 EMR spectrum

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

SC5-5WS produces a plan to investigate identified questions, hypotheses or problems, individually and collaboratively

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

a. planning and selecting appropriate investigation methods, including fieldwork and laboratory experimentation, to collect reliable data (ACSIS165, ACSIS199)

b. describing a logical procedure for undertaking a range of investigation types

c. designing controlled experiments to collect valid first-hand data

d. specifying the dependent and independent variables for controlled experiments

e. accounting for the use of an experimental control as appropriate

SC5-7WS processes, analyses and evaluates data from first-hand investigations and secondary sources to develop evidence-based arguments and conclusions

* WS7.1 Students process data and information by:

a. selecting and using a variety of methods to organise data and information including diagrams, tables, models, spreadsheets and databases

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

* WS7.2 Students analyse data and information by:

g. critically analysing the validity of information from secondary sources (ACSIS172, ACSIS206)

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:

e. presenting scientific ideas and information for a particular purpose, including constructing evidence-based arguments and using appropriate scientific language, conventions and representations for specific audiences (ACSIS174, ACSIS208)

Knowledge and understanding

SC5-10PW applies models, theories and laws to explain situations involving energy, force and motion

* PW1 Energy transfer through different mediums can be explained using wave and particle models. (ACSSU182)

Students:

c. describe qualitatively, using the wave model, the features of waves including wavelength, frequency and speed

e. relate the properties of different types of radiation in the electromagnetic spectrum to their uses in everyday life, including communications technology

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

[x] Critical and creative thinking

[ ] Ethical understanding

[x] 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 assessment task focuses on the Working Scientifically strand to engage students in designing their own investigation including posing scientific questions and testing. The assessment task uses UV sensitive beads which can be bought from most scientific supply companies.

This assessment task provides two scaffolds for student to assist for the levels of guided and semi-guided inquiry and suits students of differing abilities. A third scaffold for open inquiry is not included. The marking guidelines attempts to break down each aspect to the Working Scientifically outcomes presented.

Introduction

The electromagnetic spectrum is the range of all types of electromagnetic radiation. One of the most common types of electromagnetic radiation that we come into contact with is ultra-violet (UV) radiation as it is emitted from the sun.

UV sensitive beads are white beads that contain a special pigment that changes colour when exposed to UV radiation. The darker the colour of the beads the more UV radiation being detecting. They will not be affected by incandescent or fluorescent lights and therefore will slowly return back to their white colour once indoors or if UV light isn’t detected.

Task

You will be provided with some UV sensitive beads that will change colour in the light. Your task to design an experiment that demonstrates variation in UV radiation under different conditions.

There are three investigations which correlate to three different levels of inquiry.

1. Guided inquiry: Test the strength of the UV radiation present outside at different times of day over the course of a week.
2. Semi-guided inquiry: Test the ability of different types of clothing, sunscreens or sunglasses to block UV radiation.
3. Open inquiry: Design an investigation which uses UV sensitive beads to test a scientific question.

Whichever investigation type you choose, you must also:

1. Create or source diagrams of the electromagnetic spectrum. Using information gathered from secondary sources identify the particular wavelengths and describe the influence the results will have on the amplitude of the waves.
2. Utilising information from secondary sources, describe the effect of UV radiation on the body. Link this information with the results of your experiment and create a discussion that demonstrates safe practices in relation to sun exposure and UV lighting.

Scaffold 1

Investigation

Title

The amount of UV radiation on UV sensitive beads throughout the day.

Aim

To determine whether the amount of UV radiation changes. .

Equipment

* 25 UV sensitive beads
* Camera or electronic device
* Stopwatch or watch
* cloth or bag
* pen and paper

Hypothesis

The beads will be brightest at because this is when UV radiation is .

Method

1. Keep 5 UV beads in an area that will not be exposed to any sunlight. Take a photo.
2. At a specific time in the morning (write the time on a piece of paper) place 5 UV beads in the cloth or bag, take them outside.
3. Take the beads out of the bag place them on the paper, exposing them to the sun, after 1 minute take a photo ensuring the time written on the piece of paper is clear and bring the beads back inside.
4. Repeat steps 1 - 3 at midday, in the evening and at night time.
5. Repeat this entire experiment for a week.
6. Create a table showing the photos.
7. Identify which are brightest beads over the course of the week.

Results

| Conditions | Day 1 | Day 2 | Day 3 | Day 4 | Day 5 |
| --- | --- | --- | --- | --- | --- |
| No UV exposure |       |       |       |       |       |
| Morning, outside |       |       |       |       |       |
| Midday, outside |       |       |       |       |       |
| Evening, outside |       |       |       |       |       |
| Night, outside |       |       |       |       |       |

Observations

The beads that were in the Sun at were the .

