 MS-M1 Applications of Measurement

Year 11 mathematics standard

Duration: 4 weeks

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Rationale

To develop a student’s ability to interact effectively with the practical measurement situations that they will face, including personal health, design, energy use and costs.

Topic focus

To develop a student’s ability to make reasonable estimates for quantities, apply appropriate levels of accuracy to practical situations, and apply an understanding of measurements such as length, area and volume to a variety problems. To build an understanding of how we use units of measurement in everyday tasks such as calculating recommended dietary intake, estimating weights or using energy.

Prior knowledge required

* selects and uses the appropriate unit and device to measure the masses of objects, and converts between units of mass MA3 - 12MG
* applies Pythagoras’ theorem to calculate side lengths in right-angled triangles, and solves related problems MA4 - 16MG
* calculates the areas of composite shapes, and the surface areas of rectangular and triangular prisms MA5.1 - 8MG
* interprets very small and very large units of measurement, uses scientific notation, and rounds to significant figures MA5.1 - 9MG
* calculates the surface areas of right prisms, cylinders and related composite solids MA5.2 - 11MG
* applies formulas to calculate the volumes of composite solids composed of right prisms and cylinders MA5.2 - 12MG

Language considerations

* “Standard Form” is used in this topic in place of “Scientific Notation” which is used in Stage 5.
* “Error” is used to mean the deviation from the actual value, rather than indicating a mistake.
* Metric units are used with the exception of calories. Care should be taken to specify a metric tonne (1000 kg) rather than imperial tons.
* Joules and watts are SI units which students may not have encountered before.

Outcomes

A student:

* solves problems involving quantity measurement, including accuracy and the choice of relevant units MS11-3
* performs calculations in relation to two-dimensional figures MS11-4
* uses appropriate technology to investigate, organise and interpret information in a range of contexts MS11-9
* justifies a response to a given problem using appropriate mathematical terminology and/or calculations MS11-10

Assessment (including formative and summative)

Formative Assessment

* [Diagnostic Tests for Area and Surface Area](http://numeracyskills.com.au/images/pdfs/13542_NSWDOE_Stage%205_Diagnostic%20Tasks_web.pdf) (Stage 5.1 and 5.2), Volume (Stage 5.2), and Right-angled triangles (Stage 5.1 and 5.2) available at: http://numeracyskills.com.au/images/pdfs/13542\_NSWDOE\_Stage%205\_Diagnostic%20Tasks\_web.pdf

