 Energy efficient houses

Stage 4 Physical World

Outcomes

Values and attitudes

SC4-1VA appreciates the importance of science in their lives and the role of scientific inquiry in increasing understanding of the world around them

Working scientifically

SC4-4WS identifies questions and problems that can be tested or researched and makes predictions based on scientific knowledge

* WS4 Students question and predict by:

b. making predictions based on scientific knowledge and their own observations (ACSIS124, ACSIS139)

SC4-5WS collaboratively and individually produces a plan to investigate questions and problems

* WS5.1 Students identify data to be collected in an investigation by:

a. identifying the purpose of an investigation

* WS5.2 Students plan first-hand investigations by:

a. collaboratively and individually planning a range of investigation types, including fieldwork, experiments, surveys and research (ACSIS125, ACSIS140)

c. identifying in fair tests, variables to be controlled (held constant), measured and changed

* WS5.3 Students choose equipment or resources for an investigation by:

b. selecting equipment to collect data with accuracy appropriate to the task (ACSIS126, ACSIS141)

SC4-6WS follows a sequence of instructions to safely undertake a range of investigation types, collaboratively and individually

* WS6 Students conduct investigations by:

e. recording observations and measurements accurately, using appropriate units for physical quantities

SC4-7WS processes and analyses data from a first-hand investigation and secondary sources to identify trends, patterns and relationships, and draw conclusions

* WS7.1 Students process data and information by:

a. summarising data from students' own investigations and secondary sources (ACSIS130, ACSIS145)

e. applying simple numerical procedures, e.g. calculating means when processing data and information, as appropriate

* WS7.2 Students analyse data and information by:

c. identifying data which supports or discounts a question being investigated or a proposed solution to a problem

d. using scientific understanding to identify relationships and draw conclusions based on students' data or secondary sources (ACSIS130, ACSIS145)

SC4-8WS selects and uses appropriate strategies, understanding and skills to produce creative and plausible solutions to identified problems

* WS8 Students solve problems by:

d. using cause and effect relationships to explain ideas and findings

SC4-9WS presents science ideas, findings and information to a given audience using appropriate scientific language, text types and representations

* WS9 Students communicate by:

a. presenting ideas, findings and solutions to problems using scientific language and representations using digital technologies as appropriate (ACSIS133, ACSIS148)

b. using appropriate text types in presentations, including a discussion, explanation, exposition, procedure and recount

d. constructing and using a range of representations to honestly, clearly and/or succinctly present data and information including diagrams, keys, models, tables, drawings, images, flowcharts, spreadsheets and databases

e. constructing and using the appropriate type of graph (histogram, column, sector or line graph) to express relationships clearly and succinctly, employing digital technologies as appropriate

Knowledge and understanding

SC4-11PW discusses how scientific understanding and technological developments have contributed to finding solutions to problems involving energy transfers and transformations

PW3 Energy appears in different forms including movement (kinetic energy), heat and potential energy, and causes change within systems. (ACSSU155)

* a. identify objects that possess energy because of their motion (kinetic) or because of other properties (potential)
* e. investigate some everyday energy transformations that cause change within systems, including motion, electricity, heat, sound and light

PW4 Science and technology contribute to finding solutions to a range of contemporary issues; these solutions may impact on other areas of society and involve ethical considerations. (ACSHE120, ACSHE135)

Students:

* a. identify that most energy conversions are inefficient and lead to the production of heat energy, e.g. in light bulbs
* b. research ways in which scientific knowledge and technological developments have led to finding a solution to a contemporary issue, e.g. improvements in devices to increase the efficiency of energy transfers or conversions
* c. discuss the implications for society and the environment of some solutions to increase the efficiency of energy conversions by reducing the production of heat energy

Learning across the curriculum

Cross-curriculum priorities

Aboriginal and Torres Strait Islander histories and cultures

Asia and Australia's engagement with Asia

Sustainability

General capabilities

Critical and creative thinking

Ethical understanding

Information and communication technology capability

Intercultural understanding

Literacy

Numeracy

Personal and social capability

Other areas of learning

Civics and citizenship

Difference and diversity

Work and enterprise

Teacher notes

This task could involve a build component and therefore could be delivered as a cross-faculty STEM task, with TAS coordinating the design and build, and Mathematics extending the work done with data and analysing. IT is intended to be a project based assessment task. Students will develop an appreciation for engaging in background research and using knowledge to explain observations in this task.

Teachers can assign time to each section as this task can be performed entirely within class time or given time to complete at home, such as the initial research component. As a cross-faculty project the different faculties could coordinate their components.

The marking rubric breaks the assessment into three sections:

* Investigating
* Processing
* Problem solving

The intent of this is to mark the assessment holistically as opposed to breaking down each section into individual components. As the intention is for students to engage in research and investigation, students can receive an overall grade or mark for their efforts by showing achievement levels. The marking criteria attempts to link Working Scientifically content to achievement and can be extended.

Introduction

Australians use energy to heat and cool their houses throughout their year. An efficient house stops heat escaping during winter, and stops heat entering during the summer, reducing the overall amount of energy needed to heat and cool. In this assignment you will explore features of houses that make them efficient.

Task

This task is intended to be completed in three stages, each requiring submission of your student work.

