YEARS 11&12

PHYSICAL SCIENCES - FOUNDATION

TEACHING & LEARNING SUPPLEMENT

INDEPENDENT SCHOOLS TASMANIA
TASMANIAN CATHOLIC education office
Tasmanian Government

Teaching and Learning Supplement

PHYSICAL SCIENCES – FOUNDATION (PSC215118)

ADVICE FOR TEACHERS

This document helps to describe the nature and sequence of teaching and learning necessary for learners to demonstrate achievement of course outcomes.

It suggests appropriate learning activities to enable learners to develop the knowledge and skills identified in the course outcome statements.

Tasks should provide a variety and the mix of tasks should reflect the fact that different types of tasks suit different knowledge and skills, and different learning styles. Tasks do not have to be lengthy to make a decision about learner demonstration of achievement of an outcome.

COURSE SPECIFIC ADVICE

This *Physical Sciences – Foundation*, Level 2 Teaching and Learning Supplement must be read in conjunction with the *Physical Sciences – Foundation*, Level 2 course document and relevant External Assessment Specifications and Examination Guidelines.

It contains advice to assist teachers delivering the course and can be modified as required. This Teaching and Learning Supplement is designed to support teachers new to or returning to teaching this course. The practical component of this course may include off campus experiences.

For the content areas of *Physical Sciences*, three interrelated strands - *Science Inquiry Skills; Science as a Human Endeavour;* and *Science Understanding* will be integrated into all sections of study.

Science Inquiry Skills are common to all TASC science courses and are contextualised for each discipline.

Practical investigation, interpretation of data and reflecting on experimental design are used as a means of teaching and consolidating the course content as well as a means of assessment.

The application and impact of physical sciences in society is also an integral part of the course.

COURSE CONTENT

Specific teaching advice is given in this supplement about of the following criteria:

	Content or process for criterion	**Sequence**
Criterion 2	undertake, interpret and review physical sciences experiments	For use throughout the course in conjunction with criteria 5 to 8
Criterion 4	describe the application and impact of physical sciences on society	
Criterion 5	describe and utilise concepts of chemical structure and properties	Content can be delivered in any particular order
Criterion 6	describe and utilise physics concepts	

	Content or process for criterion	Sequence
Criterion 7	describe and interpret chemical behaviour and data related to chemistry	Content can be delivered in any particular order
Criterion 8	describe and interpret data related to physics	

Physical Sciences - Foundation has a complexity of TASC level 2 and a design time of 150 hours. Content is divided into five sections; relating directly to Criteria 5 to 8, respectively, in the course. The order of delivery of the content is not prescribed. Each of the five content sections is compulsory and learners must participate in a minimum of 40 hours of practical activities. Learning activities for Criteria 2 and 4 should be related to and support one or more of the four content areas.

TEACHING AND LEARNING ACTIVITIES

Undertake, interpret and review physical sciences experiments

Criterion 2 ***Examples of learning activities***

Learners:

investigate how the energy received by a solar cell is related to its orientation

determine how different materials affect air resistance

maximise the efficiency of a model car powered by an elastic air-filled balloon as an energy source

test what factors affect the motion of a golf ball rolling down an inclined plane

find out whether more expensive tennis balls bounce higher

determine the relationship between the pressure of the air inside a soccer ball/ basketball and its bounce and distance it travels

find out whether there is a quantitative relationship between the buoyancy of an object in water and the number of bubbles in the water

investigate which types of bubble wrap provide the most protection against breaking forces

investigate the forces of motion in the context of a balloon or a parachute

find out whether the pH of sea water is affected in the same way as the pH of fresh water when acidic or basic substances are added to them?

test and explain the conductivities of different liquids when salts, acids, or bases are added

explore how different types of shells/polymers/metals affected by different pH conditions

investigate pH of different household substances using a range of measurements (pH probes, indicators, titration, litmus paper)

design and perform experiments to further investigate the properties of vitamins, for example:

- which cooking methods preserve the most Vitamin C in carrots?

- comparing Vitamin C levels in different foods
- is Vitamin C broken-down by UV light?
- when is the Vitamin C content of fruit at its peak?

Detailed example

What factors affect the motion of a golf ball rolling down an inclined plane?

Introduction

Key knowledge of Newton's laws of motion lends itself particularly well to the design of an experiment. Learners may be familiar with the use of relevant equipment and the concepts are accessible for learner independent practical design. One aim of the task may be to hone experimental skills in readiness for the Practical Investigation.

