BRIGHT HORIZONS™

Year 8 Teachers Guide

HORIZON POWER

STAWA
SCIENCE TEACHERS' ASSOCIATION OF WESTERN AUSTRALIA

Horizon Power acknowledges the traditional custodians throughout Western Australia and their continuing connection to the land, waters and community. We pay our respects to all members of the Aboriginal communities and their cultures; and to Elders both past, present and emerging.

Acknowledgement

The following teaching and learning materials have been modelled on the STEM Learning Project resources template. The STEM Learning Project resources were produced by a consortium of STAWA, MAWA, ECAWA and Scitech under contract to the Education Department of WA.

Bright Horizons is better online

horizonpower.com.au/brighthorizons

Bright Horizons works best if used with the online resources that help maximise student engagement.

Access the Solar Race leaderboard to upload your school's winners.
Make it more fun with the leaderboard. And motivate more learning with competition results online for each school, letting students see how they compare around the regions.

Access all the Bright Horizons core resources:

- Teacher guides
- Year 6 student handbook
- Year 8 student handbook

Additional Bright Horizon resources:

- Certificates for participation
- Teacher guides for year 6 and year 8 projects

Additional energy related classroom resources:

- Energy Crosswords and puzzles
- Key energy terms and definitions

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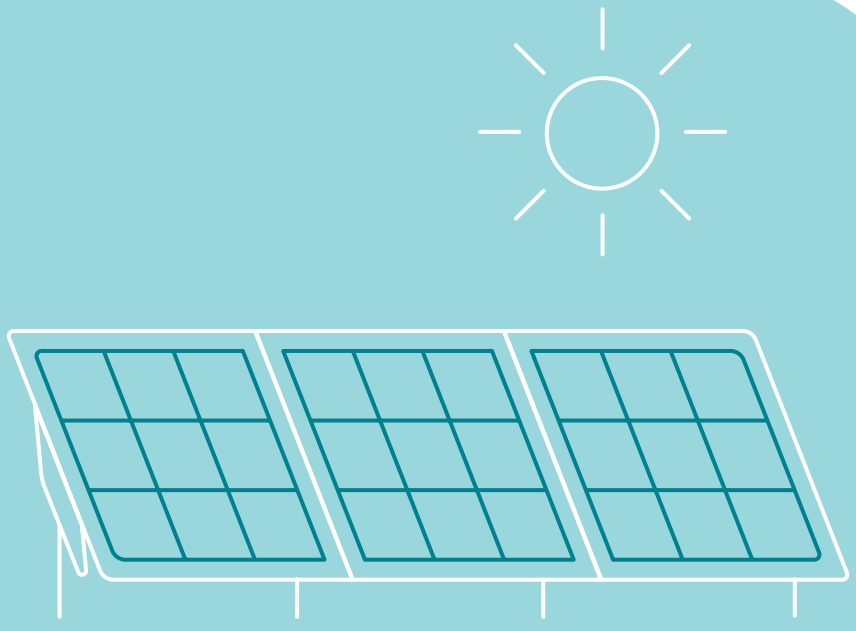


Overview

The Context

Issues of climate change and sustainability means that government, industry and households are taking action to reduce carbon production and to increase the use of renewable energies.

The energy industry is undergoing an unprecedented period of change, driven by customers adopting new technologies such as solar PV systems and batteries.

The Energy Networks Association and CSIRO have forecast that by 2030 about 50 per cent of the electricity produced will come from consumers, mainly generated by rooftop solar PV systems and batteries.

Horizon Power is exploring a future where electricity is generated by households and industry using rooftop solar, batteries and standalone power systems which can be incorporated into the electricity network or microgrid systems.

Year 8 – Projects

Purpose:

To apply an understanding of solar energy to the design and construction of a model solar car to make it as fast as possible and to raise awareness of factors, such as appearance, that impact the uptake of sustainable products and practices. Students design, build and test their modifications of a standard model solar car kit to make it faster and more attractive.

Project 1: What a Car!

Problem:

Explore and apply the design process to design, build, test and modify a model solar car to make it as fast as possible.

Project 2: Model Solar Car Body

Problem:

Explore the design process and apply it to designing and building a body structure for a model solar car to make it more attractive and marketable as a functioning model.

Links to the Western Australian Curriculum

The Horizon Power, Bright Horizons Program provides opportunities for developing students' knowledge and understanding in science, technologies and mathematics. The linked **content of the Western Australian Curriculum and integration of the STEM disciplines** to help teachers planning are listed.