Summative Assessment

* MS-M1 Applications of Measurement – Assessment Task

M1.1 Practicalities of Measurement

| Outcomes and Content | Teaching and learning strategies and evidence of learning | Resources |
| --- | --- | --- |
| * review the use of different metric units of measurement including units of area, take measurements, and calculate conversions between common units of measurement, for example kilometres to metres or litres to millilitres (ACMEM090, ACMEM092) ◊
 | Key Idea:To be able to understand and convert between different units of length, area, volume and capacity.Teaching Strategies:Students should be encouraged to estimate and then measure a variety of objects, including tables, classrooms (length, width and height), as well as larger distances such as the oval or playground. This will develop their ability to select which metric unit is appropriate for different scenarios.The measuring tool on Google Maps or Google Earth can be used by students to determine their distance from school to home.To help with estimation and visualisation of area, students can create a metre square using newspaper/recycled paper and sticky tape. Using their square metre, students can estimate and then calculate the size of classrooms. Students can then estimate and calculate the number of square centimetres in the square metre to determine the correct conversion between the two units. | Resource 1 - [Unit of Area Conversion for 1 square centimetre](https://drive.google.com/open?id=0B3TnDCmdZPNHZ3lvcE40NlB0NGM): https://drive.google.com/open?id=0B3TnDCmdZPNHZ3lvcE40NlB0NGMResource 2 - [Units of Area Conversions Introduction](https://drive.google.com/open?id=0B3TnDCmdZPNHMXVIVjN2cDYzSmM): https://drive.google.com/open?id=0B3TnDCmdZPNHMXVIVjN2cDYzSmM |
| * calculate the absolute error of a reported measurement and state the corresponding limits of accuracy ◊
	+ investigate types of errors, for example, human error or device limitations Critical and creative thinking icon
	+ calculate the percentage error of a reported measurement
 | Key Idea:To recognise the effect of different sources of error in measurement, and be able to perform calculations acknowledging the uncertainty caused by these errors.Teaching Strategies:* Students work in groups to find the perimeter and area of their desk.
	+ Students take measurements of various objects using different measuring devices. The activity can be as simple as getting students to measure the dimensions and area of their desk using: a metre ruler with no markings, a centimetre ruler, and centimetre ruler with millimetres, and a builder’s tape.
	+ Students then discuss the limitations of each of the measuring devices, the practical issues, and the error of measurement (human and device related).
	+ Students then choose the most appropriate measuring device for their task (the perimeter and area of their desk) and calculate their solutions to the problem, stating the errors and approximations applied in the process. Students reason and discuss between the groups which was the most appropriate device used and which measurement is most accurate.
	+ From the class discussion that will follow students, guided by the teacher, summarise and define a list of human errors and device errors.
* Students typically hold the misconception that error means “mistake”, rather than a limitation of the instrument. This should be dealt with explicitly, such as in the suggested Slideshow. Students should recognise that error in measurement arises from both human error and limitations of measuring device,
 | [A slideshow](https://www.slideshare.net/rjarewal/errors-in-measurement) that discusses the different sources of error and how to overcome them: https://www.slideshare.net/rjarewal/errors-in-measurement |
| * use standard form and standard metric prefixes in the context of measurement, with and without a required number of significant figures ◊  Information and communication technology capability icon
 | Key idea:Students recognise that we need a system for effectively dealing with very large and very small numbers, but that this system causes limitations in the accuracy of these measurements. This includes development of the concepts of standard form (scientific notation), metric prefixes and significant figures.Teaching Strategies:* From “The Scale of the Universe” website students choose two objects with greatly varying dimensions (one very large and one very small) and, through discussion in groups, develop the ways to compare those two measurements.
* With teacher guidance, students arrive at the usefulness of index notation, and using the formal definition of standard form, compare the two measurements.
* Students investigate the standard metric prefixes that are part of S.I. units
 | [The Scale of the Universe website](http://htwins.net/scale2/) http://htwins.net/scale2/ (interactive version requires Adobe flash). [Non-interactive version](https://youtu.be/uaGEjrADGPA): https://youtu.be/uaGEjrADGPA [Scientific Notation](http://amsi.org.au/ESA_middle_years/Year9/Year9_md/Year9_1b.html) (Supporting Australian Mathematics Project): http://amsi.org.au/ESA\_middle\_years/Year9/Year9\_md/Year9\_1b.html[Maths mq](http://maths.mq.edu.au/numeracy/tutorial/contents.htm) http://maths.mq.edu.au/numeracy/tutorial/contents.htm (maybe for some extension in parts e.g. definitions of S.I) |

M1.2 Perimeter, area and volume

| Outcomes and Content | Teaching and learning strategies and evidence of learning | Resources |
| --- | --- | --- |
| * review and extend how to solve practical problems requiring the calculation of perimeters and areas of triangles, rectangles, parallelograms, trapezia, circles, sectors of circles and composite shapes (ACMGM018) ◊ Critical and creative thinking icon Literacy icon
 | Key idea:Students can substitute measurements into a formula to calculate perimeter or area.Teaching Strategies:* Review formulae of plane shapes - squares, rectangles, triangles, parallelograms, trapezia, circles, sectors and composite shapes based on these shapes.
* The Improving Mathematics Education in Schools (TIMES) Project by the Australian Mathematical Sciences Institute has produced a series of lessons which discuss the importance of geometry in school, and review formal geometric proofs, as well as the properties, areas and perimeters of various plane shapes. These lessons could assist teachers in gaining a more detailed knowledge of the reasoning behind the course content. The lessons also contain a series of “recorded” worked examples (called ScreenCasts) which could be used as demonstrations in class.