Method

- The teacher rolls a golf ball down an inclined plane at various angles and demonstrates various methods for measuring time versus angle and/or time versus distance.
- The teacher demonstrates the use of a light gate at the bottom of the ramp to measure final velocity.
- Learners verify that as the angle increases so too does the velocity.
- Different brands and types of golf balls are then compared and learners are posed the question, 'Why don't all golf balls behave the same way?'
- Learners are provided with a range of different brands and types of golf balls and are guided in choosing a particular variable to change. Factors that may be investigated include: golf ball construction (2-piece, 3-piece, 4-piece); hardness (long, soft, very soft etc.); dimples.
- Data is collected, recorded and collated for the class.
- Learners analyse and draw conclusions, identifying how variables were controlled, and errors and uncertainties in measurements, and including appropriate graphical representations, validity of conclusions and ways of improving the experimental designs that were used.

Further examples that can be assessed using criterion are below in the Criteria 5 to 8 advice.

Describe the application and impact of physical sciences on society

Criterion 4 ***Examples of learning activities***

Learners:

design, set up and test a 'speed trap' to determine whether cyclists are exceeding 20 km/h at a particular location, including specifying the limitations of your detection system

research how has biomimicry been used to develop different materials? What biomimicry research is currently happening?

discuss would you allow a nuclear reactor to be built in your local area?

write a media article or produce an infographic on a useful isotope study are sunscreens containing nanoparticles safe? What precautions should be taken in working with nanomaterials?

devise an inquiry to test the statement that ‘if you are sinking in soft mud, you should not move vigorously to try to get out’

discuss is it worth spending public funding on space research?

research the constitution of available fuel blends (for example, E10) for motorists and summarise the advantages and disadvantages of using 100% petrol versus a mixture of petrol and other fuels

dismantle old electrical appliances (from which all cords and plugs have been removed) and explain the workings

research why crude oil reserves around the world have different hydrocarbon compositions; identify uses for crude oil fractions; justify whether oil reserves around the world can be ranked in terms of usefulness

harnessing nuclear power – should Tasmania go nuclear?

investigate the chemistry of fireworks. Examine how metals create colour

the science of sherbet: how do we you get the best fizz for your buck?

tidal power for the Derwent River: would it work? Is it really green?

antacids: what makes them work and why are they good?

Detailed example

Investigation of electrical appliances

A range of old domestic electrical appliances can easily be obtained by an appeal to the school community. Items such as toasters, hair dryers, irons and heaters are suitable. For safety reasons it is important to remove any cords and plugs.

The appliances can be prepared so that it is not too difficult for the learners to dismantle them. The learners draw a circuit diagram of the wiring in the appliance. Where necessary, help to identify components such as thermostats and safety cut-outs.

Switches will often be found that combine elements in different series and parallel combinations to alter the power settings. In the case of heating elements, the resistance can be determined and from that an estimate made of the power used in the appliance. This can be compared with the rating on the appliance. Where electric motors are involved, the resistance will not give a good indication. The reasons for this can be discussed with learners.

Ensure that any appliances examined are not reassembled for use.

Learners can document their findings using annotated photos and then be given a further intact appliance to:

- predict what is inside
- dismantle and investigate
- compare their predictions with what they found

Describe and utilise concepts of chemical structure and properties

Criterion 5 ***Examples of learning activities***

Learners:

predict the valence electron structure for the first 20 elements

create a poster for a given element

conduct an introductory experiment to demonstrate the variety of ways elements and compounds can react; write precise observations using appropriate chemical vocabulary; reflect on observations by classifying them on the basis of involvement of the five senses (sight, smell, touch, taste, hearing)

perform simple displacement reactions to deduce an activity series of metals, including group 1 as a demonstration

compare the degree of solubility of a range of ionic salts and molecular substances in water.