Science

Students build science understandings as they investigate the different forms of energy and transfer and transformation of energy and energy flow diagrams and research how solar panels can be used to generate and supply electricity (ACSSU155).

Students identify questions and problems that can be investigated (ACSIS139) plan and conduct investigations (ACSIS140, ACSIS141), and collect, represent and interpret data (ACSIS144, ACSIS145), and reflect on investigations and identify improvements (ACSIS146) and communicated their ideas and findings (ACSIS148).

Technology

Students consider the role of technology in society and ways in which people address sustainability issues when designing products (ACTDEK029/030). **Engineering** principles and systems are examined when students investigate energy within systems and create solutions while following a design process (ACTDEK031).

The *Design process guide* is included as a resource to provide assistance to teachers in understanding the complete design process as developed in the Technologies syllabus.

Mathematics

Mathematics understandings and proficiencies are developed as students select and apply efficient mental and written strategies to solve problems involving measurements taken during their experiments (ACMNA - 182/183/187); collecting,representing and interpreting data from their investigations (ACMSP - 292/284/206); when investigating the performance of solar panels, they also solve problems involving percentages and formulas (ACMMG198).

General capabilities and cross-curriculum priorities

There are opportunities for the development of general capabilities and cross-curriculum priorities as students engage with solar panels, batteries and cars. In this resource, students:

- Develop critical and creative thinking skills as they research the problem and its context *(Activity 1)*; investigate parameters impacting on the problem *(Activity 2)*; imagine and develop solutions *(Activity 3)*; and evaluate and communicate their solutions to an audience *(Activity 4)*.
- Utilise creative thinking as they generate possible design solutions; and critical thinking, numeracy skills and ethical understanding as they choose between alternative approaches to solving the problem of rooftop solar panel output and maximising the speed of a model solar car.
- Utilise personal and social capability as they develop socially cohesive and effective working teams; collaborate in generating solutions; adopt group roles; and reflect on their group work capabilities through self and peer evaluation.
- Utilise a range of literacies and information and communication technology (ICT) capabilities as they collate records of work completed throughout the module in a journal; represent and communicate their solutions to an audience using digital technologies in *Activity 4*.
- Communicate and, using evidence, justify their group's design to an authentic audience that might include entry into the Competition options of the program.

The sustainability priority concept of futures aims to build capacities for thinking and acting in ways that are necessary to create a more sustainable future. The concept seeks to promote reflective thinking processes in young people and empower them to design action that will lead to a more equitable and sustainable future.

Activity sequence and purpose

Activity 1 Research

Rooftop solar PV panels, batteries and appliance power needs

Students collaboratively research rooftop solar PV panels and battery storage for the provision of household electrical energy needs.

Activity 2 Investigate

Investigating factors affecting the power output of solar panels

Students conduct investigations into the effectiveness of solar panels for producing electricity.

Activity 3 Imagine & Create

Project 1: What a Car!

Students explore the design process and apply it to designing and building a model solar car.

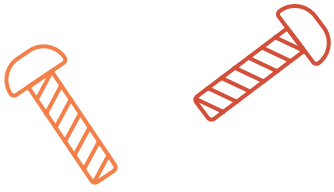
Project 2: Model Solar Car Body

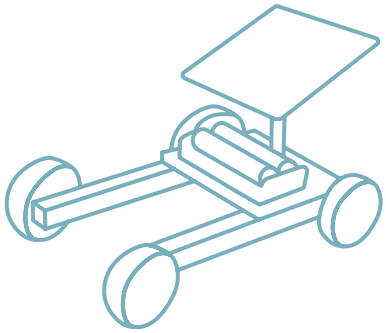
Explore the design process and apply it to designing and building a body structure for a model solar car to make it more attractive and marketable as a functioning model.

Activity 4 Evaluate & Communicate

What's the Verdict?

Students choose either Project (1 or 2) to evaluate. Students demonstrate, test and evaluate their model solar car/car body and compare the performance/marketing value of different designs. They evaluate their results and present their solution to an audience using multimedia.