Activities:* Area of Special Plane Shapes:
	+ Students develop strategies to manipulate and break up the plane shapes of triangle, parallelogram and trapezium to relate them back to the area of rectangle. Students then arrive at the necessary formulae for those plane shapes. This can be done by hands on activity of cutting and pasting or using digital technology (for example, using the Geogebra or NCTM links provided).
* Area of Circle and Pi Derivation:
	+ Students can arrive at the estimation of value of π from measuring the perimeter of polygons inscribed in a circle. The suggested Geogebra file shows this process using a slider for the number of sides of the polygons.
* Composite Shapes Activity:
	+ Students draw three different composite shapes (each made of two to three basic) with perimeters of 90 -100cm and areas of 150-160cm. Students display all dimensions and calculations, explaining them fully. Diagrams do NOT need to be to scale but dimensions must be valid e.g. a triangle with sides 3cm, 5cm and 9cm is not possible and hence these are not valid dimensions.
 | [Videos showing the formulae area of rectangles, triangle, trapezium,](http://www.mathplayground.com/mathvideos.html) circle (Math Playground): http://www.mathplayground.com/mathvideos.htmlTIMES Lessons (You will need an Adobe Flash player to utilise the ScreenCasts): [Rectangles and Parallelograms](http://amsi.org.au/teacher_modules/Paralleograms_and_rectangles.html): http://amsi.org.au/teacher\_modules/Paralleograms\_and\_rectangles.html[Other Plane Quadrilaterals:](http://amsi.org.au/teacher_modules/Rhombuses_Kites_and_Trapezia.html) http://amsi.org.au/teacher\_modules/Rhombuses\_Kites\_and\_Trapezia.html[Area and Surface Area:](http://amsi.org.au/teacher_modules/area_volume_surface_area.html) http://amsi.org.au/teacher\_modules/area\_volume\_surface\_area.html [Deriving Area Formula using Geogebra](https://www.geogebra.org/m/ChMJ32XM): https://www.geogebra.org/m/ChMJ32XM [NCTM Interactive Activity for Area Formulae](https://illuminations.nctm.org/Activity.aspx?id=3567) https://illuminations.nctm.org/Activity.aspx?id=3567 [Pi Derivation Activity using Geogebra:](https://www.geogebra.org/m/GSpKDukt) https://www.geogebra.org/m/GSpKDukt  |
| * review the use of Pythagoras’ theorem to solve problems involving right-angled triangles
 | Key idea:To understand how to calculate the unknown side of a right angled-triangle, to help solve a range of problems involving perimeter, area and volume.Teaching Strategies:* Class discussion about different methods to calculate the unknown side of a right-angled triangle. Most students will remember Pythagoras’ theorem but need to be reminded that it can be a tool used to solve a larger problem.
* A discussion of the recent discovery that Pythagoras’ Theorem was used a long time before Pythagoras lived could be used to spark interest from students. A link to this UNSW discovery is provided.

Activities:* Match card exercise.
* The Ladder at the Wall Discussion: Students calculate different heights that a 5 metre ladder can reach. Students then discuss the practicality of different ladder positions with regards to the angle of inclination.
* The YouTube video link provided relates squares to the lengths of the sides of a triangle. The video could be shown or could be used by teachers as the start of an investigation where students can use unit or pattern blocks to establish the Pythagorean pattern.
 | This is another useful resource that could assist teachers in gaining a more detailed knowledge of the reasoning behind the course content. TIMES Lessons: [Pythagoras’ Theorem](http://amsi.org.au/teacher_modules/pythagoras_theorem.html) http://amsi.org.au/teacher\_modules/pythagoras\_theorem.html [Pythagoras’ Theorem older than Pythagoras](https://newsroom.unsw.edu.au/news/science-tech/mathematical-mystery-ancient-clay-tablet-solved): https://newsroom.unsw.edu.au/news/science-tech/mathematical-mystery-ancient-clay-tablet-solved Resource 3 - Pythagoras mix and match [The Ladder at the Wall Discussion:](https://www.geogebra.org/m/MY4Ytr2A) https://www.geogebra.org/m/MY4Ytr2A[Pythagoras in 2 minutes](https://www.youtube.com/watch?v=uaj0XcLtN5c): https://www.youtube.com/watch?v=uaj0XcLtN5c |
| * solve problems involving surface area of solids including but not limited to prisms, cylinders, spheres and composite solids
 | Key idea:Students understand surface area and can use it to solve real life problems. Teaching Strategies:* Students need to understand that the surface area is the addition of the area of each face of a solid. To do this they need to be able to draw or recognise a two-dimensional net of a three-dimensional shape, in order to derive the plane shapes required and select appropriate area formulae.
* Linked to the previous section, students must recognise that Pythagoras’ Theorem may be needed to solve some surface area problems that involve right-angled triangles.