compare the physical properties of metals, for example malleability, hardness, electrical conductivity, heat conductivity, and density

examine metallic crystals under a stereomicroscope

extract copper by heating malachite and carbon

discuss the significance of size and surface area in the application of nanoparticles

demonstrate the allotropes of sulfur, for example www.nuffieldfoundation.org/practical-chemistry/allotropes-sulfur

model the properties of alloys using plasticine and sand, for example www.nuffieldfoundation.org/practical-chemistry/modelling-alloys-plasticine

investigate experimentally the effects of annealing, quenching, and tempering on metals using metal pins or nails; determine which type of heat treatment results in the hardest and/or the strongest metal

capture an image of a local environment inside or outside the classroom; print the images and label all physical objects, or parts of objects, as ‘organic’ or ‘inorganic’; later, re-visit the labelled images and re-label objects as required

use cut out cardboard cations and anions formulae of ionic compounds

create and annotate a series of images to explain:

- why evaporation of water requires more energy than evaporation of methane, despite both molecules having similar molecular masses
- how the process of dissolving in water a crystal of salt differs from dissolving a crystal of sugar

investigate and explain why when a layer of hot salt solution lies above a layer of cold water, the interface between the two layers becomes unstable and a structure resembling fingers develops in the fluid

undertake an internet search or invite a guest expert to outline contemporary research into metallic nanomaterials

use non-spherical particles such as rice, matches or lollies to determine the relationship between the shape of the particle and the fraction of space that it occupies; investigate how characteristics such as coordination number, orientation order or the random close packing fraction depend on different parameters

individually create ball-and-stick models of simple polyatomic molecules of different shapes, for example H_2, F_2, Cl_2, O_2, HCl, HF, H_2O, H_2S, NH_3, CH_4, CO_2 or BF_3; sketch them using appropriate chemical conventions to indicate their three-dimensional shape; bring together the different molecular models to show the alignments of the molecules and annotate them to show the operation of the intermolecular bonding forces

predict and research the formulae for a compound that may include C and F, or Na and Cl. What type of bonding occurs in each and why? How does this manifest itself in the properties of each compound?

Detailed example

Simulation of crystal formation in rocks using chocolate fudge

Background

Why do some rocks that are made of the same minerals have different sized crystals in them? What effect will faster versus slower cooling have on the formation of crystals?

The inside of Earth is hot enough to melt rocks. Both magma and lava are forms of hot, molten rock, with the main difference being where they are located. Magma is deep underground in chambers beneath volcanoes while lava is the molten material that is expelled from volcanoes when they erupt. When magma and lava cool and solidify, igneous rock forms. Igneous rocks contain randomly arranged interlocking crystals. The size of the crystals depends on how quickly the molten magma and lava solidify. Magmas, retained deep within the Earth, cool very slowly over tens of thousands of years to produce plutonic rocks such as granite and gabbro. The more slowly the magma cools, the larger the crystals. Lavas, erupted at Earth's surface, cool quickly to form volcanic rocks such as basalt and obsidian. These rocks are smoother and contain much smaller crystals that may not be visible even with the use of a hand lens.

In this activity, learners simulate the process of igneous rock formation by making chocolate fudge and compare fudge textures of samples that are cooled quickly with those that are cooled slowly.

General procedure

- obtain a recipe for fudge and organise to make the fudge, up to the point where the fudge is to be cooled
- divide the cooked fudge mix into two batches. Spoon equal quantities of each fudge mix into two separate greased cake tins of the same size so that the fudge mix in each tray is at least 2 cm thick
- place one cake tin into the refrigerator, and leave the other cake tin out at room temperature

- when both fudge mixes have cooled completely, cut each fudge block into 2 cm blocks
- organic Chemistry: Polymerisation of Nylon/formation of rubber balls use of fold out paper dolls to demonstrate monomers/polymers
- study of hydrocarbons as fuel, cracking, availability vs demand, physical props of various alkane length, theory of combustion.
- test the constituency of each of the two types of cooled fudge blocks:
  - observe each type of fudge block carefully; note any similarities and/or differences in a table, for example, differences in texture or colour
  - observe each type of fudge block using a hand lens; slice thinly and observe under a stereomicroscope; note any similarities and/or differences in a table, for example, differences in texture or colour

Taste each type of fudge block; note any similarities and/or differences in a table, for example, differences in flavour or texture.

Questions

Learners could respond to a series of graded questions, for example:

- explain: how does the nature of the cooling process for the fudge mimic the environmental conditions involved in rock formation?
- design: design a controlled experiment to further investigate into other factors that may affect crystal formation.
- apply: model how some igneous rocks may have a glassy appearance in terms of their formation.
- model: use a molecular modelling kit or an animation program to demonstrate why slower cooling rates encourage formation of an ordered, crystal structure while faster cooling rates lead to less orderly crystal structures.
- propose: suggest why, unlike sedimentary rocks, igneous rocks do not contain fossils.

