 Force fields

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

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

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

a. identifying suitable equipment or resources to perform the task, including safety equipment and digital technologies

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

* WS7.1Students process data and information by:

b. using a range of representations to organise data, including graphs, keys, models, diagrams, tables and spreadsheets

d. accessing information from a range of sources, including using digital technologies

* WS7.2Students analyse data and information by:
  + checking the reliability of gathered data and information by comparing with observations or information from other sources
  + constructing and using a range of representations, including graphs, keys and models to represent and analyse patterns or relationships, including using digital technologies as appropriate (ACSIS129, ACSIS144)
  + using scientific understanding to identify relationships and draw conclusions based on students' data or secondary sources (ACSIS130, ACSIS145)

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

Knowledge and understanding

SC4-10PW describes the action of unbalanced forces in everyday situations

PW2 The action of forces that act at a distance may be observed and related to everyday situations.

a. use the term 'field' in describing forces acting at a distance

Electrostatic force

b. identify ways in which objects acquire electrostatic charge

c. describe the behaviour of charged objects when they are brought close to each other

d. investigate everyday situations where the effects of electrostatic forces can be observed, eg lightning strikes during severe weather and dust storms

Gravitational

e. identify that the Earth's gravity pulls objects towards the centre of the Earth (ACSSU118)

f. describe everyday situations where gravity acts as an unbalanced force

g. distinguish between the terms 'mass' and 'weight'

Electrostatic

h. describe the behaviour of magnetic poles when they are brought close together

i. investigate how magnets and electromagnets are used in some everyday devices or technologies used in everyday life

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

In this task, students will create a hands-on interactive working model designed to be used by stage 3 students from local primary schools to explore a non-contact force. The task includes the design and creation of the model, an associated background information sheet and an instructional procedure for using the model.

The task can be modified for students to create a working model for other scientific phenomena addressed in Chemical World, Living World or Earth and Space. Furthermore, there is scope for the task to be included in a transition program. Students could set up a display of their models and invite parents/feeder primary schools to the exhibit. A guest scientist could be invited to award the most creative model or most effective.

Introduction/Background

Hands-on exhibits are an immersive and interactive way of exploring and learning about the world around you. Creating interactive models for others to use allows us to strengthen our own understanding of the scientific principles involved.

Exhibits and models are typically used in museums to engage members of the public and present how something works. Models are also used in teaching.

The [Exploratorium](https://www.exploratorium.edu/) in San Francisco is a public learning laboratory which creates inquiry based experiences through interactive exhibits and models.

Task

You are to create a hands-on interactive exhibit which may be included in an exploratorium-like set-up. It must demonstrate one of the following forces:

* Magnetic force
* Electrostatic force
* Gravitational force

Your target audience is Year 5/6 students from the local primary schools who will use your model to learn about your selected force.

Your project will include

* A single interactive working hands-on model, no bigger than 30cm x 30cm x 30cm. Please discuss with your teacher if your model needs to be bigger than this size.
* An instructional procedure detailing how young participants can use your model and gain an understanding of the phenomena they are exploring.
* An information sheet to be displayed next to the model detailing the scientific explanation of the phenomena you have selected.

You will be marked on

* Accuracy of your information.
* Quality, construction and usability of your model.
* How easily a participant can follow your instructions to gain an understanding of the force you are presenting.

Interactive working model

Your interactive model can be made from any materials you can easily access, such as Lego, household items or recyclable items. If you select magnetic force you may wish to use magnets of different shapes, sizes and strength along with a variety of magnetic and non-magnetic objects or substances. If you are exploring electrostatic force you may wish to use items such as Perspex, wool, silk, synthetic fibres, balloons and shredded paper. If you are exploring gravitational force you may wish to use different objects of the same size but different masses or the effect of varying height.

Information sheet

The information sheet mustbe no more than 1 A4 page in length and contain a brief explanation of what the force is, how it works, its effects on different types of objects and examples of where these forces can be found in everyday life.

Instructional procedure

An instructional procedure is a step-by-step process which details a suggested way a young participant could use your model and gain an understanding of the force they are exploring. This can be considered as a type of cheat sheet for young participants to use if they are unsure how to interact with the model.

Marking guidelines/rubric

The following achievement levels are referenced in the rubric

* **Elementary** - Understanding and working with support
* **Developing** - Understanding – developing skills and knowledge
* **Competent** - Understanding and achieving all outcomes
* **Highly** **developed** - Confident understanding demonstrating secure skills and knowledge
* **Outstanding** - Perceptive and sophisticated understanding demonstrating outstanding skills and knowledge

| Criteria | Non submission | Elementary | Developing | Competent | Highly developed | Outstanding |
| --- | --- | --- | --- | --- | --- | --- |
| Information:  What is force | Not completed or submitted. | Basic information presented in a way not appropriate for the task. | Limited information explained with language not suitable for target audience. | Sufficient information explained using appropriate language for the target audience. | Through information well explained using appropriate language for the target audience. | In-depth information clearly explained using appropriate scientific language for the target audience. |
| Information:  How it works | Not completed or submitted. | Basic information presented in a way not appropriate for the task. | Limited information explained with language not suitable for target audience. | Sufficient information explained using appropriate language for the target audience. | Through information well explained using appropriate language for the target audience. | In-depth information clearly explained using appropriate scientific language for the target audience. |
| Information:  Effect on other objects | Not completed or submitted. | Basic information presented in a way not appropriate for the task. | Limited information explained with language not suitable for target audience. | Sufficient information explained using appropriate language for the target audience. | Through information well explained using appropriate language for the target audience. | In-depth information clearly explained using appropriate scientific language for the target audience. |
| Information: Examples in everyday life | Not completed or submitted. | Basic information presented in a way not appropriate for the task. | Limited information explained with language not suitable for target audience. | Sufficient information explained using appropriate language for the target audience. | Through information well explained using appropriate language for the target audience. | In-depth information clearly explained using appropriate scientific language for the target audience. |
| Model:  Construction | No model constructed | A poorly constructed model that shows little effort in its construction or is hard to operate or does not perhaps not work properly. | A fragile working model that shows little effort in construction. | A fragile working model that shows some effort in construction. | A working model that is very well constructed, shows some effort in construction. | A sturdy working model that is very well constructed, shows lots of effort in construction. |
| Model:  Connection to Knowledge | No model constructed | Inappropriate model for concept(s), does not illustrate or teach viewers much about the scientific concept(s). | Model could demonstrate the scientific phenomena with some effort and previous background knowledge. Is not very clear. | Model could demonstrate the scientific phenomena with a degree of creative thinking. | Model well suited to scientific concept(s) being illustrated. Does demonstrate with a high degree of accuracy and can educate the participant about the concept(s) very well | Model highly suited to scientific concept(s) being illustrated, demonstrates and educates viewer about the concept(s) very well with clear links to the field in question. |
| Model: Ease of Use | No Model Constructed | Confusing layout and design make it difficult to operate. | Hard to operate without high degree of assistance | Somewhat easy to operate given some guidance | Is easy to operate by those older than target audience. | Very easy to operate by target audience. |
| Instructional Procedure | Not completed or submitted | Hard to follow sequence. Steps are not numbered or begin with a verb. Many mistakes | Can to follow sequence. Steps are not numbered or begin with a verb. Many mistakes | Can to follow sequence. Some steps are numbered and begin with a verb. Some Mistakes | Easy to follow in a logical sequence. Each step is numbered and begins with a verb and no mistakes. | Easy to follow in a logical sequence with clear instructions and guidance. Each step is numbered and begins with a verb and no mistakes. |