Physical World

‘The Heat is On’

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Unit Plan

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| Unit Title: The Heat is On! | Stage: Stage 2 (Year 3) |
| Term: Term 2 | Strand: Physical World, Sub-strand: Heat |
| Duration: 90 minutes per lesson (15 hours) | Concept: Heat |

**Rationale**

Students will identify the ways that heat is produced and that heat moves from one object to another. Students do this by identifying in their environment some different ways in which heat is produced, e.g. by electricity, burning (chemical) and friction (motion). Students will observe the effects of heat moving from one object to another, e.g. the feeling when hands are placed in warm or cold water. Lastly, students describe how people use scientific knowledge in their work and everyday life to control the movement of heat from one object to another, e.g. a pot holder insulated bags or thermos. Reference. This comes the unit of Physical World from the K-10 Science Syllabus using outcome ST2-6PW.

The classroom will be set up by grouping them according to their cognitive levels. There will be four groups and the resources will placed behind the grouped tables. This therefore, makes it easier for the teacher and students to set up activities. Technology is used throughout the unit to enhance, refine and improve a students learning. In the second lesson where students discuss sources of heat, students and educators use the Interactive Whiteboard to share answers with the class. Using an interactive whiteboard, teachers allow the students to communicate and collaboratively make a mind map of what heat is and discuss responses. Students also engage in a ‘sources of heat’ game, matching up images of sources of heat where students play a game of matching up the images of sources using the Interactive Whiteboard. In lesson 5 students learn about convection and use iPad to take photos to later critically reflect on their own sample of work. Students also use web links, for example, watching YouTube and other online videos toe either introduce or refine ideas. Research will also be done using the iPad.

The study of ‘The Heat is On’ will link directly to other Key Learning Areas in the following manner;

* Mathematics – students interpret data and develop charts to match the interpretations of the information that has been discovered
* English – students develop their skills in speaking and listening, writing and representing, reading and writing, and spelling
* History – students develop understandings of first contact knowledge and describe people, events, actions related to world exploration and its effect

Learning Engagements are designed in and around Bybee’s (1989) 5E model gathered from Primary Connections. These learning engagements are designed to create interactive, hands on and effective activities. Each lesson is designed around the phases of the 5E model; engage, explore, explain, elaborate and evaluate. This is also done through the TWLH chart throughout the whole unit. Research states that through reasoning the 5E model can be very effective within model. Students progress throughout the unit in the 5E model;

* **Engage**: students watch videos, read books and ask open ended questions. This acts as a diagnostic assessment
* **Explore**: students study the processes of conduction and convention and understand how these can be understood through heat. Formative assessments occur at this phase
* **Explain**: through scientific explanations and investigations students experience the elements of heat and how warmth is of food and peoples. Formative assessments continue in this phase
* **Elaborate**: using Aboriginal Torres Strait Islander people students explore with heat and compare traditional and contemporary methods of heat
* **Evaluate**: students reflect on their own learning and return back to their original question and recognize the development they have made throughout the unit

Science and technology is the knowledge brought through the study to discover the truth about new information. It is used for observation and experimentation to describe and explain natural phenomena. (K. Watson, Personal Communication, 14th August, 2012) In relation to the statement, past experiences are used as experimentation into constructing views and understanding within an individual’s world and the world around them. A constructivist view introduces teaching and learning as a way of promoting learning within Science and Technology. (K. Watson, Personal Communication, 2nd August, 2012) It is promoted that students are said to do the learning on their own bringing with them what they know into new learning experiences. Students learn to fit new information together with what they already know as knowledge can only be constructed through learners and an active and mental process of development. (K. Watson, Personal Communication, 6th August, 2012). A constructivist learning approach plays a role in the understanding of an individual’s world through the use of a ‘hearts-on, hands-on, heads-on approach’, using both mental and manual activity of solution. In addition, teachers, must be motivated in order to give students the monument to want to learn. ‘Humans can understand only what they have constructed themselves,’ (Thanasoulas, D., 2001)

**Formative Assessment** is developed throughout the unit by posing and solving questions and open and closed ended questions. The discussions at the beginning of each lesson are another form of formative assessment. Observations are another form of formative assessment and so are the TWLH chart. Students journals, observations, recording and other sample works are another form of formative assessment. The formative assessment strategies occurs throughout the whole unit from lessons 1 to 10.

**Summative assessment** is presented in the final lesson in the evaluation phase. Students contribute to an online quiz where they define the meta language in the website and adding images to support their development. Students are able to complete several of these tasks and the teacher observes the students completing the tasks while asking questions to test their learning and development.