Describe and utilise physics concepts

Criterion 6 ***Examples of learning activities***

Learners:

capture photos or images of a rapidly occurring physics phenomenon related to motion; use the images and add text to produce a photo essay or infographic of the phenomenon

view Veritasium videos about motion to initiate ideas for further investigation, for example, slow motion analysis of a falling slinky spring www.youtube.com/watch?v=uiyMuHuCFo4

undertake practical investigations and simulations related to forces and motion such as those at www.nuffieldfoundation.org/practical-physics/forces-and-motion

use data logger to test the effect of mass on acceleration. Ie: heavy vs light objects falling acceleration

the moving man simulation: https://phet.colorado.edu/en/simulation/moving-man drop a piece of chocolate into a glass of soda water and observe it periodically sink and rise to the surface; investigate the factors that affect these oscillations

use slow-mo video on phone to capture movement of golf balls sitting on moving trolleys, simulating rear end collision.

research the issue of nuclear reactor 'melt down'; What is a melt down and why is it such a danger? What sort of precautions can be taken to avoid melt down problems? What was the reason for melt down in a particular nuclear accident that happened in the past? Is there a way to make a nuclear reactor 'fail-safe', and are any such reactors operating?

design and make a device, using one sheet of A4 paper and a small amount of glue, that will take the longest possible time to fall to the ground from a height of 2 metres; collate class results and identify the three most important factors that affect flight 'hang' time

use photographs to analyse and compare the strategies used to reduce the drag area of various vehicles in order to improve fuel efficiency

investigate and explain the conditions under which a golf ball is putted into a hole and then pops back out of the hole

explain why the idea that, for an amusement park ride, 'the thrill is linked to speed' is a misconception

make a model of a fuse; explain how a fuse helps to prevent a fire caused by faulty household electricity wiring

use a predict-observe-explain approach to investigate what happens when a

- small vial full of ice water with red dye is gently poured into a large beaker of hot water; and when
- a small vial full of hot water with blue dye is gently poured into a large beaker of cold water

investigate factors that affect the drying of cutlery and crockery pieces

consider how heat/temperature is transferred with an experiment (like so: https://www.youtube.com/watch?v=vqDbMEdLiCs)

Detailed example

Newton's Second Law investigation

Introduction

How does a cart change its motion when you push and pull on it? You might think that the harder you push on a cart, the faster it goes. Is the cart's velocity related to the force you apply? Or, is the force related to something else? Also, what does the mass of the cart have to do with how the motion changes? We know that it takes a much harder push to get a heavy cart moving than a lighter one.

Learners will investigate the relationship between force and acceleration for a trolley rolling down an incline.

- learners can measure the force using a spring balance.
- learners can vary force by varying the angle of the incline.

- learners can measure the acceleration using Logger Pro and an accelerometer

Planning and conducting the experiemnt

Learners need to:

- pose a hypothesis
- give reasons for their hypothesis
- nominate their controls dependant and independent variables
- plan and record the procedure for the experiment
- perform a risk analysis and take appropriate safety measures
- prepare to record results and create appropriate table(s) to communicate these
- conduct the experiment
- record qualitative observations and any issues encountered

Writing the report

Learners need to:

- record their results clearly; all graphs and tables should:
  - be clear and simple
  - be well set out and illustrate the important points
  - show the units measured
  - have a heading or title that describes what the graph or table is showing the independent variable goes on the X axis and the dependent variable goes on the Y axis.
- address the following questions in their discussion:
  - what happened during your investigation?
  - are there any patterns, trends or relationships evident from your tables and graphs?
  - what do the results tell you about the original question?
  - do your results support your hypothesis? Give reasons
  - do your results support Newtons 2nd Law? Give reasons
  - did you have any unexpected results? Why do you think these occurred?
  - are your results reliable? Give reasons.
  - using scientific language, what is your explanation of the results?
  - what improvements might you make to your experimental design?
- write a brief conclusion for their investigation:
  - restating the hypothesis and indicating if the hypothesis was supported
  - only summarising what has been stated above
  - state and evaluate the significant and general outcomes of the investigation.
- include acknowledgements and a bibliography