Sections 1 and 2, including scaffolds, should be collated in your logbook. Section 3 is a scientific investigation report and will be completed in class as an assessment.

Section 1: Initial research

In this activity you will begin by researching information about methods of keeping a house cool.

The purpose of this research is to gain knowledge and understanding of the different ways to make houses more energy efficient. By developing our understanding, we can come up with a scientific question to test.

All sources of information used for your research should be clearly referenced in a bibliography.

Section 2: Investigation plan

Using your research, you will identify the variable you will test and plan an investigation. Remember, you should only change one variable. You will brainstorm variables that could relate to

Some examples of variables to investigate:

* Insulation
* Window size
* Wall thickness
* Veranda overhang

At school you will be able to use measuring equipment such as thermometers and a heat source. Two periods will be available to perform testing and gathering of data. You will need to be ready to test your question on the date discussed by your teacher.

Throughout this process, you should keep a logbook containing the following:

* All of the sheets handed out for this task
* A diary of what you did and when (electronic or handwritten)
* Your draft plan and final plan with reasons for changes, including all rough working and plans for your house
* Final results (collected in class)

Section 3: Investigation report (written in class)

The investigation report will be written up individually and should contain the following headings:

* Scientifically Testable Question – the question you are trying to answer with this investigation
* Prediction – what you think will happen based on your research
* Identified Variables – changed, measured and those kept the same (to ensure a fair test)
* Equipment list – equipment you will use in in your experiment
* Method – a series of steps on how you carried out your experiment including how to use the equipment
* Results – these may be measurements or observations organised into an appropriate table
* Conclusion – a brief statement addressing your testable question
* Discussion – explanation of the results using scientific understanding. You will need to use your knowledge of energy studied in class and from your research to write cause and effect statements.

Scaffold

Individually, complete the table by researching information on the Internet. Explain (using cause-effect statements) how each method works to keep a house warm, cold or both. In your explanation, include your understanding of how heat travels (conduction, convection, radiation) relating to the method.

Ensure that you state the websites used in the bibliography. You may add more lines if needed.

| Method for controlling temperature | Explain how it keeps the house warm | Explain how it keeps the house cold |
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Bibliography

Websites used for this information.

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Based on this research, choose one technique to test its effect on energy efficiency.

Marking guideline/rubric

| Grade/ Mark | Investigating | Processing | Communicating |
| --- | --- | --- | --- |
| A  13-15 | * Makes a prediction which is supported by research. (WS-4B) * Writes a scientific question that involves the variables being tested. (WS-5.1A) * Plans a fair test to collect valid first-hand data. (WS-5.2A,5.2B) * Clearly indicates variables the variables kept the same, the measured variable and the changed variable. (WS-5.2C) * Selects and describes the use of appropriate equipment to accurately perform the experiment. (WS-5.3B) * Records relevant observations and accurate measurements using appropriate units. (WS-6.E) | * Relevant information summarised and presented from identified secondary sources. (WS-7.1A) * Applies simple numerical procedures, e.g. calculating a mean. (WS-7.1E) * Student records all results and identifies data from successful tests to produce conclusions. (WS-7.2C) * Student draws conclusions or relationships based on experimental data * Student explains conclusions or relationships using relevant background information. (WS-7.2D) * Uses clear cause and effect relationships to explain ideas and findings. (WS-8D) | * Presents scientific ideas using appropriate scientific language. (WS-9A) * Presents information as a scientific report using all appropriate headings correctly. (WS-9B) * Selects and accurately presents experimental results in an appropriate form, e.g. diagrams, tables or graphs. (WS-9D,9E) |
| B  10-12 | * Makes a prediction using some scientific knowledge * Writes a scientific question for the investigation including one of the variables. * Clearly indicates some of the variables kept the same, the measured or changed variables. * Selects and describes the use of appropriate equipment. * Records relevant observations or accurate measurements using appropriate units. | * Information about energy efficiency summarised and presented from an identified secondary source. * Student presents relevant data to draw a conclusion which addresses their aim. * Student attempts to explain conclusion using background information. * Attempts to use cause effect relationships to explain ideas | * Presents a scientific report using all appropriate headings. * Selects and accurately presents experimental results, e.g. diagrams, tables or graphs |
| C  7-9 | * Makes a prediction using some scientific or valid general knowledge * Gives a clear purpose for their investigation. * Plans a fair test. * Design an experiment that has a measured variable, a changed variable and at least one variable kept the same. * Selects or describes use of appropriate equipment. * Records observations or measurements. | * Information about energy efficiency presented from an identified secondary source. * Student identifies relevant data to use to draw a conclusion. * Students draw a valid conclusion or relationship based on experimental data. * Attempts to use science or everyday language to explain their ideas or findings. | * Presents ideas using appropriate language. * Presents a scientific report in a legible and fluent manner. * Selects and presents experimental results in a scientific form, e.g. diagrams, tables or graphs. |
| D  4-6 | * Makes a prediction. * A relevant idea for an investigation is presented. * Writes a basic description of the steps followed * Records results | * Draws a conclusion related to their question | * Presents report using a correct format. * Presents results in a structured and logical manner |
| E  1-3 | * Writes a description of an investigation | * Some background information on energy efficiency presented. * Students write an inference related to their experiment. | * Presents basic information. * Presents their investigation. * Presents results in a legible format. |