**Text types**:

1. Personal response- In which students are asked to place themselves in Antarctica, dessert and discuss ways in which they would stay cool and warm. This will allow students to see for themselves they have learnt.
2. Narrative – dreamtime story
3. Journal – Students will continually do a journal when they discuss what they have learnt in a personal response

**Goals**

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| **Science K-10 (Incorporating Science and Technology) K-6 Syllabus Outcomes and Indicators, pages, 50-58****Physical Environment:** ST2 – 6PW identifies ways heat is produced and that heat moves from one object to anotherHeat can be produced in many ways and can move from one object to another. (ACSSU049)Students:* Identify in their environment some different ways in which heat is produced, e.g. by electricity, burning (chemical) and friction (motion)
* Observe the effects of heat moving from one object to another, e.g. the feeling when hands are placed in warm or cold water
* Describe how people use scientific knowledge in their work and everyday life to control the movement of heat from one object to another, e.g. a pot holder, insulated bags or thermos

**Material world:**ST2 – 12MW Identifies that adding or removing heat causes a change of state between solids and liquidsA change of state between solid and liquid can be caused by adding or removing heat, (ACSSU046)Students:* Describe some everyday situations where solids and liquids change state by adding heat (heating) or removing heat (cooling)
* Predict and observe the effects of adding heat or removing heat on a variety of everyday solids and/or liquids, e.g. butter, chocolate and water
* Describe how scientific knowledge about the effects of heating and cooling is used by people in their everyday life, e.g. the types of clothes worn, the packaging and preparation of food and everyday devices, e.g. freezers, irons or cooktops

**Working Scientifically** ST2 – 4WS Investigates their questions and predictions by analyzing collected data, suggesting explanations for their findings, and communicating and reflecting on the processes undertaken Students question and predict by:* Using curiosity, prior knowledge, experiences and scientific information with guidance, identifying questions in familiar contexts that can be investigated scientifically (ACSIS053, ACSIS064)
* Predicting what might happen based on prior knowledge in an investigation (ACSIS053, ACSIS064)

Students plan investigations by: * Working collaboratively and individually, to suggest ways to plan and conduct investigations to find answers to questions (ACSIS054, ACSIS065)
* Suggesting appropriate materials, tools and equipment they could use in conducting their investigations and recording their findings, identifying appropriate safety rules
* Identifying where Working Scientifically might inform or test elements of Working Technologically in relation to established criteria

Students conduct investigations by:* Following the planned method, adjusting procedures as necessary, including exploration, fieldwork, surveys and researching secondary sources
* Safely using appropriate materials, tools or equipment to make and record observations, using formal measurements and digital technologies as appropriate (ACSIS055, ACSIS066)

Students process and analyze data and information by:* Sharing their findings and reflecting on the investigation, including whether a test was fair or not (ACSIS058, ACSIS069)
* Describing patterns and relationships in data collected from investigations (ACSHE050, ACSHE061)
* Comparing results with predictions, suggesting possible reasons for findings (ACSIS215, ACSIS216)
* Using their ideas and findings to identify what they could find out next through the processes of Working Scientifically and Working Technologically

Students communicate by:* Representing and communicating ideas and findings in a variety of ways such as diagrams, physical representations and simple reports, tables, simple column graphs, written and oral factual texts, explanation and argument (ACSIS060, ACSIS071)
* Sharing what they did and found out, including identifying some strengths and limitations of the method they used and what could be done differently to improve their investigation, including fairness as appropriate

**Working Technologically**ST2 – 5WT Applies a design process and uses a range of tools, equipment, materials and techniques to produce solutions that address specific design criteriaStudents explore and define a task by:* Exploring design situations and/or existing solutions relevant to the needs and wants of themselves and others
* Working individually and collaboratively to develop a design brief that identifies simple design criteria relating to requirements that make the proposed solution useful and attractive while having minimal impact on the environment

Students generate and develop ideas by:* Using creative thinking techniques, including brainstorming, mind-mapping, sketching and modeling
* Using a range of research techniques to access information relevant to the task
* Using techniques, including labeled drawings, modeling and storyboarding, for documenting and communicating design ideas
* Using digital technologies and multimedia for communicating design ideas
* Refining ideas in responding to feedback from others

Students produce solutions by:* Exploring a range of materials appropriate for the task
* Developing and applying a plan and sequence for production that considers, where relevant, time and resources
* Safely and correctly using a range of tools and equipment, materials and techniques, e.g. cutting, combining, joining, shaping, assembling and finishing materials

Students evaluate by:* Reflecting on the process followed and what could be done differently to ensure that the solution meets the needs of the user/audience
* Using established design criteria to evaluate the process, product or solution, and suggesting how their design solution could be improved
* Reflecting on findings to identify what they could find out next through the processes of Working Technologically and Working Scientifically