Describe and interpret chemical behaviour and data related to chemistry

Criterion 7 ***Examples of learning activities***

Learners:

illustrate Dalton's theory that atoms are rearranged in chemical reactions by carrying out a series of experiments whereby a sample of copper metal is reacted to form a series of copper compounds and then extracted as the metal determine experimentally the percentage composition and empirical formula of an ionic compound, for example magnesium oxide or copper(II) oxide

create a classroom display of one mole of different substances (learners weigh out the different substances after calculating the mass required)

reactions of acids and metals/carbonates/bases- predicting products and testing products for confirmation

reactions of metals - predicting whether reaction will occur based on reactivity series

explain why acids should be added to water, rather than adding water to acids, when diluting acids or when undertaking acid-base experiments

investigate the Law of Conservation of Mass by tracking mass changes occurring during chemical reactions in closed systems

introduce stoichiometry including balancing equations

perform simple titrations

find the concentration of oxygen in water samples using water testing kits

practice the use of volumetric equipment and discuss their accuracy

solve quantitative exercises involving the mole and Avogadro's constant

solve quantitative exercises involving empirical and molecular formulas of compounds

identify cation and anion in solution and write the formula using a flowchart such as: https://www.nobraintoosmall.co.nz/students/chemistry/NCEA_Level2/pdfs/che_91162_analysis.pdf

Detailed example

How does water quality differ at various points along a river?

The following questions require consideration:

- What input will learners have into the selection of the investigation question?
- Will different groups of learners in the class be able to undertake different investigations?
- To what extent will all learners consider the same investigation question, or complete different parts to the same question so that class data can be collated?
- What input will learners have into the design of the experiment?
- Will off-school site work be involved?

Teachers could provide learners with a template that structures the investigation into a series of timed phases. The template may subsequently be adapted by learners as a personal work plan.

Topic selection phase

During a class discussion, following learner measuring the pH and total dissolved solids of river water samples, learners discuss the different environmental conditions at various points in the river, such as shaded or exposed sites, and treed versus cleared areas. From this discussion learners can formulate a number of research questions for investigation, based on a general question: How does water quality differ at various points along a river?

- What chemical categories of rubbish are dumped into the river and how is water quality affected?
- How do recreational activities such as swimming and fishing affect water quality?
- Does exposure to sunlight affect the pH of water?
- Does exposure to sunlight affect the solubility of salts in water?
- Do overhanging trees change the chemical composition of the water?
- Is the proportion of chemicals in faster-running parts of the river different from the proportion of chemicals in slower-running parts of the river?
- Is the proportion of chemicals in deeper parts of the river different from the proportion of chemicals in shallower parts of the river?

Planning phase

Learners may need guidance in:

- formulating a testable hypothesis
- fitting the investigation into the time available, and developing a work plan
- identifying the technical skills involved in the investigation, and
- ensuring that resources are available that meet the requirements of the investigation.

Teachers should work with learners to:

- determine to what extent learners will work independently or in groups in undertaking the experiment (for example, different learners or groups may investigate different aspects of river quality; all learners may investigate a selected question and work at different sites along the river to collect and collate data; a limited number of questions may be self-selected for investigation by learners)
- discuss the independent, dependent and controlled variables in proposed experiments
- determine the types of quantitative experiments that will be performed, for example titrations, solubility tests, instrumental analysis
- identify safety aspects associated with undertaking experiments in the field and in the laboratory, and in working with chemicals and apparatus
- establish the use of physical units of measurement and standard notation
- determine the nature of the communication: Who would be interested in the results of learners' investigations? What would be the most effective way to communicate results to an interested audience?

Investigation phase

Learner-designed methodologies must be approved by the teacher prior to learners undertaking practical investigations. A possible schedule for management of the multiple investigations in the class is as follows:

- each learner undertakes internet research to find background information related to the general topic for investigation
- learners work individually or in groups to confirm a research question, formulate a hypothesis and propose a research methodology, including management of relevant safety and health issues

- teacher approval for the methodology is granted prior to learners undertaking the investigation
- time is allocated for water sample collection in the field
- if required, time is allocated to access equipment/instrumentation out-of-school
- learners perform investigations, record and analyse results and prepare final presentation of their findings using an agreed report format.

Reporting phase

Learners consider the data collected, report on any errors or problems encountered, and use evidence to explain and answer the investigation question. Other avenues for further investigation may be developed following evaluation of their experimental design and quality of data.

Learners may work individually or in groups.