Activities:* Make a prism (example rectangular prism). Colour in faces that are equal in size the same colour. Unfold the shape into its net. Discuss the concept that there are 3 matching faces. Calculate area of each colour. Add all 6 faces up for the total surface area. Repeat with other prisms including triangular, pentagonal, and composite prisms.
* Draw a cylinder and its net (Use a physical cylinder that you can show the net of the rectangle section). Write the formula for the area of a circle in each circle. Discuss that the rectangle dimensions are actually the circumference of the circles times the height of the cylinder. Use this fact to derive the formula . Discuss how this formula changes with “an open cylinder” or “a pipe”.
* Discuss surface area of a sphere formula and use in examples such as the surface of the Earth.
* Different surface areas for the same volume (Sustainability):
* Students compare the surface area of rectangular prisms, with the same volume. This activity begins very simply, with students given a task to build as many as possible rectangular prisms with given volume, using unit cubes. Students then discuss in groups and derive the process to determine minimum surface area required for any given volume. This activity leads to the issue of packaging where the minimum amount of paper/cardboard can be used. Surface area is also important in living organisms including maximising nutrient transferal in the stomach, and oxygenation of the blood in the lungs or gills.
 | This is another useful resource that could assist teachers in gaining a more detailed knowledge of the reasoning behind the course content. [Cones, pyramids and spheres](http://amsi.org.au/teacher_modules/Cones_Pyramids_and_Spheres.html) http://amsi.org.au/teacher\_modules/Cones\_Pyramids\_and\_Spheres.html[Prisms](http://www.learner.org/interactives/geometry/3d_prisms.html) (Interactives – Geometry 3D Shapes): http://www.learner.org/interactives/geometry/3d\_prisms.html[Pyramids](http://www.learner.org/interactives/geometry/3d_pyramids.html) (Interactives – Geometry 3D Shapes): http://www.learner.org/interactives/geometry/3d\_pyramids.html [Surface Area of a Rectangular Prism](http://www.learner.org/interactives/geometry/area_surface.html) (Interactives – Geometry 3D Shapes): http://www.learner.org/interactives/geometry/area\_surface.html[Surface Area of a Cylinder](http://www.learner.org/interactives/geometry/area_surface2.html) (Interactives – Geometry 3D Shapes): http://www.learner.org/interactives/geometry/area\_surface2.html |
| * solve problems involving volume and capacity of solids including but not limited to prisms, cylinders, spheres and composite solids
	+ convert between units of volume and capacity
 | Key idea:Students can calculate the volume and capacity of prisms, cylinders, spheres and composite solids.Teaching Strategies:* Area and volume are great opportunities to open lessons with discussion gathering student strategies before teaching a formal method. For example, present an object and ask students to come up with strategies to find the volume of the object. This can be linked to previous discussions of unit conversion.
* Show how adding slices which are the same shape, will “build” a prism and can help to determine volume. This is the method used by 3D printers, or building a brick wall, layer by layer. Eventually conclude that the volume of a prism is the area of the cross section multiplied by the amount of layers it’s made up of i.e. .
* Converting volume to capacity (Also refer to M1.1 Conversions):
	+ Fill up a 10cm cube with liquid, pour it into a measuring container.
	+ Find that  which = 1L or 1000mL so ,  or .
* Attempt to fill up a cylinder with centicubes, discuss the problem of why we can’t accurately do it. Then fill up cylinder with water. Pour it into a rectangular prism to accurately measure it. Discuss again that it is still the area of the cross section (circle) multiplied by how many layers (height)
* It is useful to actually see the relationship between volume and capacity by practical activities such as pouring sand and/or liquid into 3-Dimensional shapes. This also helps to generalise the relationship between the volume of prisms and pyramids/cones, as you need three pyramids/cones to take the filling from each ‘matching’ prism. The YouTube video link shows the derivation of the formula for a sphere using this method. Discuss formula for volume of a sphere:

Activities:* Surface Area and Volume Calculations of the Same Composite Solid
* In this activity, students learn to recognise that the volume of a composite solid is equal to the addition of its component shape, while the surface area of a composite solid cannot be found with straight addition due to the “invisible” surfaces.
* Students build two or more basic solids from their nets or using lego or unit blocks. They calculate the surface area and volume of each shape. Next, they create a composite solid of their choice (made from their basic solids). Students then calculate the surface area and the volume of the composite solid. In pairs, students discuss the similarities and differences in these calculations. Students then present their solids to the class, for a whole class discussion of this issue as it relates to the different types of basic solids used by individual students/groups.
* How high?
	+ Students use the National Library of Virtual Manipulatives interactive activity “How high?” to predict the height of liquid when it is poured into a different container. This activity leads to the conclusion that the volume is the essentially the product of three numbers. For the volume given as a whole number, the measurements of the solids must be the factors of the volume number.
 | [Volume of Rectangular Prism](http://www.learner.org/interactives/geometry/area_volume.html) (Interactives – Geometry 3D Shapes): http://www.learner.org/interactives/geometry/area\_volume.html [Volume of a Cylinder](http://www.learner.org/interactives/geometry/area_volume2.html) (Interactives – Geometry 3D Shapes): http://www.learner.org/interactives/geometry/area\_volume2.html [Visualising the Volume of a Sphere Formula:](https://www.youtube.com/watch?v=YNutS8eIhEs&feature=youtu.be) https://www.youtube.com/watch?v=YNutS8eIhEs&feature=youtu.be[How high?:](http://nlvm.usu.edu/en/nav/frames_asid_275_g_4_t_4.html?from=category_g_4_t_4.html) http://nlvm.usu.edu/en/nav/frames\_asid\_275\_g\_4\_t\_4.html?from=category\_g\_4\_t\_4.html |
| * calculate perimeters and areas of irregularly shaped blocks of land by dissection into regular shapes including triangles and trapezia (ACMEM094) AAM
	+ derive the Trapezoidal rule for a single application,
	+ use the Trapezoidal rule to solve a variety of practical problems
	+ use the Trapezoidal rule to estimate the base area of a solid in a practical context, using digital technology, and then calculate its approximate volume, for example the volume of water in a swimming pool  Information and communication technology capability icon
* solve problems involving perimeters, area, surface area, volumes and capacity in a variety of contexts AAM
 | Key idea:Students can calculate the perimeter and area of irregular shapes, by breaking up the area into a series of plane shapes, including trapeziums.Teaching Strategies:Use a map of a residential land estate that involves irregular shapes. Discuss how to dissect a specific land area into regular shapes. Activities:* Students take the measurements of an irregular block of land in their community (their house, a local park, etc.). They can create a scale plan of this area and break up the area into triangles, rectangles and trapezia. Students then calculate the total perimeter and area, discuss the measurement errors, limitations and approximations and may compare with the official measurements (the known area of their block of land, the area of the park taken from the council records etc., measurements from Google Ruler tools).
* This activity can be extended into, for example, calculating the ratio of the built in areas and green areas in their suburb.
* An alternative extension activity if using the area that they have found to calculate the volume of rain that falls over this area in a ‘typical’ month. This can then be converted into the volume of runoff that would be generated if an area was changed from green space to concrete. Rainfall data is available at the Bureau of Meteorology.
 | There are many mapping websites including:[Google Earth](https://earth.google.com/static/): https://earth.google.com/static/[Google maps](https://www.google.com.au/maps): https://www.google.com.au/maps[Map of Australia States](https://maps.six.nsw.gov.au/): https://maps.six.nsw.gov.au/[Maps of US States](http://www.mapcoordinates.net/en): http://www.mapcoordinates.net/enResource 4 – Using Google Earth[Average Rainfall from the Bureau of Meteorology](http://www.bom.gov.au/jsp/ncc/climate_averages/rainfall/index.jsp): http://www.bom.gov.au/jsp/ncc/climate\_averages/rainfall/index.jsp |