Board of Studies, New South Wales. (n.d). *NSW Syllabuses for the Australian Curriculum: Science K-10 (Incorporating Science and Technology K-6) Syllabus.* Retrieved from: <http://syllabus.bos.nsw.edu.au/science/science-k10/>  |
| **Maths K-10 Syllabus Outcomes and Indicators, pages 128 - 198**Data * MA2 – 1WM Uses appropriate terminology to describe, and symbols to represent, mathematical ideas
* MA2 – 2WM Selects and uses appropriate mental or written strategies, or technology, to solve problems
* MA2 – 3WM Checks the accuracy of a statement and explains the reasoning used
* MA2 – 18SP Selects appropriate methods to collect data, and constructs, compares, interprets and evaluates data displays, including tables, picture graphs and column graphs

Students: Identify questions or issues for categorical variables; identify data sources and plan methods of data collection and recording (ACMSP068)* Pose questions about a matter of interest to obtain information that can be recorded in categories
* Predict and create a list of categories for efficient data collection in relation to a matter of interest

Collect data, organise it into categories, and create displays using lists, tables, picture graphs and simple column graphs, with and without the use of digital technologies (ACMSP069)* Collect data and create a list or table to organise the data

Interpret and compare data displays (ACMSP070) Describe and interpret information presented in simple tables, column graphs and picture graphsBoard of Studies, New South Wales. (n.d). *NSW Syllabuses for the Australian Curriculum: Maths K-10 Syllabus.* Retrieved 2nd of July from: <http://syllabus.bos.nsw.edu.au/mathematics/mathematics-k10/>  | **History K-10 Syllabus Outcomes and Indicators, pages, 46 – 47** First ContactsHT2 – 3 Describes people, events and actions related to world exploration and its effects The diversity and longevity of Australia's first peoples and the ways Aboriginal and/or Torres Strait Islander peoples are connected to Country and Place (land, sea, waterways and skies) and the implications for their daily lives (ACHHK077)Students:* Investigate, drawing on Aboriginal and Torres Strait Islander community representatives (where possible) and other sources, the traditional Aboriginal way of life, focusing on people, their beliefs, food, shelter, tools and weapons, customs and ceremonies, art works, dance, music, and relationship to Country

The nature of contact between Aboriginal people and/or Torres Strait Islanders and others, for example, the Macassans and the Europeans, and the effects of these interactions on, for example, families and the environment (ACHHK080)Students:* Describe the nature of contact between Aboriginal people and/or Torres Strait Islander peoples and others, including Aboriginal resistance

Board of Studies, New South Wales. (n.d). *NSW Syllabuses for the Australian Curriculum: History K-10 Syllabus.* Retrieved 2nd of July from: <http://syllabus.bos.nsw.edu.au/history/history-k10/>  |
| **English K-10 Syllabus Outcomes and Indicators, pages, 75 – 97** Speaking and listening EN2 – 1A – communicates in a range of informal and formal contexts by adopting a range of roles in the group, classroom, school and community contextsDevelop and apply contextual knowledge* Understand the ways in which spoken language differs from written language when adopting a range of roles
* Interpret ideas and information in spoken texts and listen for key points in order to carry out tasks and use information to share and extend ideas and information (ACELY1687)
* Understand that social interactions influence the way people engage with ideas and respond to others for example when exploring and clarifying the ideas of others, summarising their own views and reporting them to a larger group (ACELA1488)

Understand and apply knowledge of language forms and features* Understand that successful cooperation with others depends on shared use of social conventions, including turn-taking patterns, and forms of address that vary according to the degree of formality in social situations (ACELA1476)
* Understand and adopt the different roles in a debate, e.g. through experience of formal debates and role-playing

Respond to and compose texts* Interact effectively in groups or pairs, adopting a range of roles
* Use interaction skills, including active listening behaviours and communicate in a clear, coherent manner using a variety of everyday and learned vocabulary and appropriate tone, pace, pitch and volume (ACELY1688, ACELY1792)
* Use information to support and elaborate on a point of view
* Demonstrate understanding of ideas and issues in texts through dramatic representation, role-play and simulations
* Retell or perform part of a story from a character's point of view
* Adapt language to suit familiar situations, e.g. giving instructions to a younger child
 | **English K-10 Syllabus Outcomes and Indicators, pages, 75 – 97** Writing and Representing EN2 – 2A – Plans, composes and reviews a range of texts that are more demanding in terms of topic, audience and language Students:Respond to and compose texts* Plan and organise ideas using headings, graphic organisers, questions and mind maps
* Experiment with visual, multimodal and digital processes to represent ideas encountered in texts
* Identify elements of their writing that need improvement and review using feedback from teacher and peers
* Reread and edit texts for meaning, appropriate structure, grammatical choices and punctuation

Reading and viewingEN2 – 4A Plans, composes and reviews a range of texts that are more demanding in terms of topic, audience and languageUnderstand and apply knowledge of language forms and features * Use metalanguage to describe the effects of ideas, text structures and language features of literary texts

SpellingEN2 – 5A Uses a range of strategies, including knowledge of letter–sound correspondences and common letter patterns, to spell familiar and some unfamiliar words Develop and apply contextual knowledge* Understand how accurate spelling supports the reader to read fluently and interpret written text