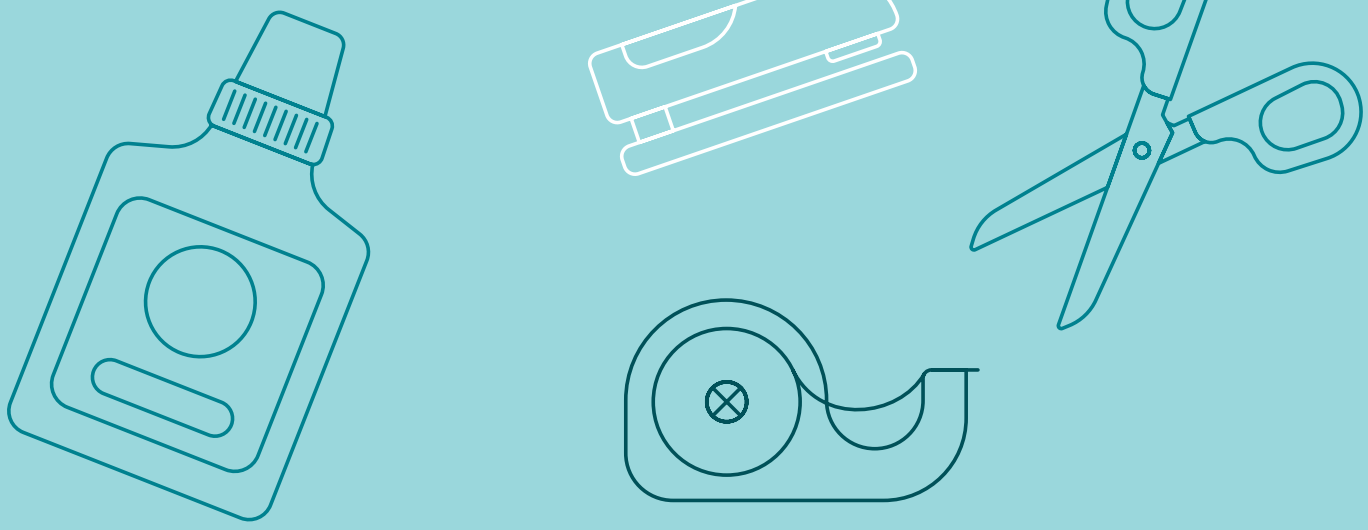


Background

Expected learning	Students will be able to: 1. Define sustainability and sustainable patterns of living. 2. Describe sustainable methods of electricity generation including the use of solar panels. 3. Describe how energy sources can be transformed to generate electricity. 4. Formulate a question, plan and conduct an investigation, collect and analyse data to measure the performance of a solar (photovoltaic) panel under different conditions. 5. Formulate a question, plan and conduct an investigation, collect and analyse data to measure the performance of modifications to a model solar car. 6. Convert units of measurement and calculate the electrical output of a solar (photovoltaic) panel/s. 7. Compare solar (photovoltaic) panel electricity generation to those required to meet domestic needs. 8. Using scientific principles, justify the choice of materials and shapes used to angle a solar panel and in the design modification of a model solar car. 9. Imagine and design modifications of a solar car/car body and represent the design modifications as annotated before and after diagrams, including measurements of length, area, and angle. 10. Working from their design, select appropriate materials and construction techniques to make their model solar car/car body. 11. Test and compare the effectiveness of their designs.
Vocabulary	This resource uses subject-specific terminology. The following list contains vocabulary that needs to be developed, either before the module commences or as it is used: non-renewable resources, renewable resources, sustainable, environmental footprint, utilities, consumption, energy, power, solar energy, convert, transfer, energy transformation, generate, conductor, insulator, current, voltage, electrical circuit, parallel circuit, series circuit, multimeter, output, photovoltaic, prototype, radiation, rate, reflect, solar panel, heat, temperature, watts, current, amp, voltage, volt, AC and DC.

Timing	There is no prescribed duration for this resource. The learning materials are designed to be flexible enough for teachers to adapt. Activities do not equate to lessons; one activity may require more than one lesson to implement.
Materials	The Horizon Power: Bright Horizons Equipment Pack In addition to the Bright Horizons Equipment Pack, you will need the following materials: • digital camera; tablet • light weight cardboard or foam or balsa wood • tissue box size cardboard boxes • newspaper • scissors • tape • glue • stapler • graph paper • additional materials as requested by students .
Safety notes	There are potential hazards in these activities and with the equipment being used. Risks assessments will be required. Potential hazards specific to this resource include but are not limited to: • Possible exposure to cyber bullying, privacy violations and uninvited solicitations when using the internet. • Sharp tools for cutting and joining materials. • Sun exposure during outdoor activities. • Using a multimeter - DC power only and must not be used for AC power.
Enterprise skills	The lessons focus on higher order skills with an emphasis on expected learning from the general capabilities and Enterprise skills. Enterprise skills include: problem solving, communication skills, digital literacy, teamwork, financial literacy, creativity, critical thinking and presentation skills. Further background on this is available from the *Foundation for Young Australians New Work Order* research. This is a series of reports which show how disruption to the world of work has significant implications for young Australians *www.fya.org.au/our-research/*. A summary report is *The New Basics: Big data reveals the skills young people need for the New Work Order* (Foundation for Young Australians, 2016) *www.fya.org.au/wp-content/uploads/2016/04/The-New-Basics_Web_Final.pdf*