The report of the investigation can take various forms including a written report, a scientific poster or a multimedia or oral presentation of the investigation.

Describe and interpret data related to physics

Criterion 8 ***Examples of learning activities***

Experimental design

Learners:

investigate practically the flight of water powered rockets and evaluate the factors that influence the performance of the rocket

use photographs to analyse and compare the strategies used to reduce the drag area of various vehicles in order to improve fuel efficiency (record video, slow motion playback with time frames)

use a fan and a model wind turbine to investigate the relationship between airspeed and electricity generated

suggest a method to measure the speed of:

- an electric train midway between two stations
- a bus in which you are going, if there are no reliable distance signs on the route

design and undertake experiments, including writing a hypothesis, to investigate the following research questions:

- is copper the best conductor of electricity?
- are heat and electrical conductivity related?
- does electricity move faster through thin or thick wires?

investigate whether two identical open glasses, filled with hot and warm water respectively, can cool at room temperature check whether the glass filled with hot water reaches a lower temperature than the glass filled with warm water; explain your results

design and undertake practical explorations of change of temperature and change of state with a focus on the development of practical skills including: observation; recording of qualitative and quantitative data; graphical analysis; and consideration of accuracy, precision and reliability use a temperature probe to monitor the phase change of wax cooling or crushed ice warming

construct and explain the operation of a Galilean thermometer

investigate the claims that:

- it is important to put a lid on the pot when you want to boil water for tea to save energy and time; determine any energy and time savings
- to cool a pot effectively, ice should be placed above it rather than under it

investigate the rate that an ice cube melts when placed on different types of blocks, for example foam, rubber, wood and metal

design and investigate the effects of different types of earth surfaces (for example, ice, grass, concrete, sand, water) on energy reflection or absorption; relate findings to land use and its effects on atmospheric energy

investigate how concepts of conduction, convection, radiation, specific heat capacity and latent heat capacity are used to determine the energy rating of appliance and features of homes, for example insulation, glazing (type and size), choice of lighting, floor covering, window covering, and appliances

Detailed example

Stopping at all thermodynamic stations

Aim

To explore the thermodynamic concepts of conduction, convection and radiation and to relate these concepts to applications involving different methods for heating and cooling homes.

Preparation

Teachers should organise an appropriate number of stations. Stations could include:

- **Scientific observation and measurement**: put a piece of ice into a small glass filled with vegetable oil; qualitatively and quantitatively analyse its motion.
- **Thermal effects**: compare the effects of placing potassium permanganate crystals in a beaker of hot water and a beaker of cold water.
- **Comparison of temperature above and beside a candle**: using a cardboard tube, place it vertically above the candle and then place it horizontally adjacent to the flame; find the temperature of the air at the furthest end of the tube in each instance.
- **Convection and flight**: make a hollow cylindrical tube from an empty, dry tea bag; explain the factors that affect the cylinder's take off when the top end of the cylinder is lit.
- **Convection currents in air**: place whirly gigs over a heat source.

- **Convection currents in water**: half fill a beaker with cold water; using a spatula, gently drop a few crystals of potassium permanganate down one side of the beaker; use a Bunsen burner to heat the base of the beaker where the crystals had fallen.
- **Effect of colour**: take readings of temperatures of thermometers that are painted different colours and placed in a sunny spot in the laboratory or outdoors.
- **Movement of heat**: heat different types of metal rods and compare how long it takes for the heat to reach the end of the rod; affix corks with wax along the length of the rod to assist in measuring time.
- **Temperature gradient in warm water**: place a temperature probe into some warm water; gently pour some hot water to the top of the warm water; leave for a minute. Slowly remove the temperature probe and watch the temperature gradient as the probe is removed.
- **Conduction in metal**: time how long it takes the temperature at the end of a metal rod to increase when held in a flame and compare with rods made of different metals; use wax to attach corks at 10 cm intervals along the rods to monitor the progress of heat conduction.

Health and safety notes

Safety data sheets for chemicals (for example, potassium permanganate) used must be distributed to learners.

Learners must be reminded of safe use of heating apparatus.

Science skills

Teachers should identify and inform learners of the relevant key science skills embedded in the task.

Method

Learners should work through the activity at each station and record results. Data may include descriptive observations, temperature readings, photographs and labelled sketches.

Discussion

Learners could set up a table to show how the results of each station activity relate to different household methods for cooling and heating.