Board of Studies, New South Wales. (n.d). *NSW Syllabuses for the Australian Curriculum: English K-10 Syllabus.* Retrieved 2nd of July from: <http://syllabus.bos.nsw.edu.au/englush/english-k10/>  |
| **Evaluation of unit:**This will be based on;* Was the overall ‘Heat is On’ Successful?
* Were the outcomes and indicators achieved in each lesson?
* Did students undertake the activities in each lesson successful?
* Were all the students sufficiently challenged/not over challenged (working in the Zone of Proximal Development)
* Were the resources used throughout the unit of work appropriate and sufficient for students to achieve the desired learning outcomes?
* Were the students using the correct terminology and specific language throughout the unit of work?
* Was communication effective? Were explanations throughout the unit of work clear, concise and appropriate for student’s level of understanding?
* Was my understanding of student’s prior knowledge accurate?
* Were students possible misconceptions revealed and addressed?
* Did the unit of work follow the 5E model?
* Did the unit of work allow for co-operative learning, and learning social interaction effectively?
* Did the lesson and unit of sequence flow and build upon the previous lesson?

(Marsh, 2008, p.97) |
| **Differentiation:**Differentiation is responsive teaching rather than one size fits all teaching (Tomlinson, 2005). To put it yet another way, it means that teachers proactively plan varied approaches to what students need to learn, how they will learn it, and/or how they will show what they have learned in order to increase the likelihood that each student will learn as much as he or she can, as efficiently as possible (Tomlinson, 2003).Learning activities may be differentiated on the basis of students' readiness for learning the specific content or skill, their interests or their preferred ways of learning. Teachers can differentiate in terms of:**Styles of learning** **Kinesthetic**- The hands on materials where students perform experiments allows them to physically use objects in order to further develop their information. This is show when students need to place hot and cold water together with dye in order to show heat rises.**Auditory** - students throughout many lessons will be provided many YouTube clips which enable them to rethink their ideas and alter any ideas that need to be altered. Also video clips such as “” enable them to learn through the use of singing if students prefer in this manner. **Visual**- students use the interactive whiteboard, pictures and diagrams to explore heat and understand the concept of heat. For example students play the matching game in order to understand what is products that produce heat**Cognitive level:** **Gifted and talented:** students who are working beyond the stage level will be given open ended and closed questions to develop higher ordered critical thinking. Students will be given a question and required to present a scientific report using either; book, ipad or computer. **Students working at the stage level:** students at the stage level will be asked to explore how popcorn is made and how the heat is transferred. **Students working below**: exploring and elaborating how popcorn is made; students at this level will use diagrams, images to present the process.  | **Special needs:** Students with writing or verbal deficiencies can draw pictures rather to explain their responses and create charts using the I pad. * Manipulative or concrete materials for those who need it
* Varying the length of time to complete a task – thus providing additional support for a struggling student or to encourage an advanced learner to pursue a topic in greater depth
* Set out clear guidelines for independent work which match individual needs
* Develop routines that allow students to get help when teachers are busy with others and can’t help immediately.
* Pair students with special needs with peers who can help during group activities.
* Diagrams or explanations: Use short phrases with key words listed on the board. Verbal clues help with definitions.

**Aboriginal Torres strait island students:**The Eight Aboriginal Ways of Learning is a pedagogical framework allowing teachers to incorporate Aboriginal perspectives, values and traditions. This can be achieved through bringing an authentic Aboriginal standpoint, which also conveys Aboriginal community and place-based learning into mainstream content. **Symbols and Images:** Indigenous pedagogy involving the use of both concrete and abstract imagery (Bindarriy et al. 1991) Teachers use diagrams or visualisations to map out processes for students to follow, for example in lesson 7; students are presented with visual images of traditional Aboriginal methods of heat sources such as; sticks, banana leaves, large stones etc. **Community Links:** The traditional method of heat sources and heat transfer connects with real life purposes, contexts and aboriginal communities. **Story sharing:** Narratives and the dream time story will actively involve learners in introspection and analysis. Dreamtime story (snippet) The two sisters**Learning maps**: this is presented in this unit map and presentation through the sequential 1, 2, 3 activities where the journey flows from the beginning, to the middle then to the end.**Non-verbal**; this is demonstrated through; spiritual connections; physical activities, body, position, observations and listening**Land links**: this is portrayed through the story telling, especially in lesson 1**Deconstruct, reconstruct:** achieved through purpose (contextualized), and ones strength to learn and understand**Non-linear:** presented through the incorporation of various KLA’s throughout the unit |

