.

Finding bacteria to degrade pesticides
This is a clip about the isolation of a bacterium that degrades atrazine. The clip shows a farmer spraying crops with atrazine herbicide. Then a CSIRO scientist talks about the benefits and problems of using atrazine, a herbicide to control grass and weeds in crops such as maize and sugar cane. It is very effective, but there are health concerns for animals and humans.

Synthesising natural compounds for cosmetics
This clip shows a CSIRO scientist talk about synthesising a compound from sharks that is used successfully in acne lotions. Many people object to the harming of animals to extract materials for human use, especially when the product is not closely connected to human survival. Synthesising natural animal compounds in a laboratory may be a solution to sourcing ingredients from animals.

Making biodegradable plastic, 2001
Biodegradable plastic can be produced from wheat starch using conventional plastic manufacturing equipment. In this clip, the production process begins by mixing wheat starch with small amounts of other biodegradable ingredients. Using wheat starch to make biodegradable plastic means it will degrade rapidly in landfills.
Getty Images

TLF has licensed hundreds of high-quality images from the extensive Getty Images collection to include in the digital curriculum content pool.

Refer to the Index of Science digital curriculum content for a complete list of images available for Science. You can use the search options in your educational jurisdiction’s gateway to TLF to view the content.

**A silicon ingot**
The silicon ingot, a long thin cylindrical crystal of almost pure silicon, which is about 1.5 m long, is suspended from above and is being observed by a technician. The technician is wearing full protective clothing including a white laboratory suit, gloves, glasses, face mask and hair net.

**Fluorescent nanophosphoric dyes**
The tubes contain a type of nanoparticle called nanophosphors, or fluorescent phosphoric dyes. The nanophosphors are being tested under ultraviolet light in the laboratory to assess their illumination properties.

**Nanorobot in human bloodstream**
This image is a digital artist's impression of what a nanorobot could look like inside a human bloodstream. The image shows red blood cells and two arteries, one to the left and the other to the right, in the background. In the foreground is a transparent structure representing the nanorobot.
**Themes**

**Water, water, water! (Years 5–10)**

This collection of digital curriculum content allows students to explore the water cycle, conduct tests to identify water among a number of types of matter, learn about some properties of water and perform experiments to discover the effect of temperature on the behaviour of water molecules.

**The colour of water**

Students explore factors that affect the appearance of water and use a simulated water tank to control levels of salinity, temperature, dissolved oxygen, nutrients, suspended solids and micro-organisms. They compare results and identify key factors that affect micro-organism growth and thus colour. For example, they look at seas and lakes that appear blue, green, brown, red or pink and reproduce environmental conditions in an 'Experitank' to match the water colour to the water sample provided.

**Condenser, c1900**

This photographic print shows men and a woman at a condensing plant set up alongside a well on the Western Australian goldfields. Practically all underground water in the goldfields was saline. Because of this it was boiled and the resulting steam collected and condensed into potable if not palatable water.

**Making water drinkable: water and us**

Look at why water is so important to humans. Explore the water cycle. Find out how water often dissolves other compounds in nature. Notice that drinking water contains dissolved carbon dioxide and minerals.

**Making water drinkable: water cycle jigsaw**

Answer multiple-choice questions about water and the water cycle, including facts about Australian rivers and catchments. Score points and earn pieces of a jigsaw.
Test for oxygen, carbon dioxide and water
Discover which of five different tests can be used to identify the presence of oxygen, carbon dioxide and water. Choose one of these three types of matter essential to life. Then perform each of the five tests in turn to determine if that type of matter is present in the test tube. Record your findings and use them to answer the conclusion questions.

Making water drinkable: mixtures
Look at the differences between elements, compounds and mixtures. Notice that water is a compound that dissolves many substances. See how rainwater is treated to remove unwanted substances. Notice that purifying water involves separating mixtures. Explore how solutions form and how solubility is affected by temperature.

Matter and evaporation
Experiment with phase transformations of water. Heat a block of ice and a beaker of liquid water. Predict changes to the molecular structure and molecular motion. Look closely at movement of the water molecules, especially at the surface. Explore relationships between temperature, molecular speed and states of matter.

Making water drinkable: colloids
Look at colloids such as clay suspended in water. See how flocculation works. Notice that colloids have fine particles spread throughout a solid, liquid or gas. Explore a range of colloids such as sols, aerosols, gels, foams and emulsions.

Water molecule
This is a colour image of a model of a molecule of water, H_2O. In this model, atoms are represented by coloured spheres held together by grey rods, representing covalent bonds. The water molecule contains one oxygen atom (the red sphere) and two hydrogen atoms (the grey–white spheres).
What the world is made of: properties of liquids

Explore why ice floats in water. Notice that water expands when it freezes, so a block of ice has fewer particles than the same volume of water. Explore why liquids flow at different rates. Compare the viscosity of substances such as honey and water.