Assessment	The Horizon Power Bright Horizons Program has been developed to provide students with learning experiences to solve authentic problems using science, technology, engineering and mathematics capabilities. While working through the resource, the following assessment opportunities will arise. • Anecdotal notes of observations as students work collaboratively through the activities. • Predictions and observations gathered through the science investigation. • Reflections and justification of understandings when students present their learning in Activity 4. Evidence of learning from journaling, presentations and anecdotal notes can contribute towards the larger body of evidence gathered throughout a teaching period and can be used to make on-balance judgements about the quality of learning demonstrated by the students in the Science, Technologies and Mathematics learning areas. Students can further develop the general capabilities of Information and communication technology (ICT) capability, Critical and creative thinking and Personal and social capability. Continuums for these are included in the *General capabilities continuums* but are not intended to be for assessment purposes.



Digital resources

Activity 1

eSafety classroom resources (Office of the eSafety Commissioner, 2018)

esafety.gov.au/education-resources/classroom-resources

How solar and batteries work (Horizon Power)

https://www.horizonpower.com.au/solar/how-solar-and-batteries-work/

What's a Watt? (Horizon Power)

https://vimeo.com/548221149/8b88e1f2d6

What are the factors that influence how much solar power I make?
Scroll down to this frequently asked question on the Horizon Power web page:

https://www.horizonpower.com.au/solar/onslowsolar/

Learn About Solar Power (Solarquotes - 2009)

https://www.solarquotes.com.au/learn-about-solar-energy.html

What is Electricity? (Technovation - 2016)

https://www.youtube.com/watch?v=oB1v-wh7EGU

Electric Vovabulary – TedEd (2012)

https://www.youtube.com/watch?v=MBRTR2dlwvA

Primary Connections – Essential Energy (Australian Academy of Science, 2018)

https://www.primaryconnections.org.au/curriculum-resource/essential-energy

How Solar Works - The Desert Knowledge Australia Solar Centre

http://dkasolarcentre.com.au/how-it-works

The Energy Rating Label -

https://www.energyrating.gov.au/label

The following links can be used as extra teacher background or materials for extension students.

How to Use a MULTIMETER - Beginners Guide
(Measuring Volts, resistance, continuity & Amps) (Junky DIY guy - 2017)

Caution: Do not give students access to this site. Teacher control delivery to avoid the measuring of AC voltage – only show times 0-3:37 min (DC Volts); 4:26-5:33 min (resistance) and 6:12-7:25 min (current)

https://www.youtube.com/watch?v=hgTgx_h5QOk

Electrical Current Explained – AC DC, fuses, circuit breakers, multimeter, GFCI, ampere (2020)

https://www.youtube.com/watch?v=kcL2_D33k3o

How do solar panels work? – TedEd (Richard Komp, 2016)

https://www.youtube.com/watch?v=xKxrkht7CpY OR

How do solar cells work? SciTunes Brown University (2018)

https://www.youtube.com/watch?v=UJ8XW9AgUrw

What is electricity? How does it work? Nikola Tesla's AC vs DC (2020)

https://www.youtube.com/watch?v=ag6ltdwqfms

Electric Power - Sparkfun

https://learn.sparkfun.com/tutorials/electric-power/all

What is a kWh – kilowatt hour + calculations – The Energy Mindset

https://www.youtube.com/watch?v=SMPhh8gT_1E

Solar Power for DIY – What's a Watt? AltE Store

https://www.youtube.com/watch?v=s5GprKNpeUY

Intro to Solar Panels: Part 2 – AltE Store

https://www.youtube.com/watch?v=E8jigMskopQ

Intro to Solar Panels: Part 1 – AltE Store

https://www.youtube.com/watch?v=oXYurLzkmHc

Activity 2

Energy Resources: What power can you get from a solar panel - practical activity (Education Services Australia, 2017)