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| **What task is being undertaken** | **What harm can happen to person**  | **risk ?1(high) to 6 low** | **Suggested Control Measures** |
| touching items around classroom | Touch objects that are hot, cold and sharp  | 4 | **Lesson1 -** Place dangerous out of reach of student’s e.g. hot objects. Make sure all chairs are tucked in so students do not trip. Make sure whiteboard markers are not in the reach of student’s. Make sure students do not rock on their chairs. Remind students no to run in class for all lessons.  |
| Students writing on the IWB | See inappropriate images, students may trip over each other  | 4 | **Lesson 2-** Make sure there is space between students and interactive whiteboard so students do not trip. |
| Role play with hairdryer. Using plastic, metal and boiling water | Hair dryer and boiling water may burn students. Cuts because of plastic and metal knife and allergic reaction  | 2 | **Lesson 3-** Allow enough space for students to participate in role play. Hairdryer and boiling water is not placed on skin as they can cause burns. Make sure no water is placed around the hairdryer as cause people to get electric shots. Metal knife is not place near boiling water. Check if any students are allergic to pepper corn. Teachers handles boiling water and does not feel it to the top to minimise spilling. First aid kit is present and bucket of cold water  |
| Using candle, balloons,nails, rulers and bottles | The use of candles. Nails and glass bottles can break. Balloons can cause shock.  | 2 | **Lesson 4-** Teacher lights up the candle for the students. Glass bottles are not broken .Nails are not sharp and if so are blunted. Balloons are stretchable enough to not pop on students while blowing.   |
| Student create a snake. | Scissors and pins are sharp.  | 2 | **Lesson 5-**Cardboard is soft and not hard so It cannot be used a weapon. Pins are blunt and remind students not to place on body or clothing.  |
| Creating a volcano | Jars breaking ,hot water may fall, dye get in students eye .  | 5 | **Lesson 6-** Dye and droppers are not placed near students clothing and explain students that only one drop is needed. Hot water is not carried around and given to students.  |
| Cooking popcorn | Using oil and pop corn pop cause skin irritation.  | 4 | **Lesson7 -**Pour the oil beforehand in order for students not to spill or get on themselves. Teacher supervise and students that are observing will be asked to stand back in case oil start popping. Do not allow students to touch while in use. Students do not touch the hot plate. |
| Use of iPads | Running with iPad | 1 | **Lesson 8-**Remind students not to run with iPad and to use it when sitting down.  |
| Rubbing of hands and making of fire triangle | Rubbing of hands cause skin irritation. | 1 | **Lesson 9&10-**Remind students not to rub hands to hard as this causes skin irritation. The wood that is going to be used does not have splinters. Prior to the lesson determine whether students are allergic to grass.  |

**Risk assessment –** parents helpers will be advised to assist students at any point throughout the unit, to ensure adequate safety