Variables

|  |  |
| --- | --- |
| **Conditions** | **Name** |
| Control (what the test was measured against) |       |
| Controlled variables (what was kept the same) |       |
| Independent variable (what you changed) |       |
| Dependent variable (what changed as a result) |       |

Conclusion

Based on the results obtained

Research

Electromagnetic spectrum

The diagram shows that smaller waves are

Effect of UV on health

UV radiation occurs naturally through . It causes S and eye damage which leads to the development of S C . As the results in the experiment conducted show, UV radiation is strongest around . From what we understand about UV radiation, this means it is best to the outdoors during these times unless wearing proper protection.

Scaffold 2

Investigation

Title

The effect of on the absorption of UV radiation.

Aim

To determine if UV the absorption of UV radiation is hindered by

Equipment

[to be completed]

Hypothesis

As the amount of UV radiation

Method

[to be completed]

Observations

[to be completed]

Variables

|  |  |
| --- | --- |
| Conditions | Name |
| Control (what the test was measured against) |       |
| Controlled variables (what was kept the same) |       |
| Independent variable (what you changed) |       |
| Dependent variable (what changed as a result) |       |

Conclusion

[to be completed]

Research

Electromagnetic spectrum

[to be completed]

Effect of UV on health

[to be completed]

Marking guideline/rubric

|  |  |  |  |
| --- | --- | --- | --- |
| **Grade** | **Planning a first-hand investigation** | **Describes the properties of the electromagnetic spectrum** | **Collects data from secondary sources and experiments to draw conclusions** |
| Skills content | * SC5-5WS WS5.2a-e
 | * SC5-10PW PW1c
* SC5-7WS WS7.1a
 | * SC5-10PW PW1e
* SC5-7WS WS7.1e
* SC5-7WS WS7.2g
* SC5-9WS WS9e
 |
| A | Neatly plans a controlled investigation with a clearly stated aim, equipment list, testable hypothesis and sequenced method. Experiment reliably tests the ability of substances or structures to block UV radiation from being exposed to the beads, tested against an appropriate control with correctly identified independent, dependent and controlled variables. Ensures appropriate repetition to collect reliable data.  | Creates a diagram for each of the independent variables tested showing the change in wavelength over the electromagnetic spectrum and explains how the wave is being affected, making accurate reference to the amplitude and the UV spectrum in the explanation | Data is neatly presented in a table and a valid conclusion that is linked to the hypothesis is drawn. Develops a thorough discussion (500 words) making clear links between the data collected in the experiment and the information from secondary sources to give insight into the effect of UV radiation on the body as well as the safety measures required when being exposed to UV radiation (Sunlight, UV light). Task is carried out with at least 3 references. |
| B | Creates a controlled experiment stating the aim hypothesis and sequenced method to test the ability of substances or structures to block UV radiation being exposed to the beads, correctly identified independent and dependent variables with some repetition of data. | Creates a diagram for each of the independent variables tested, showing the change in wavelength over the electromagnetic spectrum as well as a demonstrating a change in amplitude with a brief explanation.  | Data is presented in a table. Draws a valid conclusion. And develops a strong discussion that makes links between the data collected in the experiment and information from secondary sources to give insight into the effect of UV radiation on the body and provides some understanding of safe sun practices. Task is carried out with at least 2 references |
| C | Plans and creates an experiment to test the ability of substances or structures to block UV radiation being exposed to the beads identify the aim, method, and control that the independent/dependent variables are being tested against | Draws a two diagrams comparing what the amplitude of the waves of the UV spectrum would look like under the independent variables  | Draws a conclusion based on the collection and presentation of data in a table (preferably with photographs). Briefly discusses UV radiation and its relationship with sunlight. One reference is given in conducting the test |
| D | Follows the given method to carry out the experiment with some repetition. OR Designs an experiment with an aim, an illogical method but some appropriate variables | Draws a wave over the image given that shows there is a frequency change between UV radiation and the visible spectrum | Places some collected data in the table provided (preferably with photographs) draws a conclusion. Fills in all the cloze passage or provides some information on UV radiation |
| E | Partially follows the given method to carry out the experiment without repetition to collect reliable dataOR Designs an irrelevant investigation | Draws a wave over the image given that portrays the electromagnetic spectrum to some extent | Shows some results (preferably photographs) and makes an irrelevant conclusion. Fills in most of the cloze passage |