www.scootle.edu.au/ec/viewing/R12284/pdf/stelr_06b.pdf

Putting STEM into Science - Innovative STEM teaching resources (STELR, 2016)

www.stelr.org.au

Solar Energy – Electricity (STELR, 2016)

www.stelr.org.au/solar-cells

How do Photovoltaics Work? (NASA Science, 2008)

https://science.nasa.gov/science-news/science-at-nasa/2002/solarcells

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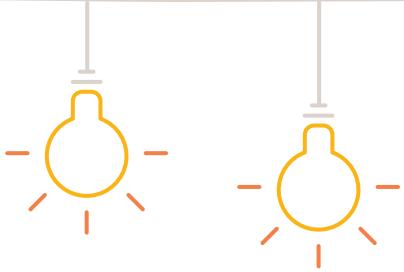
The Energy Rating Label -

https://www.energyrating.gov.au/label



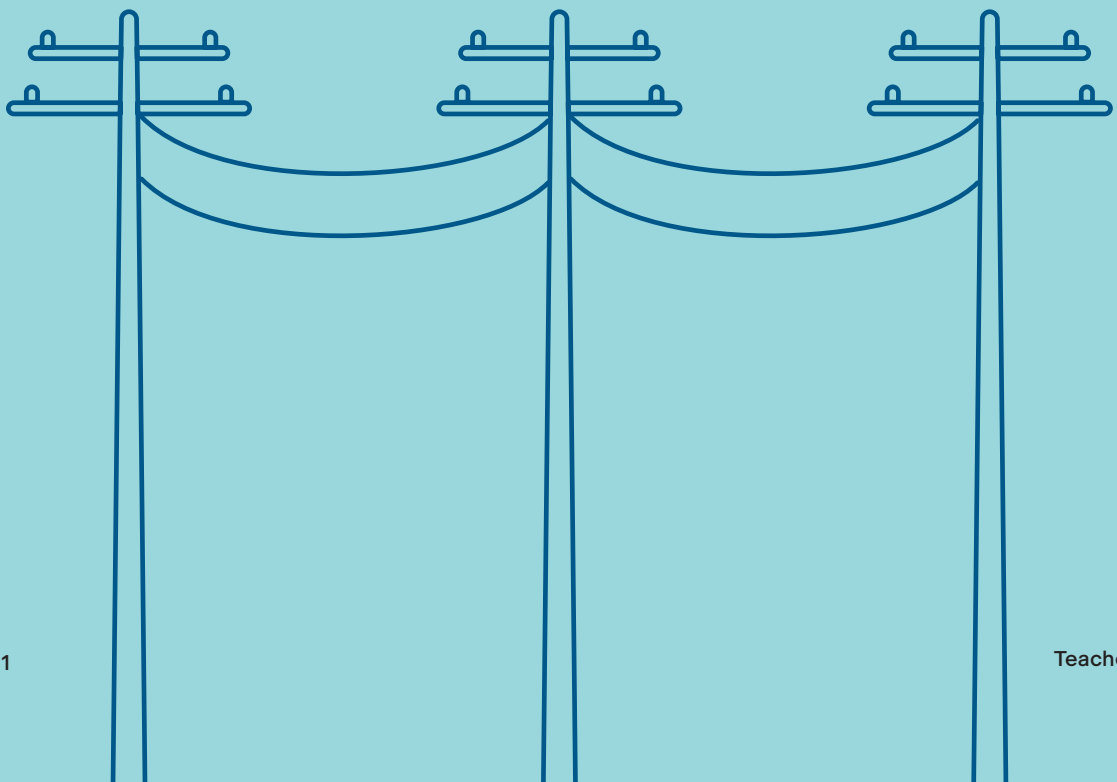
STEM Learning Project resources template

The Bright Horizons teaching and learning materials have been modelled on the STEM Learning Project resources. For your convenience, the following appendices have been copied directly from the STEM Learning Project resources template. They represent an integrated STEM teaching and learning approach that engages students in collaborative learning to solve authentic problems.

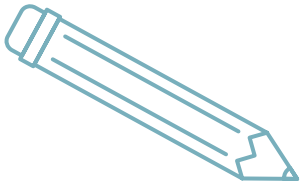
The STEM Learning Project resources were produced by a consortium of STAWA, MAWA, ECAWA and Scitech under contract to the Education Department.