**Learning sequence**

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| 5 E | Learning Engagement | Resources/ References | Outcome | Link to KLA |
| **Engage**The introduction to the lesson will capture students interests into moving around and discovering what hot/cold is by touching tactile and concrete materials. | **Lesson 1: What is Heat?*** Students will move around the room and touch items around them and describe whether they think the item is hot or cold. They will record their observations in their science journals and share their observations with the class. This is beneficial for kinesthetic learners as they move, touch tactile objects to discover hot/cold.
* The teacher works with students to establish a TWLH chart on butcher’s paper. Discuss what students think they know, so that later we can discuss what children want to know, what they have learnt and how they know
* Inform students that heat is a type of energy and that energy is the ability to make things happen. This will be done using the Interactive whiteboard- flipchart program.
* Explain that heat energy is not always easy to see, but one way to observe it is to use our sense of touch.
* To conclude the lesson, the teacher will pose a series of open ended questions such as “what would you do to keep warm in Antarctica?” “How would you keep cool in the desert?” “Imagine that you are an Indigenous Aboriginal 300 years ago (without electricity), how would you survive facing the elements of heat and cold?”
* Students will record their answers in their journal.
 | * Butchers paper
* Textas
 | ST2 – 6PWST2 – 12MWST2 – 4WSST2 – 5WT | EN2 – 2AEN2 – 1AEN2 – 4AEN2 – 5AHT2 – 3 |
| **Engage**The activity will capture students’ attention and make connections between prior knowledge and the new concept they will be learning. | **Lesson 2: Sources of Heat*** Students go into a discussion about what can be a source of heat in their environments, e.g. fridges, microwaves (materials things), and then go back to the things like the sun, done with the whole class.
* Teachers ask open-ended questions to develop higher ordered thinking: Why do people need heat? In what kinds of specific everyday situations do we need heat? What are some of the major sources of heat that we rely on? Use the IWB to share answers with the class.
* Students will explore heat in familiar context and define heat as a type of energy.
* Using an interactive whiteboard, teachers allow the students to communicate and collaboratively make a mind map of what heat is and discuss responses
* Ask students to think about familiar sources of heat around the home, and individually write a journal entry containing a list of the heat in the household
* Students engage in a sources of heat game, matching up images of sources of heat on the IWB
* Students develop a mind map of how individuals keep warm – asking ‘how do we keep warm?’
* Ask students to list ways they think that heat is produced through these items
* Through the interactive activity, using the students responses, the educator using students input to demonstrate why and how jumpers keep us warm. Through this experiment students will understand that the jumper is not a conductor of heat but rather the baking tray retains heat for a longer period of time.
* Add this to the TWLH chart, of what they now know
 | * Interactive Whiteboard
* Images of sources of heat
* Education Services Australia, (n.d.).
* Baking tray
* Hairdryer
* Jumper
* Interactive whiteboard
* (BrainPop, 2014)
 | ST2 – 6PWST2 – 12MWST2 – 4WSST2 – 5WT | MA2 – 18SPEN2 – 2AEN2 – 1AEN2 – 4AEN2 – 5A  |
| **Explore**Students receive opportunities to interact socially as they acquire a common set of experiences by actively exploring the new concept through experimental activities. | **Lesson 3: Conduction*** Introduce what conduction is and ensure students understand the process of conduction (Conduction works because molecules are always in motion)
* Ask children to move to an open area where they can participate in a role-play. Students place themselves in rows of three becoming particles within an object.
* One side of the group will ‘heat’ up using a hairdryer the students will both predict and perform the process. This is conduction using role-play.
* This lesson allows students to add to the TWLH chart by creating questions and probing their own learning, adding to what they want to know regarding conduction.
* The following activity will encourage students to critically compare predictions with observations, identify how heat (hot water) has an effect on an object.
* Students will be firstly given a recording worksheet where they will note down their predictions and be engaged in open/closed questions.
* Students will then participate in an experiment where they will be exposed to the different ways that heat is transferred between objects, at this stage students will be engaged in the knowledge.
* Through the experiment using plastic, wood and metal, students will predict which type of materials acts as a primary conductor from heat.
* Using three cups, students will carefully pour hot water into them and place them in the middle of the table.
* Students will then place a small amount of butter on the end of a metal ruler, plastic knife and a tongue depressor.
* On the butter, students will place a peppercorn firmly in place so that it does not fall off.
* Students will then predict which material will conduct heat faster.
* Students will then observe and document which material will melt the butter first, allowing the peppercorn to drop into the water.
* **Differentiation tasks for students working, to, at and beyond stage outcomes:**
* Struggling students- Will use two containers one with cold water and the other hot water. The cold water will use blue dye which will go slower and the other container will use red dye which will clearly go faster.
* Excelling students- -Students above level will use a hair dryer which will have one that is hot and one which cold, students need to move faster when its hot and move slow when it’s the dryer is moved into cold.
* Students at stage level will also use a dryer however the dryer will only be hot, when the dryer is on they need to move fast, when the dryer is turned off they need to move slower