M1.3 Units of energy and mass

| Outcomes and Content | Teaching and learning strategies and evidence of learning | Resources |
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| * review the use of metric units of mass in solving problems, including grams, kilograms and tonnes, their abbreviations and how to convert between them (ACMEM025) Literacy icon
 | Key idea:Students can understand different units of mass, utilise common notation for units, and determine when to use different measures.Teaching Strategies:* Students should discuss appropriate ways to describe the weight of different objects. E.g. a dump truck can carry tonnes, but the removal of dirt for the North West Sydney Metro tunnel would be measured in Megatonnes.
* Mix and match abbreviations with the appropriate units.
* Many students would not have been formally taught mass since Stage 3. Pre-testing will be essential in this topic. There are several online quizzes available on Mathlinks.net and at Kahoot.

Activities:* “Practical mass today” Activity
	+ Students bring one object from home which they estimate to have a mass of 1kg. Students then use the kitchen scales and scientific scales to check the actual weight of the object, express the weight in grams and kilograms and determine the error of measurement.
 | [Kahoot game for quick recap](https://play.kahoot.it/#/k/621114c2-d836-421e-9ce8-d9e45dc6d82d) https://play.kahoot.it/#/k/621114c2-d836-421e-9ce8-d9e45dc6d82d[Quick Quiz starters from MathLinks](https://mathsstarters.net/quickquiz) under measurement and measurement conversions https://mathsstarters.net/quickquiz |
| * use metric units of energy to solve problems, including calories, kilocalories, joules and kilojoules, their abbreviations and how to convert between them (ACMEM034)
 | Key idea:Students develop an understanding of a calorie and joule. (Note: a joule is a unit of energy and can be linked to electrical output as well.)Teaching Strategies:* In the syllabus glossary, calories are defined as “units of energy found in food and drink”. Scientifically, a calorie is the energy required to raise the temperature of 1 gram of water through 1°C. This is a very small amount of energy and is usually referred to as kilocalories (kcal or Cal). Note that cal and Cal are two different abbreviations. Cal=kilocalorie whereas cal=calorie and 1 Cal = 1000 cal. This is a good opportunity to link abbreviations and their size to prior learning. (kilo, Mega, Giga etc).
* If students complete some research into energy use, particularly when balancing energy use by a person vs energy in food, they will quickly realise that we usually measure energy use in joules and kilojoules, not calories and kilocalories. 1 joule is the amount of energy required to exert a force of one newton over a displacement of one square metre. Joules measurement uses the same prefixes as other measurements.
* Due to the confusion between energy from food (energy in) being measured in calories and energy use (energy out) being measured in joules, it is useful for students to be able to convert between the two measures. There are many websites dealing with calorie and joule conversions. Linking teaching to PDHPE units of work may also be useful.
* The use of kilojoules to refer to the energy in food is discussed in the article from Coca-Cola.