The STEM Learning Project provides digital copies of innovative STEM teaching and professional learning resources to support teachers in all Western Australian schools to implement and extend the Kindergarten to Year 12 Curriculum and develop the general capabilities.

The full suite of the STEM Learning Project curriculum resource modules can be accessed via the STAWA link: https://www.stawa.net/resources/stem-learning-project/



Appendix 1



Design process guide

Research

Finding useful and helpful information about the design problem.

Gathering information, conducting surveys, finding examples of existing solutions, testing properties of materials, practical testing.

Analysis

Understanding the meaning of the research findings.

Analysing what the information means, summarising the surveys, judging the value of existing solutions, understanding test results.

Ideation

Idea generation – turning ideas into tangible forms so they can be organised, ordered and communicated to others.

Activities such as brainstorming, mind mapping, sketching, drawing diagrams and plans, collecting colour samples and/or material samples and talking through these ideas can help to generate fu creative ideas.

Using the **SCAMPER** model can assist with this:

www.mindtools.com/pages/article/newCT_02.htm

www.designorate.com/a-guide-to-the-scamper-technique-for- creative-thinking

Development

Development of the design ideas. Improvements, refinements, adding detail, making it better.

Activities such as detailed drawings, modelling, prototyping, market research, gaining feedback from intended user, further research – if needed – to solve an issue with the design, testing different tools or equipment, trialling production processes, measuring or working out dimensions, testing of prototypes and further refinement.

Production

Safe production of the final design or multiple copies of the final design.

Fine tuning the production process, such as division of labour for batch or mass production.

Use of intended materials and appropriate tools to safely make the solution to the design problem.

Evaluation

Reflection on the process taken and the success of the design.

Evaluation can lead to further development or improvement of the design and can be a final stage of the design process before a conclusion is reached.

Could be formal or informal and verbal or written.

Appendix 2
Reflective journal

When students reflect on learning and analyse their own ideas and feelings, they self-evaluate, thereby improving their metacognitive skills. When students self-monitor or reflect, the most powerful learning happens.

Journaling may take the form of a written or digital journal, a portfolio or a digital portfolio. Early childhood classrooms may use a class reflective floor book with pictures of the learning experience and scribed conversations.

Teachers can model the journaling process by thinking aloud and showing students how they can express learning and thoughts in a variety of ways including diagrams, pictures and writing.

A journal is a useful tool that gives teachers additional insight into how students value their own learning and progress, as well as demonstrating their individual achievements.

The following links provide background information and useful apps for journaling.

Kidblog – digital portfolios and blogging

kidblog.org/home

Edmodo – for consolidating and storing class notes and learning materials

www.edmodo.com/

Explain Everything™ – a screen casting, video and presentation tool all in one

explaineverything.com

Popplet – allows you to jot down your ideas and then sort them visually

Popplet.com

Seesaw – for capturing work completed by students in class, using a device's camera function

web.seesaw.me

Connect – the Department of Education's integrated, online environment

connect.det.wa.edu.au

Evernote (a digital portfolio app)

evernote.com

Digital portfolios for students (Cool tools for school)

cooltoolsforschool.wordpress.com/digital-student-portfolios

Appendix 3

Student activity sheet 1.0: Journal checklist

As an ongoing part of this module, you have been keeping a journal of your work.

Before submitting your journal to your teacher please ensure you have included the following information.

- Tick each box once complete and included.
- Write N/A for items that were not required in this module.

Your name and group member's names or photographs	
An explanation of the problem you are solving	
Your notes from *Activity 1*	
Your notes from *Activity 2*	
Your notes from *Activity 3*	
Your notes from *Activity 4*	
Student activity sheet	
Student activity sheet	
Student activity sheet	
Student activity sheet	
Student activity sheet 1.0: Journal checklist	

Appendix 4

Teacher resource sheet 1.1: Cooperative learning – Roles

Cooperative learning frameworks create opportunities for groups of students to work together, generally to a single purpose.

As well as having the potential to increase learning for all students involved, using these frameworks can help students develop personal and social capability.

When students are working in groups, positive interdependence can be fostered by assigning roles to group members.

These roles could include:

- working roles such as Reader, Writer, Summariser, Timekeeper
- social roles such as Encourager, Observer, Noise monitor, Energiser.

Teachers using the *Primary Connections* roles of Director, Manager and Speaker for their science teaching may find it effective to also use these roles for STEM learning.