* Students below stage level will listen to the voice of the teacher in which she will provide what type of movement is wanted for example hot so students need to move fast. Students will be assessed through the use of observation
* Using the Macquarie aspect, the test has been made unfairly as students need to decide what material has caused this to occur, foe example, the metal knife has caused the test to be unfair as it is the strongest conduct. This can further the students who are working beyond by asking them why it is an unfair test. Students can show why this is an unfair text by creating an adaption to the test.
* Students will reflect upon this experiment and create a claim that will support their evidence in their journal.
* With the whole class watch a short conduction Video - Video 24– 0.38-2.18 min <http://www.animatedscience.co.uk/flv/>
* Students may add to their journals if necessary to adjust their claim
* Note: students must keep their original claim and create a new one if need be.
* The teacher impact in this lesson is crucial, because unless she is motivated and interested, the students wont be either. It is important to note: ‘teachers who are insecure in their knowledge of science find the uncomplicated transmission of knowledge attractive and revert to more traditional teacher-directed methods when they are less confident.’ (Appleton, K. & Kindt, L., 2002).
 | * Hair drier
* Butter
* Plastic knife
* Plastic wood
* Metal knife
* Peppercorns
* Hairdryer
* *Anonymous*. (n.d.).
 | ST2 – 6PWST2 – 12MWST2 – 4WSST2 – 5WT | EN2 – 2AEN2 – 1AEN2 – 4AEN2 – 5A |
| **Explore**Students receive opportunities to interact socially as they acquire a common set of experiences by actively exploring the new concept through experimental activities. | **Lesson 4: Conduction** * Students will be lead into a discussion through probing questions recapping how metal is used through a conduction method of transferring heat. The integration of blooms taxonomy will be included to develop the level of cognitive thinking.
* Students will be further exploring this concept through hands on experiment, adding to a kinesthetic learning ability.
* In this first experiment, students will use metal and heat to explore the process of how heat travels through a solid (metal)
* Students will determine how long it takes for the heat to travel out and provide their own explanation of how it travels.
* In the second experiment, students stretch the balloon over the neck of an empty bottle. Students place the net on top of the candle and remove the bottle after 3-5 minutes noticing the before and after affects. This furthers knowledge and understanding of conduction. Students will find that balloons blow up while over the heat and deflate when taken away from the heat
* After the educator briefly explains the experiment, students will be asked to predict what will happen before the experiment is carried out.
* Students add to their TWLH chart of what they have learnt
* A hearts-on, hands-on, minds on science approach allows students to use ‘concrete materials in order to make rational sense of how their physical and natural world works from a scientific perspectives.’ (Skamp, 2012). In this experiment students use very hands on experiences, therefore switching hearts and minds on.
 | * Candle
* Matches
* Nails
* (Mr.Temme, 2013, March 13). Metal rulers
* Balloons
* Glass bottles
* Candle
* Tongs
* (Miller, L., n.d.).
 | ST2 – 6PWST2 – 12MWST2 – 4WSST2 – 5WT | MA2 – 1WMEN2 – 2AEN2 – 1AEN2 – 4AEN2 – 5A |
| **Explore** Students should be able to explain and provide a definition of the concepts. Teacher will use open and targeted questions to connect experiences with the observations | **Lesson 5: Convection** * The teacher will light up a candle in the middle of the classroom, if students sit very still without talking they should be able to see smoke rising from the candle by free convection.
* The teacher will begin a discussion identifying and defining what the students think convection is. The teacher will lead the students into a discussion on their thoughts.
* In the first experiment of convection, students will participate in a ‘hot and cold water’ experiment. Students explore the process of convection utilizing food dye and hot and cold water
* Students use iPads to take photos
* In order to extend students understanding and knowledge an activity will be set up on group tables.
* Students will follow the steps to create a ‘Convection Snake’.
* Add to the TWHL chart
 | * Soft cardboard
* Scissors
* A cotton reel
* A pin
* Bluetac
* A source of heat, e.g. Radiator
* (TheRoadshow, n.d.).
 | ST2 – 6PWST2 – 12MWST2 – 4WSST2 – 5WT | EN2 – 2AEN2 – 1AEN2 – 4AEN2 – 5A |
| **Explore** Students should be able to explain and provide a definition of the concepts. Teacher will use open and targeted questions to connect experiences with the observations. | **Lesson 6: Convection*** Students will be lead into discussion by the teacher regarding the activity they had completed last lesson.
* Teacher will ensure that students will explore the concepts of convection and understand the definition.
* The educator will show students a video and ask them to identify what they think is happening
* Video Link <https://www.youtube.com/watch?v=FrhgsPbB27A>
* To further extend students knowledge teacher will present an underwater volcano and ask students to predict what would happen throughout this experiment
* The teacher will instruct the students on how the experiment will be carried out and advise them that the resources are set out on the table. An instruction sheet will be provided for the students.
* Teachers will ensure that students are cautious when using the hot water.
* Students will be asked to work within their groups and complete the worksheet individually using both prior and new knowledge
* After the completion of the experiment students will be reflect on their process and experiment. Students will be asked to write in their journal in regards to the experiment
* Pupils learn to use their practical skills to link it with content and purpose for effective science pedagogy, in a hearts-on, hands-on, minds-on approach. (Fensham, P., 1981). This experiment impacts students long-term, and sustained interest in sciences
 | * 8 jars
* Coloured dye
* Droppers
* Hot and cold water