Activities:* Daily Intake of Energy (Intercultural Understanding):
	+ Students research the required daily energy intake males and females of different ages in different countries. They can compile their findings in a table and discuss the reasons and implications for differences between different cultures. Students then bring one item of packaged food with the energy description (or use a fitness application on their mobile phones) and calculate what percentage of daily intake it represents for different cultures.
	+ This activity can be carried out in different units of energy and used for practical applications of energy unit conversions.
	+ It can also be extended to research into the required energy intake for different athletes (see article on [Usain Bolt’s energy intake](https://theconversation.com/what-food-does-it-take-to-fuel-athletes-like-usain-bolt-to-olympic-success-64074)). Students can focus on the sports discipline that they are most interested in and then compare their results in class discussion.
 | [Metric Conversion](http://www.measurement.gov.au/Pages/MetricConversion.aspx) (Australian Government National Measurement Institute): http://www.measurement.gov.au/Pages/MetricConversion.aspx[You Say Calorie, We Say Kilojoule: Who’s Right?:](http://www.coca-colajourney.com.au/stories/you-say-calorie-we-say-kilojoule-whos-right) http://www.coca-colajourney.com.au/stories/you-say-calorie-we-say-kilojoule-whos-right[Balancing energy in and out](http://www.nutritionaustralia.org/national/resource/balancing-energy-and-out) (Nutrition Australia): http://www.nutritionaustralia.org/national/resource/balancing-energy-and-outThere are a wide variety of fitness applications available on mobile phones (such as My Fitness Pal) that students can use to monitor their actual energy use. |
| * use units of energy and mass to solve problems related to food and nutrition, including calories (ACMEM032) Personal and social capability icon
 | Key idea:Students solve problems related to food and nutrition, making connections between energy calculations and rate problems. Teaching Strategies:* There are many websites with information relating to food and nutrition. This is an excellent opportunity to use Excel to generate graphs to compare any data collected during research.
* Prior learning on unit conversion and rates should be explicitly linked.
* If a significant number of students complete PDHPE, links with course content would be helpful.

Activities:* Compare different food groups and calculate their rate of energy consumption to their mass.
* Students can research different sources of nutritional information (see resources list). For example, students can research the nutritional value of a subway foot long and compare it to McDonalds. Is Subway really a healthy alternative? Discussion points could include: What extra calculations were required to find the content of your particular meal? Could these calculations be misleading? Do these differ between countries? If so, why?
* Students can research appropriate online or mobile applications that can assist in the converting of units.
* Students calculate a particular food items RDI (Recommended Dietary Intake) percentage.
* “Setting Up a Healthy Meals Cafe/Canteen” Activity
	+ Students investigate the menu of the school canteen. They choose an item each and calculate its nutrition and energy value. Those calculations can then be used to display in the canteen and to determine what percentage of daily intake a chosen canteen meal represents.
 | [8700](http://www.8700.com.au/) (NSW Government website, find energy in food types, energy requirements estimator): http://www.8700.com.au/[Using MyFitnessPal with my students](https://www.theedublogger.com/2016/01/29/myfitnesspal/): https://www.theedublogger.com/2016/01/29/myfitnesspal/[Subway food guide:](https://www.subway.com.au/site/assets/NutritionalDoc/2017.05.04-Nutritional-Info-Per-100g.pdf) https://www.subway.com.au/site/assets/NutritionalDoc/2017.05.04-Nutritional-Info-Per-100g.pdf[McDonald’s nutrition guide:](https://mcdonalds.com.au/maccas-food/nutrition) https://mcdonalds.com.au/maccas-food/nutritionResource 5 – Energy in versus energy out – My Fitness Pal |
| * use units of energy to solve problems involving the amount of energy expended in activities, for example, kilojoules (ACMEM033) Personal and social capability icon
 | Key idea:Students recognise that different types of activities require varying amounts of energy, and that their lifestyle can affect their daily energy requirements.Teaching Strategies:* This topic can be linked to the previous outcome. Students should know that Energy In - Energy out = weight loss/gain, and be able to work with rates such as energy used per hour of an activity. This can be used to compare the energy requirements of different physical activities. Websites listed in the Resource column can be useful for this.

