 Creating a sustainable house

Stage 5 Physical world

Outcomes

Values and attitudes

SC5-1VA appreciates the importance of science in their lives and the role of scientific inquiry in increasing understanding of the world around them.

Working scientifically

SC5-8WS applies scientific understanding and critical thinking skills to suggest possible solutions to identified problems

* WS8 Students solve problems by:

c. applying the processes of Working Scientifically in developing creative solutions to problems

e. using models to explain phenomena and make predictions

SC5-9WS presents science ideas and evidence for a particular purpose and to a specific audience, using appropriate scientific language, conventions and representations

* WS9 Students communicate by:

a. selecting and using in presentations, for different purposes and contexts, appropriate text types including discussions, explanations, expositions, procedures, recounts or reports

b. selecting and constructing an appropriate table, type of diagram, table or graph (histogram or sector, column or line graph) to present information and show relationships clearly and succinctly using digital technologies as appropriate

Knowledge and understanding

SC5-11PW explains how scientific understanding about energy conservation, transfers and transformations is applied in systems

* PW3 Scientific understanding of current electricity has resulted in technological developments designed to improve the efficiency in generation and use of electricity.

Students:

c. compare the characteristics and applications of series and parallel electrical circuits

* PW4Energy conservation in a system can be explained by describing energy transfers and transformations. (ACSSU190)

Students:

b. describe how, in energy transfers and transformations, a variety of processes can occur so that usable energy is reduced and the system is not 100% efficient

c. discuss, using examples, how the values and needs of contemporary society can influence the focus of scientific research in the area of increasing efficiency of the use of electricity by individuals and society (ACSHE228, ACSHE230)

d. discuss viewpoints and choices that need to be considered in making decisions about the use of non-renewable energy resources

Learning across the curriculum

Cross-curriculum priorities

[ ] Aboriginal and Torres Strait Islander histories and cultures 

[ ] Asia and Australia's engagement with Asia 

[x] Sustainability 

General capabilities

[x] Critical and creative thinking 

[x] Ethical understanding 

[ ] Information and communication technology capability 

[ ] Intercultural understanding 

[ ] Literacy 

[ ] Numeracy 

[x] Personal and social capability 

Other areas of learning

[x] Civics and citizenship 

[ ] Difference and diversity 

[ ] Work and enterprise 

Teacher notes

In this task students design and build a functional model of their dream house. The task, including assessment, is set out as an inquiry based model, including brief lesson sequences. As the lessons are inquiry based, teachers serve as facilitators of student learning, including simple directions and facilitated questions. Levels of inquiry should be accommodated to meet individual student needs.

This task introduces an engineering aspect to the Physical World strand and can be heavily incorporated into the assessment task. Engineering requires students to plan, prototype and analyse their findings to continue to come up with solutions to problems. This ties neatly with the Problem Solving strand of Working Scientifically which states students apply the processes of Working Scientifically in developing creative solutions to problems. Students may make circuit diagrams or blueprints of their models to support their build.

The task also allows opportunities to incorporate Mathematics outcomes and skills, including those of ratio, scale and working numerically. STEM opportunities are available.

Teachers may modify the task, including lesson sequences and materials used. A modification may be made to remove the battery source and rely on renewable sources to power the functional house.

Introduction

It is expected that students will have:

* Learnt about the requirements for a circuit
* Had experience drawing and creating simple and parallel circuits, including using resistors
* Used Ohm’s law qualitatively and quantitatively

It is noted that the syllabus states that students describe qualitatively the relationship between voltage, resistance and current (SC5-PW11 PW3 b). Additional content states students explain the relationship between resistance, voltage and current, using Ohm's Law quantitatively.

Inquiry lesson sequence

|  |  |  |  |
| --- | --- | --- | --- |
| Title | Lesson | Deliverable | Time |
| Creating wire diagrams | **Engage and Explore*** Students use circuit diagrams to create a diagram of their house.
 | Students submit diagram to City Planner. | 1 period (60 minutes) |
| Creating prototypes | **Explain and Elaborate*** Students build prototypes of switches to be used in their house (ready-made switches should not be used).
* Students build prototypes of their series and parallel circuits and attempt to power using a voltage source or a form of renewable energy.
 | Student submit prototypes (using electronic images) to City Approver for use in buildings.  | 1 period (60 minutes) |
| Building a functional house | **Evaluate*** Students construct their houses using their approved prototypes.
* Students write a report to discuss the energy efficiency of their constructed model.
 | Students submit buildings for inspection to City Inspector. | 2 periods (120 minutes)2 weeks take-home task |

Task

Your whole class will be building a small city of houses that will be powered by a battery and renewable energy sources.

Your teacher will take on the role of City Planner, City Approver and City Inspector throughout the task.

Your functional house/model must meet the criteria below.

| Category | Criteria |
| --- | --- |
| Size | Your building must be at least 30cm x 30cm |
| Rooms | Your building must have:1. At least 3 rooms
2. A door for each room
3. At least 1 hallway
4. At least one outdoor area (e.g. patio)
 |
| Circuitry | Your building must have the following circuitry:1. At least 1 series circuit, with 2 light globes/LEDs in series
2. At least 2 parallel circuits, with at least 3 light globes/LEDs wired in parallel
3. 1 standalone light globe/LED
4. Switches, at least one for each circuit (no number designated)
5. Resistors (if you are using LEDs it is highly recommended that you use resistors)
6. Wires
 |
| Power | To power your house, you must use the following energy sources:1. A minimum of one solar panel
2. A maximum of one 9V battery
 |

Creating wire diagrams

You must provide a complete circuit diagram of your house. Your diagram may be handed in on paper or electronically. All rooms, including outdoor areas must be included. Your diagram must be labelled correctly and include all electrical components using circuit symbols as studied in class.

The City Planner must approve your schematic before you move on. If it is denied, it will need to be resubmitted with any corrections made.

Creating prototypes

You will have access to small light globes, LEDs and resistors and copper wire.

You will need to prototype the switches you will use in your house. Switches can be made from household items and small stationary supplies, such as tacks, paperclips and hairclips. It is intended that these working switches will be incorporated in your functional house. You must provide a labelled diagram of the switch/switches you wish to use.

The City Approver must approve your switches as working properly before you move on to building your functional house.

Building a functional house

After you have approval from the City Planner and City Approver you may start on building your functional house. Your house must meet the criteria above. Remember to make your model as functional and as realistic as possible e.g. wires not showing, battery source hidden or inconspicuous.

The City Inspector will evaluate your functional model using a checklist.

Checklist

Teachers can amend the checklist below to suit their needs.

|  |  |  |  |
| --- | --- | --- | --- |
| Criteria | Yes | No | Comments |
| The house is at least 30cm x 30cm |[ ] [ ]        |
| 3 rooms accounted for with a door each |[ ] [ ]        |
| 1 hallway |[ ] [ ]        |
| 1 outdoor area |[ ] [ ]        |
| A series circuit, containing 2 lights in series |[ ] [ ]        |
| A parallel circuit, with at least 3 lights in parallel |[ ] [ ]        |
| A parallel circuit, with at least 3 lights in parallel |[ ] [ ]        |
| 1 standalone light, works independently |[ ] [ ]        |
| A working switch for each circuit |[ ] [ ]        |
| Resistors |[ ] [ ]        |
| Wiring is correct  |[ ] [ ]        |
| Solar panel, connected to a circuit or circuits |[ ] [ ]        |
| 9V battery, connected to a circuit or circuits |[ ]  [ ]  |       |
| Additional criteria*
*
*
 | [ ] [ ] [ ]  | [ ] [ ] [ ]  |       |