(PaikeaProductionsPro, 2011, October 19). | ST2 – 6PWST2 – 12MWST2 – 4WSST2 – 5WT | EN2 – 2AEN2 – 1AEN2 – 4AEN2 – 5A |
| **Explain**Students share, present their observations and engage in meaningful discussions. | **Lesson 7: Comparison between convection and conduction*** Students will recap what they have done in all their experiments and compare them to one other
* Students will predict what will happen in both scenarios using their journals and open-ended questioning, which will challenge students who are working beyond the stage level.
* Students will investigate the differences between conduction and convection processes.
* Students do this by performing experiments cooking popcorn using two different methods
* Popcorn is used as an example of how heat can be transferred
* The first method is using oil in the bottom of a pan – conduction
* The second is using a popcorn popper – convection
* A video will be shown to outline what conduction and convection is:

<http://www.wisc-online.com/objects/heattransfer/> * Students will continue their journal by comparing their predictions to their observations
* Students will then recap and selected students will present journal entries to the class.
* Through these activities students see and experience it for themselves, they also, need to test predictions and experience doing ‘real’ science, (Skamp, 2012).
 | * Popcorn
* Hot plate
* Oven
* Popcorn popper
* Oil
* (Jarvis, L., & Simonson, D., 2013, July 11).
* (Vuong, S., 2010, May 22).
 | ST2 – 6PWST2 – 12MWST2 – 4WSST2 – 5WT | EN2 – 2AEN2 – 1AEN2 – 4AEN2 – 5A |
| **Elaborate**Students apply the concept in a new context.  | **Lesson 8: Traditional Aboriginal methods*** Students will reflect through discussion upon their Aboriginal understandings how Aboriginal use heat.
* Through the teachers probing students will discuss the process of the heating and elaborate using previous lessons and concepts undertaken. This reflects the Aboriginal and Torres Strait Islander peoples traditional way of living and conducting heat.
* Students will concentrate on how the Aboriginal and Torres Strait islander people use conduction to heat the rocks, to prepare their food and water to use in their everyday
* Students will have the opportunity to compare contemporary ovens with traditional ovens, so what they used before and what they are using now. They used to use rocks and wood fire and now we have ovens. They will also investigate physical properties of insulation materials, both traditional (coconut or banana leaves) and modern (aluminum foil) used to wrap the food. They will do this using iPads. This online observation provided further evidence and refined ideas of ensuring effective and continued use
* Students use their knowledge of the behavior of heat in soils, sand and stone in the preparation of food.
* Students explore how Aboriginal and Torres Strait people have observed natural events on occasions.
* Finally, students will reflect on this process by creating another journal entry and comparing this journal entry to previous journal entries created throughout the unit.
* Students again will discuss what they have learnt and how the concepts occur
 | * (Chigeza, P., 2011).
* (Jarvis, L., & Simonson, D., 2013, July 11).
 | ST2 – 6PWST2 – 12MWST2 – 4WSST2 – 5WT | EN2 – 2AEN2 – 1AEN2 – 4AEN2 – 5AHT2 – 3 |
| **Elaborate** Activities allow students to apply concepts in contexts, and build on or extend understanding and skill. | **Lesson 9: Heat and Fire – Traditional Methods** * Students will be lead into a discussion recapping their new knowledge regarding conduction and convection as well as Aboriginal and Torres Strait Islander (ATSI) methods of using these processes.
* Students will be asked to use their iPad’s to use the website <http://lrrpublic.cli.det.nsw.edu.au/lrrSecure/Sites/Web/iplan/physics/documents/43920_12_04_P4.pdf>
* Students will be researching how ATSI peoples have used heat and their methods of heating traditionally.
* The teacher will ask students to rub their hands together at a slow pace. The students will then document in their journals what is happening.
* The teacher will then ask students to rub their hands together at a fast pace. The students will then document what is happening.
* Once students have documented what is happening, they will pair off and one of the pair will collect a stopwatch.
* Students will then repeat this activity but time each other and document how long it takes for their hands to get hot.
* Students will then be asked to make sure all results are documented so this can be used in drawing a graph.
* Students will then draw a graph on their findings.
* After their graph is completed, students will then proceed to their groups where they will make their own fire triangle using materials found around the school.
* These include sticks, dried grass and rubbing these sticks together.
* Using the website, students will prepare the fire triangle.
* Students will use their journal to reflect upon their challenges, successes and frustrations whilst completing this activity.
* Students need to be invited by the teacher to conduct and interpret their own science investigation with their peers, (Brickhouse, N. W., 1990, Cronin-Jones, L., 1991, Femstermacher, G. D., 1994, Pajarer, M. F., 1992). In this lesson students input, beliefs and understanding are valid and should be used as a springboard.
 | (Board of Studies, New South Wales, *2003).* |  | MA2 – 1WMMA2 – 18SPEN2 – 2AEN2 – 1AEN2 – 4AEN2 – 5AHT2 – 3 |
| **Evaluation** Students assess their knowledge, skills and abilities. Activities permit evaluation of student development and lesson effectiveness. | **Lesson 10: Evaluation** * Ask the students to define or give examples of heat transfer by means of conduction and convection.
* Teacher will revisit the question they asked in lesson one; the teacher will pose a series of open ended questions such as “what would you do to keep warm in Antarctica”, “How would you keep cool in the desert?” “Imagine that you are an Indigenous Aboriginal 300 years ago (without electricity), how would you survive facing the elements of heat and cold?”
* Students are invited to write a critical and reflective journal entry about how they would use conductors and convectors both in traditional and contemporary times
* Students will assess their knowledge by engaging in an online quiz. The quiz allows students to review their answers and receive feedback of them. This feedback is immediate
* Students watch a clip to re-develop their understanding by learning the song
* This acts as a summative assessment
* Students critically reflect on their own sample work from the photographs taken from the iPad in previous convection lessons. In addition, students will incorporate the knowledge they took from the lesson on comparisons of convection and conduction. This will therefore, act as a summative assessment for the whole unit.
* Students add to the TWLH chart by stating how they know the new information they have taught
 | (WebQuest, n.d.)(ParrMr., 2011, August 23). | ST2 – 6PWST2 – 12MWST2 – 4WSST2 – 5WT | EN2 – 2AEN2 – 1AEN2 – 4AEN2 – 5AHT2 – 3 |

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