Further to this, specific roles can be delineated for specific activities that the group is completing.

It can help students if some background to the purpose of group roles is made clear to them before they start, but at no time should the roles get in the way of the learning. Teachers should decide when or where roles are appropriate to given tasks.

Appendix 5

Teacher resource sheet 1.2: Cooperative learning – Jigsaw

This resource sheet provides a brief outline of a collaborative learning strategy known as 'jigsaw'.

Cooperative learning frameworks create opportunities for groups of students to work together, generally for a single purpose.

As well as having the potential to increase learning for all students involved, using these frameworks can help students develop personal and social capability.

The jigsaw strategy typically has each member of the group becoming an 'expert' on one or two aspects of a topic or question being investigated. Students start in their cooperative groups, then break away to form 'expert' groups to investigate and learn about a specific aspect of a topic. After developing a sound level of understanding, the students return to their cooperative groups and teach each other what they have learnt.

Within each expert group, issues such as how to teach the information to their group members are considered.

Step 1	**Cooperative groups** (of four students)	**1 2 3 4**		**1 2 3 4**	
Step 2	**Expert groups** (size equal to the number of groups)	**1 1**	**2 2**	**3 3**	**4 4**
Step 3	**Cooperative groups** (of four students)	**1 2 3 4**		**1 2 3 4**	

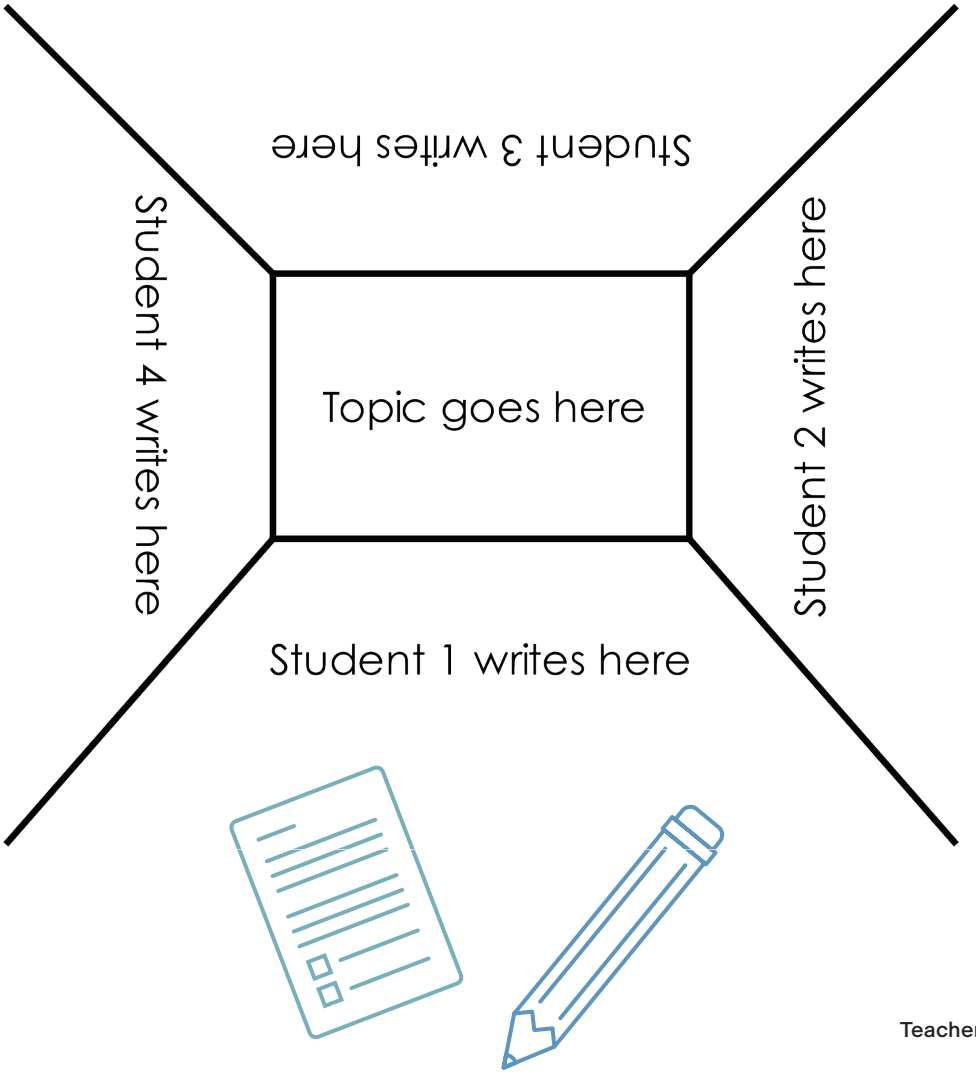
Appendix 6
Teacher resource sheet 1.3: Cooperative learning – Placemat

This resource sheet provides a brief outline of a cooperative learning strategy known as ‘placemat’.