Activities:* Students could keep a food and activity journal that records energy intake and expenditure. There are many applications and websites such as the “My Fitness Pal” app, which can vary the activity levels, ages etc. in settings to analyse the impact of these variables on energy expenditure and weight loss.
 | [myfitnesspal:](https://www.myfitnesspal.com/) https://www.myfitnesspal.com/mobile application that allows user to record nutritional intake and activity log to help monitor energy intake vs energy expended[8700](http://www.8700.com.au/) (NSW Government website, find energy in food types, energy requirements estimator): http://www.8700.com.au/[Using MyFitnessPal with my students](https://www.theedublogger.com/2016/01/29/myfitnesspal/): https://www.theedublogger.com/2016/01/29/myfitnesspal/[Calorie Counter – How Much Energy Have I Burned](http://theblueroom.bupa.com.au/healthier/be-active/energy-burned/): http://theblueroom.bupa.com.au/healthier/be-active/energy-burned/[Food Diary activity using My Fitness Pal](https://drive.google.com/open?id=0B-USPAJXwSjsYWNhZ1JuY053YW8) https://drive.google.com/open?id=0B-USPAJXwSjsYWNhZ1JuY053YW8 |
| * use units of energy to solve problems involving the consumption of electricity, for example, kilowatt hours, and investigate common appliances in terms of their energy consumption (ACMEM031) AAM Sustainability icon Literacy icon
 | Key idea:Students understand that there are units of energy (e.g. kW) and energy use rates (e.g. kWh). They appreciate that different appliances use energy at different rates, and understand that switching off an appliance is not the same as putting an appliance on standby.Teaching Strategies:* Use different energy rates to calculate the cost of electricity.
* Teachers should discuss the difference between units of energy (e.g. kW) and energy use rates (e.g. kWh). A discussion of petajoules (one quadrillion joules) as an alternative, is useful. Conversion websites can be used to assist.
* Use two way tables to interpret energy consumption/production with varying factors. E.g. air cons with heating and cooling, solar panel production direction and angle.
* Investigate energy efficient homes.
* Discuss simple steps students can do to make their own home [more energy efficient](http://yourenergysavings.gov.au/guides/reduce-your-energy-bills) http://yourenergysavings.gov.au/guides/reduce-your-energy-bills.
* Investigate the cost of electricity in different states of Australia. The [Office of the Chief Economist](https://industry.gov.au/Office-of-the-Chief-Economist/Publications/Pages/Australian-energy-statistics.aspx) publishes a range of annual reports and statistics about Australian Energy use which can be used to link this topic to the Statistics outcomes https://industry.gov.au/Office-of-the-Chief-Economist/Publications/Pages/Australian-energy-statistics.aspx . There is a lot of data available on this site. Teachers should use it as a teaching resource, rather than a site to direct students towards.

Activities:* Students make a list of electric appliances which they personally use every day (an iron, a hairdryer, a laptop etc.). They can attempt to order appliances based on their assumed electricity consumption, and then research the actual electricity consumption of this item. This can be done for one day, one week or each year. Students can then calculate their annual personal energy usage and expenditure.
 | [Energy Efficient Homes](http://splash.abc.net.au/res/i/L895/index.html): http://splash.abc.net.au/res/i/L895/index.html[Single dwelling](https://www.basix.nsw.gov.au/iframe/getting-started/dwelling-types/single-dwelling.html) https://www.basix.nsw.gov.au/iframe/getting-started/dwelling-types/single-dwelling.html[Solar Panel Information:](https://www.solarchoice.net.au/blog/wp-content/uploads/Solar-Choice-Clean-Energy-Council-Solar-PV-Consumer-guide.pdf) https://www.solarchoice.net.au/blog/wp-content/uploads/Solar-Choice-Clean-Energy-Council-Solar-PV-Consumer-guide.pdf[Solar panel direction](https://www.solarquotes.com.au/panels/direction/) https://www.solarquotes.com.au/panels/direction/[Powerwall](https://www.tesla.com/en_AU/powerwall) https://www.tesla.com/en\_AU/powerwallHousehold Appliances:[Energy rating](http://www.energyrating.gov.au/) http://www.energyrating.gov.au/[Essential energy](http://www.essentialenergy.com.au/asset/cms/PDF/Appliance_Nov2011.PDF) http://www.essentialenergy.com.au/asset/cms/PDF/Appliance\_Nov2011.PDF[Appliances](http://www.yourhome.gov.au/energy/appliances) http://www.yourhome.gov.au/energy/appliances |

Reflection and evaluation: