# Science Stage 4 – learning sequence – plant requirements for growth



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## Overview

**Stage and Learning Area:** Science Stage 4

**Description:** this resource has been designed to address the SC4-14LW, by relating the structure and function of living things to their classification, survival and reproduction in Living World.

This learning sequence builds understanding of plant requirements for growth through the development of critical thinking and problem-solving using an inquiry-based learning model. Students will develop content knowledge while developing a range of working scientific skills.

**Duration:** while timing will vary based on the mode of delivery, differentiation strategies employed and class or school context, this series of activities should take approximately 3 × 50-minute lessons over 2 weeks. Allow 2 lessons for See-Think-Wonder, investigation design and setup and one period at the end to analyse results and draw conclusions. Ten minutes should be allocated during lessons to monitor and care for the seedlings.

## Information for teachers

### Introduction

This learning sequence allows students to investigate the requirements for plant growth using an inquiry-based learning activity. Two punnets of seedlings should be purchased a week before the first lesson of this learning sequence. Keep one punnet well maintained and healthy and neglect the other punnet. The neglect could take the form of lack of sunlight, lack of water or other appropriate form of lack of care. After one week, the 2 punnets of seedlings are presented to students to make observations, hypothesise and ask questions. The students are then guided through the process of developing and conducting a first-hand investigation.

This learning sequence is designed to build skills gradually throughout the task. Teachers may wish to modify the task or focus on specific sections based on their class context, student ability and current mastery of content. For more information relating to curriculum planning for every student see the [Planning programming and assessing K-12](https://aus01.safelinks.protection.outlook.com/?url=https%3A%2F%2Feducation.nsw.gov.au%2Fteaching-and-learning%2Fcurriculum%2Fplanning-programming-and-assessing-k-12&data=05%7C01%7CMALISSA.KING%40det.nsw.edu.au%7Ce57f700f6b0645c5a3b208db0e2531af%7C05a0e69a418a47c19c259387261bf991%7C0%7C0%7C638119325128611063%7CUnknown%7CTWFpbGZsb3d8eyJWIjoiMC4wLjAwMDAiLCJQIjoiV2luMzIiLCJBTiI6Ik1haWwiLCJXVCI6Mn0%3D%7C3000%7C%7C%7C&sdata=QMXNZlMveabQO6mP%2FqxsIyEn9Z64YTBcLnoM8uK6yfA%3D&reserved=0) website.

### Outcomes

A student:

* identifies questions and problems that can be tested or researched and makes predictions based on scientific knowledge **SC4-4WS**
* collaboratively and individually produces a plan to investigate questions and problems **SC4-5WS**
* processes and analyses data from a first-hand investigation and secondary sources to identify trends, patterns and relationships, and draw conclusions **SC4-7WS**
* selects and uses appropriate strategies, understanding and skills to produce creative and plausible solutions to identified problems **SC4-8WS**
* relates the structure and function of living things to their classification, survival and reproduction **SC4-14LW**

[Science Years 7–10 Syllabus](https://educationstandards.nsw.edu.au/wps/portal/nesa/k-10/learning-areas/science/science-7-10-2018) © NSW Education Standards Authority (NESA) for and on behalf of the Crown in right of the State of New South Wales, 2018.

### Learning intentions and success criteria

Students:

* identify and communicate the requirements for plant growth
* design and conduct an investigation into plant growth
* analyse first-hand data.

Students can:

* describe various factors that influence plant growth
* identify variables that could be investigated
* collaboratively develop an aim, hypothesis and valid method to investigate one variable
* collect and analyse data collected and relate it to plant growth
* draw conclusions from first-hand data.

**Differentiation consideration**: learning intentions should not be differentiated. All students need access to the same core content, big ideas and concepts. Differentiation should be evident in the success criteria, or the activities/support needed to achieve the success criteria (Wiliam and Leahy 2015). Teachers may co-construct the success criteria with students or adjust them to suit their class context, for example using the strategies and resources for curriculum planning on the [Planning programming and assessing 7-12](https://education.nsw.gov.au/teaching-and-learning/curriculum/planning-programming-and-assessing-k-12/planning-programming-and-assessing-7-12) webpage.

## Teaching and learning activities

### Teacher preparation for the task

The teacher will need to obtain 2 trays of seedlings a week prior to the first lesson. Additionally, purchase one tray of seedlings per student group.

One tray of teacher seedlings should be neglected in some way. For example, they could be left without water, sunlight or fertiliser. The type of neglect can be used as a differentiation strategy for more able students. The other trays of seedlings should be well looked after.

Students could be provided with a scaffold to create a glossary of key terms or new terms that they encounter as they progress through the task.

**See, Think, Wonder**

This activity is based on the See-Think-Wonder model of learning which teaches students the difference between an observation and inference and encourages the inquiry process. Students are presented with a puzzling observation. They are encouraged to make careful observations, think critically about what is happening and be curious. Students use their observations to develop a hypothesis, and from this, an investigation that tests their hypothesis.

Figure – See-Think-Wonder chart



Students will undertake a series of activities to make observations, hypothesise, design and investigate the conditions essential for the growth of healthy plants. The activities are designed to be student driven with the support and guidance of the teacher.

### Activity 1: See-Think-Wonder

**Note:** students use [Resource 1: learning map](#_Learning_map) to inform their progress through the task.

Teachers guide students through the See-Think-Wonder process. This could be achieved using the [Modelling through think alouds](https://www.education.vic.gov.au/school/teachers/teachingresources/discipline/english/literacy/speakinglistening/Pages/teachingpracmodelling.aspx) process.

In this learning sequence, students are provided with a scenario with a puzzling observation and 2 punnets of seedlings, bought at the same time and from the same place, that have a different appearance. Students examine them closely looking for observations from which to create a list of possible variables. They develop a hypothesis and design an investigation into a plant’s requirements for growth. There are opportunities to encourage stories about experiences of growing plants at home to encourage links to land and experiential knowledge during sharing and class discussions.

**Differentiation:** the term ’yarn-up’ is used in the learning map. Consider the students in your class and the possible need to explain this term.

**See**

This activity could be completed individually, as a class on a Jamboard, or in small groups, followed by a class discussion or gallery walk.

1. Set up the 2 trays of seedlings – one neglected and one well looked after.
2. Have the students look carefully at the seedlings and list as many observations about them as possible.
3. Students share their observations with the class.

**Note:** students are collecting observations at this stage of the investigation.

**Think**

* Guide students to think about what has happened to the seedlings.
* Use questions such as:
* What do you think is happening?
* What has caused the changes to the seedlings?
* Why do you think that?
* Have the students list as many possible causes as they can. Encourage them not to get caught up thinking they know the answer. Instead, look at **all** the possibilities, no matter how far-fetched.

**Note:** students begin to create plausible explanations for their observations.

**Wonder**

* Ask students to list the questions that their observations raise. These questions will be developed into a hypothesis for investigation in the next activity.
* Guide students to use what they have learned today to develop a set of requirements for plant growth. For example, water, light, nutrients, carbon dioxide, temperature and space.

**Note:** students create a hypothesis based on their observations.

#### Assessment for learning

This activity could be used as formative assessment of the development of an aim and hypotheses. Use the [See-Think-Wonder](#_see-think-wonder) worksheet for students to complete their work and inform class discussions.

Explicit teaching practices involve teachers clearly showing students what to do and how to do it, rather than having students discover that information themselves. Students who experience explicit teaching practices make greater learning gains than students who do not experience these practices.

[CESE What works best update 2020](https://education.nsw.gov.au/about-us/educational-data/cese/publications/research-reports/what-works-best-2020-update)

#### Activity 1: See-Think-Wonder sample response

Your teacher will provide you with 2 trays of seedlings. Use these to fill out this worksheet.

A smart chart with 3 components:  A diagrammatic eye above a navy blue text box with the text: see - What do you see?  Brainstorm all the things that you notice about the seedlings. This is above a navy blue text box with the text See followed by examples:  The plants are wilted in one tray.
The soil is dry in one tray.
The 2 trays have different soil in them.
The leaves of the plants in one tray are a bit yellow, the other tray has green leaves.
This is next to a diagram of a thinking cloud above a red text box with the text: think. What do you think is going on? List all the possibilities.  Below this is a text box with suggested answers:  I think that the plants are yellow because they were in the dark.
I think that the plants that grew tall had lots of fertiliser. 
To the right of this is a blue text box with the text: wonder What questions do you have?  Below this is a the text with suggested answers:  
I wonder if the yellow leaves will turn green if they get some sunlight?
I wonder how much sunlight plants need?
I wonder if the seedlings can grow in cotton wool like seeds do?

### Activity 2: investigation design

**Note:** this activity can be teacher-led, to model investigation design, or used as a formative assessment tool with teacher support. It could be conducted in small groups followed by a gallery walk with students evaluating the methods created by others (see scaffold attached).

* Guide the students to create a set of variables for plant growth that could be tested. This list could include the amount of water, type of soil, amount of soil, temperature, amount of light and plant crowding.
* The students choose one variable to be investigated and create an aim and hypothesis.
* Support students in developing a valid, reliable method to investigate the aim.

**Differentiation:** the activity could be differentiated for lower ability classes or those learning investigation design, by conducting it as a whole class activity with discussion of the elements that make a valid and reliable method.

Conducting this activity as a whole class would also support the learning of EALD students in the early stages of English acquisition.

Consider the needs of your class and the requirement for explicit teaching or revision of terminology such as independent, dependent variables, hypothesis, mitigation, observation, systematic error, and random error.

Students may require guidance in the type of graph used in this task. Consider the need for review of graphing techniques.

#### Assessment for learning

This activity could be used as formative assessment for the development of an investigation. If the task is to be used for formative assessment, [Resource 3: Designing an investigation scaffold](#_Designing_an_investigation:) or [Resource 4: Designing an investigation (differentiated) scaffold](#_Designing_an_investigation:_1) can be used. The scaffold can be removed to extend students or for use as summative assessment.

### Activity 3: data processing and analysis

**Note:**

* Accuracy is a measure of how close an answer is to the true value.
* Precision is a measure of how close multiple measurements are to each other.
* Reliability is a measure of how close multiple measurements are to each other.
* Validity is a measure of whether the investigation answers the aim (does it test what you want it to test).
* Lead a discussion to decide whether the data gathered should be quantitative, qualitative, or both.
* Discuss the design of a table to record the results, based on dependent and independent variables.
* The students tabulate and graph their gathered data.

**Differentiation:** this learning sequence can be modified for extension studentsby encouraging them to calculate the mean and standard deviation of gathered data.

* Guide the students to analyse the data and draw conclusions.
* Discuss sources of error, accuracy, precision, reliability, validity and improvements.
* Encourage students to use the gathered data and conclusions to raise another question.

**Differentiation:** this learning sequence can be modified for extension students through the removal of scaffolding and the encouragement of deep questioning by the students. The level and cause of neglect of the seedlings can also provide a means of differentiation. A differentiated scaffold is included and can be further modified as needed to suit individual students. Some students may require explicit teaching of some terminology, for example, quantitative and qualitative. Deconstruction of the terms during explicit teaching could improve the support of EALD students.

#### Assessment for learning

This activity could be used as formative assessment for the analysis of an investigation. If the task is to be used for formative assessment, the [Resource 3: Designing an investigation scaffold](#_Designing_an_investigation:) or [Resource 4: Designing an investigation (differentiated) scaffold](#_Designing_an_investigation:_1) can be used. The scaffold can be removed to extend students or for use as summative assessment.

## Student resources

### Resource 1: learning map

Figure – learning map

A learning map with an image of seedlings which shows the activities that will be undertaken in this learning sequence and the suggested order of completion to answer the question 'What do plants need to grow?'  
The activities in order are: see-think-wonder, yarn up, design time, let's do it and where to now?

### Resource 2: See-Think-Wonder

Your teacher will provide you with 2 trays of seedlings. Use these to fill out this worksheet.

Figure – See-Think-Wonder chart

This chart shows the 3 processes and thinking required for the See-Think-Wonder process and provides space to write thoughts and observations.
A diagrammatic eye above the text see What do you see? Brainstorm all the things that you notice about the seedlings with space below to write your observations.
To the right of this is a diagrammatic thinking cloud about the text think What do you think is  going on? List all the possibilities with space below to write your thoughts.  To the right of this is a question mark above the text wonder What questions do you have? with space below to write your questions.

### Resource 3: designing an investigation – What do plants need to grow?

Look at the information that you gathered in the previous activity. You will use this information to develop an investigation into plant growth. Check with your teacher at the end of each section before you go on.

**Variables**

|  |  |
| --- | --- |
| List all the variables that affect plant growth that you can. |  |
| **Independent variable:**  Choose one variable to test.  How will you change it? |  |
| **Dependent variable:**  Which variable will you measure?  How will you measure it? |  |

**Questioning and predicting**

|  |  |
| --- | --- |
| Write an aim for your investigation.  *(What do you want to find out?)* |  |
| Write a **hypothesis** for your investigation.  *(What do you think the results will be, and why do you think that?)* |  |

**Method design**

|  |  |
| --- | --- |
| What equipment will you need? |  |
| What variables will you need to control?  How will you control each one? |  |
| Write the steps of your method.   1. Use numbered steps. 2. Start each step with a verb. 3. Make each step short.   Remember to make your method:   * **valid** by changing only one variable * **reliable** by repeating it to reduce random errors. |  |
| Draw a labelled diagram of your equipment setup*.*  *(Use a pencil and ruler)* |  |

**Risk assessment**

|  |  |  |
| --- | --- | --- |
| What are the risks involved in the investigation? *(Include risks to yourself, others and property)*  How will you prevent the risks? *(Mitigation)* | **Risk** | **Mitigation** |

**Results**

|  |  |
| --- | --- |
| What observations do you need to make?  What data do you need to collect?  Design a table for your results.  *(Hint: the independent and dependent variables are usually the headings.)* |  |

**Analysing data**

|  |  |
| --- | --- |
| Design a graph for your results. |  |
| What patterns do you see?  What do the results mean?  Is your hypothesis supported? Use evidence from your investigation to support your answer.  Do your results raise any other questions?  What sources of error are there in your investigation? *(Identify systematic and random errors and how they can be overcome)*  Discuss the accuracy, precision, reliability and validity of your investigation. Support your argument with evidence.  How could you improve your investigation? *(Address any issues identified above.)* |  |

**Conclusion**

|  |  |
| --- | --- |
| What have you found out?  *(Answer the question in the aim)* |  |

### Resource 4: designing an investigation – What do plants need to grow? (differentiated)

Look at the information that you gathered in the previous activity. You will use this information to develop an investigation into plant growth. Check with your teacher at the end of each section before you go on.

**Variables**

|  |  |
| --- | --- |
| List all the things that you think might help plants grow.  *(These are called variables).* | * Amount of water * \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ * \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ * \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ * \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| **Independent variable:**  Pick one variable from the list above to test.  How will you change it? | I will change the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  I will change it by \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| **Dependent variable:**  Which variable will you measure?  How will you measure it? | I will measure the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  I will measure it by \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |

**Questioning and predicting**

|  |  |
| --- | --- |
| Write an aim for your investigation.  *(What do you want to find out?)* | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| Write a **hypothesis** for your investigation.  *(What do you think the results will be, and why do you think that?)* | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  will make the plant grow \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  because \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |

**Method design**

|  |  |
| --- | --- |
| What equipment will you need? | * seedlings * pots * \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ * \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ * \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ * \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ * \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| Choose 2 variables you will keep the same.  How will you do this? | *For example: Each seedling will get the same amount of sunlight by keeping them on the same windowsill.*   * \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_   \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_   * \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_   \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| Write the steps of your **method**.   1. Use numbered steps. 2. Start each step with a doing word 3. Make each step short.   Remember to make your method:   * **valid** by changing only one variable * **reliable** by repeating it to reduce random errors. | *For example: Plant each seedling in a 10cm pot with 2 cups of potting mix|
| Draw a labelled **diagram** of your equipment setup.  (Use a pencil and a ruler.) |  |

**Risk assessment**

|  |  |  |
| --- | --- | --- |
| What are the **risks** involved in the investigation?  *(Include risks to yourself, others and property)*  How will you prevent the risks? *(Mitigation)* | **Risk**  *Infection from bacteria in potting mix* | **Mitigation**  *Wear gloves and wash hands well when finished* |

**Results**

|  |  |
| --- | --- |
| What observations do you need to make?  What will you measure?  How often will you measure it?  Design a table for your results.  *(Hint: the independent and dependent variables are usually the headings).* | * \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ * \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ * \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ * \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_   A scaffolded table of results. |

**Analysing data**

|  |  |
| --- | --- |
| Ask your teacher for some graph paper to create a graph for your results. |  |
| What patterns do you see?  What do the results mean?  Is your hypothesis correct? How do you know? (Look at your results).  Do your results raise any other questions?  What sources of error are there in your investigation? How can you fix these errors? **Systematic** errors are errors that are always there because of a poor method or incorrect use of equipment.  **Random** errors are not predictable, often they are because people make mistakes.  Discuss the accuracy, precision, reliability and validity of your investigation. Support your argument with evidence.  How could you improve your investigation? (Address any issues identified above.)  What else could you investigate? | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  The pattern in the results means that \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  The hypothesis was supported because \_\_\_\_\_\_\_\_\_\_\_\_\_  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  A question that I have is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  A systematic error in the experiment was \_\_\_\_\_\_\_\_\_\_\_\_  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  It could be fixed by \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  A random error in the experiment was \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  It could be fixed by \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  The experiment was accurate because \_\_\_\_\_\_\_\_\_\_\_\_\_\_  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  The experiment was precise because \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  The experiment was reliable because \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  The experiment was valid because \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  The experiment could be improved by \_\_\_\_\_\_\_\_\_\_\_\_\_\_  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  Other topics to investigate include: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |

**Conclusion**

|  |  |
| --- | --- |
| What have you found out?  *(Answer the question in the aim* | In this investigation it was found that \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |

### Resource 5: investigation Evaluation tool

This tool will assist you to evaluate an investigation design. You should be able to justify each answer with evidence from the investigation.

A flow chart with the following text: Aim:  is the aim. tick boxes clear, concise, independent variable, dependent variable, testable
an arrow to the right pointing to a text box with the following text:  Hypothesis: Does the hypothesis include: checkboxes: an independent variable, dependent variable, their relationship, a reason
an arrow down to to a text box with the text: Method: is the method
checkboxes:  clear, concise, valid (only one independent and one dependent variable?, accurate, reliable,  written using the correct format (numbered steps beginning with a verb?
arrow down followed by a text box with the text: Results:  Look at eh table in the results section.
Checkboxes - is the table clear, is the table logical?
Give the investigation a rating out of five with a reason.

### Resource 6: exit ticket

Printable Exit tickets can be found in the [Exit tickets – Rose, bud, thorn PowerPoint](https://schoolsnsw.sharepoint.com/:p:/s/DLS/EU6WU9t6u9FJrMeCgBV4Qq0BBbIoqopBPLbwf4hIyIlzdQ?e=pyvN2b&clearCache=23f2215b-bf9f-c224-fc1d-f6154a4c2291)

## Support and alignment

**Resource evaluation and support:** all curriculum resources are prepared through a rigorous process. Resources are periodically reviewed as part of our ongoing evaluation plan to ensure currency, relevance and effectiveness. For additional support, advice or feedback, contact the Science Curriculum team by emailing Science7-12[@det.nsw.edu.au](mailto:Science7-12@det.nsw.edu.au).

**Differentiation:** further advice to support Aboriginal and Torres Strait Islander students, EALD students, students with a disability and/or additional needs and High Potential and gifted students can be found on the [Planning programming and assessing 7-12](https://education.nsw.gov.au/teaching-and-learning/curriculum/planning-programming-and-assessing-k-12/planning-programming-and-assessing-7-12) webpage.

**Assessment**: further advice to support formative assessment is available on the [Planning programming and assessing 7-12](https://education.nsw.gov.au/teaching-and-learning/curriculum/planning-programming-and-assessing-k-12/planning-programming-and-assessing-7-12) webpage.

**Professional learning**: relevant professional learning is available on the [Science statewide staffroom](https://education.nsw.gov.au/teaching-and-learning/curriculum/statewide-staffrooms).

**Related resources:** further resources to support Stage 4 Science can be found on the [Science Curriculum page](https://education.nsw.gov.au/teaching-and-learning/curriculum/science).

**Consulted with:** inclusive Education, Multicultural Education, Literacy and Numeracy and subject matter experts.

**Alignment to system priorities and/or needs:** [School Excellence Policy](https://education.nsw.gov.au/policy-library/policies/pd-2016-0468), [School Success Model.](https://education.nsw.gov.au/public-schools/school-success-model/school-success-model-explained)

**Alignment to the School Excellence Framework:** this resource supports the [School Excellence Framework](https://education.nsw.gov.au/policy-library/policies/pd-2016-0468) elements of curriculum (curriculum provision) and effective classroom practice (lesson planning, explicit teaching).

**Alignment to Australian Professional Teaching Standards:** this resource supports teachers to address [Australian Professional Teaching Standards](https://educationstandards.nsw.edu.au/wps/portal/nesa/teacher-accreditation/meeting-requirements/the-standards/proficient-teacher) 3.2.2, 3.3.2

**Author:** Science 7-12 Curriculum Team

**Resource:** classroom resource

**Creation date:** 15 September 2022

## References

[Science Years 7–10 Syllabus](https://educationstandards.nsw.edu.au/wps/portal/nesa/k-10/learning-areas/science/science-7-10-2018) © NSW Education Standards Authority (NESA) for and on behalf of the Crown in right of the State of New South Wales, 2018.

State of New South Wales (Department of Education) and CESE (Centre for Education Statistics and Evaluation) (2020a) ‘[What works best: 2020 update](https://education.nsw.gov.au/about-us/educational-data/cese/publications/research-reports/what-works-best-2020-update)’, CESE, NSW Department of Education, accessed 23 May 2022.

State of New South Wales (Department of Education) and CESE (Centre for Education Statistics and Evaluation) (2020b) ‘[What works best in practice](https://education.nsw.gov.au/about-us/educational-data/cese/publications/practical-guides-for-educators-/what-works-best-in-practice)’, CESE, NSW Department of Education, accessed 23 May 2022.

Wiliam D and Leahy S (2015) *Embedding formative assessment: practical techniques for K-12 classrooms,* Learning Sciences International, US.

### Further reading

State of New South Wales (Department of Education) (2022) [*Literacy and numeracy priorities*](https://education.nsw.gov.au/teaching-and-learning/curriculum/literacy-and-numeracy/priorities), NSW Department of Education website, accessed 24 February 2023.

State of New South Wales (Department of Education) (2022) [*Teaching strategies for reading by learning stage*](https://education.nsw.gov.au/teaching-and-learning/curriculum/literacy-and-numeracy/teaching-and-learning-resources/literacy/teaching-strategies), NSW Department of Education website, accessed 27 February 2023.

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