Cooperative learning frameworks create opportunities for groups of students to work together, generally for a single purpose.

As well as having the potential to increase learning for all students involved, using these frameworks can help students develop personal and social capability.

The placemat strategy involves students working collaboratively to record prior knowledge about a common topic and brainstorm ideas. It also allows teachers to readily see the contribution of each student. The diagram below shows a typical placemat template.



Appendix 7

Teacher resource sheet 1.4: Cooperative learning – Think, Pair, Share

This resource sheet provides a brief outline of a cooperative learning strategy known as 'think – pair – share'.

Cooperative learning frameworks create opportunities for groups of students to work together, generally to a single purpose.

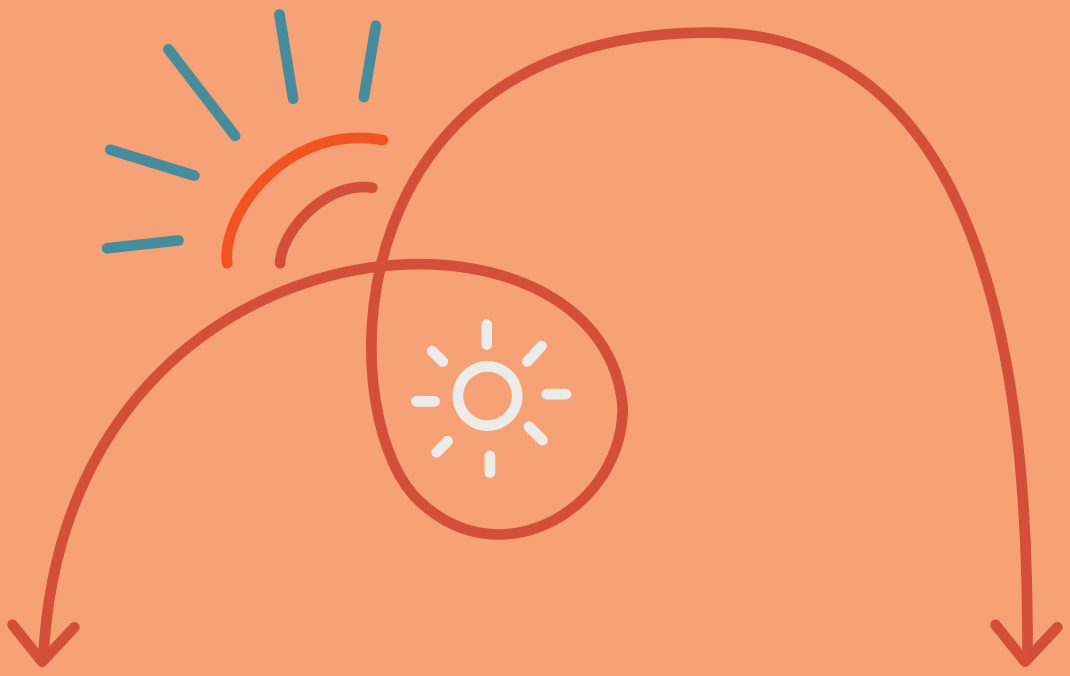
As well as having the potential to increase learning for all students involved, using these frameworks can help students develop personal and social capability.

In the 'think' stage, each student thinks silently about a question asked by the teacher.

In the 'pair' stage, students discuss their thoughts and answers to the question in pairs.

In the 'share' stage, the students share their answer, their partners answer or what they decided together. This sharing may be with other pairs or with the whole class. It is important also to let students 'pass'. This is a key element of making the strategy safe for students.

Think – pair – share increases student participation and provides an environment for higher levels of thinking and questioning.



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APPROVED ARTWORK SIGN OFF Year 8 Bright Horizons Teachers Guide_FA

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Please check and initial your internal approval:

Engagement Team	Copy	Design/ Art Direction	Producer	Studio
any changes	any changes	any changes	any changes	

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