Designing a hydroponic system

Strand	Organiser	Level						
		1	2	3	4	5	6	B6
Technology Practice	*Investigation*							
	Ideation							
	Production							
	Evaluation							
Information	*Nature*							
	Techniques							
Materials	*Nature*							
	Techniques							
Systems	*Nature*							
	Techniques							

Purpose

The activities in this module are planned to provide students with opportunities to understand hydroponic and traditional methods of growing plants. As a class, they grow tomatoes and strawberries using both traditional and hydroponic methods.

Overview

The following table shows the activities in this module and the way in which these are organised into introductory, developmental and culminating phases.

Introductory	Developmental	Culminating
Brainstorm 'What we know' and 'What we need to know'. Use research activities to find information on growing strawberries and tomatoes. Find a local hydronponic farmer and visit their farm. Brainstorm a list of the materials that will be needed.	Select a patch of ground for growing the crops. Work out how much space is needed. Design a top-view to-scale plan of the patch. Invite an expert from a local farm and an irrigation company to offer advice about the designs. Construct the irrigation system and plant the crops. Plan and implement ways to control diseases and pests. Design a system for monitoring and maintaining the patch.	Brainstorm ways to measure the success of the project. Collect information about the strawberries and tomatoes. Observe and record information about the growth of the plants. Devise a system to assess the quality of the crops. Compare traditional and hydroponic systems of agriculture. Design a survey to determine what worked well and what could be improved. Make inferences and recommendations.

Core learning outcomes

This module focuses on the following core learning outcomes from the *Years 1 to 10 Technology Syllabus*:

Technology Practice

TP 3.1 Students examine knowledge, ideas and data from a range of sources and establish the relevance of this information when meeting design challenges.

TP 3.2 Students collaboratively generate design ideas and communicate these using presentations, models and technical terms.

TP 3.3 Students cooperatively develop and follow production procedures to make products that reflect their design ideas.

TP 3.4 Students test and judge how effectively their own and others' processes and products meet the design challenge.

Information

INF 3.1 Students describe advantages and disadvantages of different sources and forms of information.

INF 3.2 Students select and use techniques for generating, modifying and presenting information for different purposes.

Materials

MAT 3.1 Students choose materials according to various characteristics that best suit the product and user.

MAT 3.2 Students select and use suitable equipment and techniques to combine materials accurately in order to meet design requirements.

Systems

SYS 3.1 Students identify and describe relationships between inputs, processes and outputs in systems.

SYS 3.2 Students assemble and trial systems they design by considering inputs, processes and outputs.

Core content

The core learning outcomes are the focus for planning learning activities and assessment tasks. Students will engage with core content (see pp. 37-40 of the syllabus) when they are provided with opportunities to demonstrate core learning outcomes. While the content is listed in strands for organisational convenience, no one part of that content is to be viewed as discretely associated with a single strand.

The organisation of content within a strand should not be considered hierarchical. Any of the content can be addressed at any appropriate level; not all of the content need be addressed at every level. Core content should be selected to suit students' needs, interests and abilities and to take account of their prior knowledge and experiences.

The core content should be studied in a range of contexts. These could include personal and global contexts, as well as contexts of agriculture, business, communities, home and family, industry, leisure and recreation, and school.

Using this module

The activities in this module are designed to provide opportunities for students to demonstrate Level 3 learning outcomes from the Technology Practice, Materials and Systems strands. These activities can also provide opportunities for students to develop and demonstrate the related learning outcomes at other levels. In order to do this, teachers will need to develop additional sets of anticipated evidence derived from the related learning outcomes at different levels. They may also need to modify aspects of the activities.

This module includes a variety of sequenced activities requiring varying amounts of time. Teachers can modify the design brief and related activities depending on the local contexts, particular needs and prior knowledge of students and the availability of materials and resources.

The project needs to be started at the beginning of the year due to growing conditions for strawberries. Cost, depending upon support from the local community, is likely to range from $500 to $1000.

This activity is designed around growing 100 strawberries and 20 tomato plants traditionally and 100 strawberries and 20 tomato plants hydroponically.

Advice to teachers

This module could provide:

- opportunities for community involvement and support
- opportunities for the integrated use of computers for research (Internet), graphing and multimedia presentations.

Resources

Students' creativity in demonstrating core learning outcomes in this module should not be limited by the range and scope of resources and equipment provided by the teacher. A variety of resources should be collected over time and should be safely stored and made available to students as required.

A variety of materials and equipment are needed in this module. Most of the materials will be supplied if a prefabricated hydroponic kit is used. If you are making your own system, its construction will need to be investigated. Equipment for construction of the system may vary, but a supply of gardening and building equipment is recommended.

Evaluation of a unit of work

After completion of a unit or units of work developed from this module, teachers collect information and make judgments about:

- teaching strategies and activities planned or selected to allow students to demonstrate the core learning outcomes
- future learning opportunities for students who have not yet demonstrated the core learning outcomes and to challenge and extend those students who have already demonstrated the core learning outcomes
- the extent to which activities matched needs of particular groups of students and reflected equity considerations
- the appropriateness of time allocations for particular activities
- the appropriateness of resources used.

Information from this evaluation process can be used to plan subsequent units of work so that they build on, and support, student learning. The evaluated units of work may also be adapted prior to their reuse. For further information, refer to the 'Curriculum evaluation' section of the sourcebook guidelines.

Links

Links to other key learning areas

Activities from this module can be used as part of an integrated unit that makes links to other key learning areas. When incorporating this module into an integrated unit of work, teachers can select activities that provide opportunities for students to demonstrate learning outcomes from other key learning areas and identify anticipated evidence of students' demonstrations of these learning outcomes. It is important, however, that the integrity of the processes and concepts within key learning areas is maintained.

This module could link to the following key learning areas:

- English
- Mathematics
- Science

Contributions to the cross-curricular priorities

This module contributes to students' development of the cross-curricular priorities:

- **literacy** as students keep a journal of what is happening in the plot each week,publish updates in a class newsletter,give oral presentations and compile written presentations
- **numeracy** as students collect information,use a spreadsheet to construct graphs, use formulas in spreadsheets, investigate money concepts and calculate areas
- **lifeskills** as students development personal, social and self-management skills
- **a futures perspective** as students envision and work towards preferred futures by using the knowledge,practices and dispositions of 'working technologically'.

The valued attributes of a lifelong learner

The overall learning outcomes of the Queensland Years 1 to 10 curriculum contain elements common to all key learning areas and collectively describe the valued attributes of a lifelong learner.

The following points indicate how various activities in this module might contribute towards the development of these attributes.

Knowledgeable person with deep understanding

- draws together knowledge from a range of areas (including mathematics, science, history and the arts) to design and develop creative solutions
- explores issues behind challenges and predict the impacts of the products of technology on people and environments
- develops understandings about investigation, ideation, production and evaluation.

Complex thinker

- uses inductive and deductive thinking to make predictions about the impacts of the processes and products of technology
- predicts and identify possible sources of error and bias in research and test results
- judges the relevance, reliability and validity of data and information.

Active investigator

- examines and cause-and-effect relationships within systems, and refine systems by finding and rectifying faults or design flaws
- generates and access information from a variety of sources.

Responsive creator

- uses imagination, originality, intuition, enterprise and aesthetic judgment
- envisions and generate a range of potential solutions.

Effective communicator

- uses a variety of methods to communicate design ideas effectively to a range of audiences
- uses accepted standards and forms for measurement, calculation, and written and visual representations.

Participant in an interdependent world

- works individually and collaboratively on a variety of design challenges with confidence and initiative
- negotiates with others and resolve conflict in appropriate ways as they work towards common goals and share equipment and resources.

Reflective and self-directed learner

- critically evaluates processes and products of technology
- displays self-motivation and perseverance in seeing projects through to completion.

Assessment strategies

The assessment opportunities outlined are examples of how to assess students' demonstrations of the identified learning outcomes. As often as possible, negotiate assessment with students and support a variety of ways of demonstrating the learning outcomes. Reflect with students on evidence gathered when making judgments about their demonstrations of learning outcomes. Some students may require more time and/or other contexts in which to demonstrate these learning outcomes. Other modules may provide such time and/or contexts.

Suggestions for gathering information about student learning are provided in the activities section of this module. The table below provides descriptions of anticipated evidence that teachers might gather to support their judgments about students' demonstrations of learning outcomes and suggests sources of evidence. The table is neither exhaustive nor mandatory. Once sufficient evidence has been collected, judgments can be made about students' demonstrations of learning outcomes.

[This table spreads over two pages.]

Core learning outcomes	Anticipated evidence	Sources of evidence
TP 3.1 Students examine knowledge, ideas and data from a range of sources and establish the relevance of this information when meeting design challenges.	Research various sources, such as the library and Internet. Establish the relevance, reliability, currency and credibility of the information.	Anecdotal records observation of students as they participate in planned activities. Consultation with students to verify the evidence gathered.
TP 3.2 Students collaboratively generate design ideas and communicate these using presentations, models and technical terms.	Work in groups to develop design proposals. Collaborate with experts to generate ideas. Present 2D presentations/ 3D models and use technical terms to describe major features.	Students' detailed design proposals. Feedback sheets. Observation of students as they participate in planned activities.
TP 3.3 Students cooperatively develop and follow production procedures to make products that reflect their design ideas.	Work together to describe and sequence steps. Follow identified production procedures. Modify procedures to suit changing circumstances. Monitor the quality of their work. Adhere to safety procedures.	Consultation with students to verify the evidence gathered. Observation of students as they participate in planned activities. Students' products.
TP 3.4 Students test and judge how effectively their own and others' processes and products meet the design challenge.	Carry out tests on products and processes. Make judgments about appropriateness. Rate effectiveness and efficiency. Make comparisons between different products. Identify requirements or constraints.	Peer and self-assessment sheets. Technology project folios. Students' presentations.

INF 3.1 Students describe advantages and disadvantages of different sources and forms of information.	Identify different sources of information that are appropriate to their needs. Compare information to determine appropriateness. Consider how different forms of information achieve different effects.	Observation of students as they participate in planned activities. Technology project folios.
INF 3.2 Students select and use techniques for generating, modifying and presenting information for different purposes.	Organise information and record data using tables they have designed. Use equipment such as scanners, digital cameras and computers to present information.	Technology project folios. Students' work samples.
MAT 3.1 Students choose materials according to various characteristics that best suit the product and user.	Identify a number of characteristics that make a material suitable. Identify purposes of products and describe how some materials support these purposes.	Observation of students as they participate in planned activities. Technology project folios. Students' work samples.
MAT 3.2 Students select and use suitable equipment and techniques to combine materials accurately in order to meet design requirements.	Combine materials accurately in order to meet design challenges. Select and use appropriate equipment for the task.	Observation of students as they participate in planned activities. Students' work samples. Students' products.
SYS 3.1 Students identify and describe relationships between inputs, processes and outputs in systems.	Identify inputs, processes and outputs in systems. Use simple flow charts, diagrams and drawings to record information. Describe the effects that may arise if an input or process is changed.	Technology project folios. Students' work samples.
SYS 3.2 Students assemble and trial systems they design by considering inputs, processes and outputs.	Design and assemble systems. Develop a system to achieve a specific output. Describe the function of components in a simple system. Trial systems they have designed.	Students' work samples. Peer and self-assessment.

In gathering evidence to make judgments about students' demonstrations of core learning outcomes, it may be necessary to look at the level before and after Level 3 The following table indicates evidence of the level after. Students may be demonstrating core learning outcomes at another level.

[This table spreads over two pages.]

Core learning outcomes	Anticipated evidence	Sources of evidence
TP 4.1 Students use consultative methods to gather knowledge, ideas and data when researching alternatives within design challenges.	Use a variety of sources and range of methods to gather information. Observe the products developed by others in order to incorporate features in their own designs.	Observations of students as they participate in planned activities. Anecdotal records. Consultation with students to verify the evidence gathered.
TP 4.2 Students generate design ideas through consultation and communicate these in detailed design proposals.	generate possible solutions and alternatives and communicate these to others. Plan and organise a consultation process. Annotate design ideas to show changes made following consultation. Collaborate with others to develop a range of design alternatives. Use lists and flow charts to identify what is needed to implement a proposal. Recognise the importance of scale in plans and draw plans from several views.	Detailed design proposals. Feedback sheets. Observations of students as they participate in planned activities.
TP 4.3 Students identify and make use of the practical expertise of others when following production procedures to make products for specific users.	Share and refine design ideas before commencing and at regular intervals throughout the production process by collaborating with peers or others with specialist knowledge. Document the decisions made while developing and modifying their products in their Technology project folios. Critically reflect on production processes to evaluate effectiveness and efficiency. Keep a working diary.	Consultation with students to verify evidence. Observations of students' participation in activities. Products.
TP 4.4 Students gather feedback to gauge how well their design ideas and processes meet design challenges and how effectively products meet the needs of specific users.	Use feedback to design criteria that could be used to select one design proposal from a range of alternatives. Reflect on their final design by comparing their finished product with their original idea. Demonstrate how their ideas evolved by presenting their product to others, pointing out special features and explaining why these features are included.	Feedback sheets. Peer- and self-assessment sheets. Technology project folios. Students' presentations.

Core learning outcomes	Anticipated evidence	Sources of evidence
INF 4.1 Students analyse sources and forms of information and match these to the requirements of design challenges.	Recount ways in which they have accessed and used information purposefully. Communicate ideas using clearly labelled diagrams and charts.	Observations of students as they participate in planned activities. Technology project folios.
INF 4.2 Students apply techniques for transforming and transmitting information for different audiences.	Record class ideas on how to translate one source of information into another. Convert data to graphical/ pictorial presentations. Consider which information is needed for special audiences when generating presentations or charts.	Technology project folios. Work samples.
MAT 4.1 Students explain how characteristics of materials affect ways they can be manipulated.	Conduct basic testing and comparison of materials. Compare the performance, function and cost of similar and different materials. Match characteristics and properties of materials to requirements.	Observations of students as they participate in planned activities. Technology project folios. Work samples.
MAT 4.2 Students employ their own and others' practical knowledge about equipment and techniques for manipulating and processing materials in order to enhance their products.	Select tools and materials to achieve their design purposes. Identify and discuss the effects that various materials have on: • cost • techniques used to manipulate the material • equipment used.	Observation of students as they participate in planned activities. Work samples. Students' products.
SYS 4.1 Students identify and explain the logic of systems and subsystems.	Identify and explain parts within a whole system. Identify how systems and subsystems work together. Alter subsystems to change the operation of a more complex system. Draw charts explaining the operation of systems and subsystems.	Technology project folios. Work samples.
SYS 4.2 Students incorporate feedback to refine and modify systems and/or subsystems.	creating flow charts and diagrams to devise and explain systems. Monitor and test system: • reliability • durability • efficiency • stability.	Work samples. Students' products. Peer- and self-assessment.

Background information

Terminology

In this module students have opportunities to become familiar with and use the following terminology:

hydroponics	monitor	reservoir
inputs	outputs	solenoid
irrigation	processes	timer

School authority policies

Teachers need to be aware of and observe school authority policies that may be relevant to this module.

Safety policies will be of particular relevance to some of the activities that follow. It is essential that teacher demonstrations and student activities are conducted according to procedures developed through appropriate risk assessments at the school.

In this module, teachers may need to consider safety issues relating to:

- chemical fertilisers
- equipment and materials
- sun safety.

Equity considerations

This module provides opportunities for students to increase their understanding and appreciation of equity and diversity within a supportive environment. It includes activities that encourage students to:

- be involved
- work individually or in groups
- value diversity of ability, opinion and experience
- value diversity of language and cultural beliefs
- support one another in their efforts
- become empowered to communicate freely
- negotiate
- accept change.

Some students with disabilities may need assistance with some activities. Advice should be sought from their support teachers. It is important that these equity considerations inform decision making about teaching strategies, classroom organisation and assessment.

Activities

Introductory activities: Traditional growing of plants

Focus

TP 3.1 Students examine knowledge, ideas and data from a range of sources and establish the relevance of this information when meeting design challenges.

INF 3.1 Students describe advantages and disadvantages of different sources and forms of information.

INF 3.2 Students select and use techniques for generating, modifying and presenting information for different purposes.

Activities

Start the activity by discussing where the food we eat comes from. Narrow the discussion to strawberries and tomatoes. 'How could we grow our own?'

Brainstorm 'What we know' and 'What we need to know'.

List ways to verify 'what we know' and find answers to 'what we need to know' — for example, by accessing encyclopaedias and the Internet and contacting local experts.

Use research activities to find information on growing strawberries and tomatoes. Collect written facts and clippings and present them on a display board.

Conduct a formal lesson on plants. Look at how plants grow and discuss root systems and leaves.

Refine 'what we need to know'. This may have increased after the initial research if students discovered areas where they didn't have much knowledge or the information they found presented them with more questions. Arrange the information into questions.

Find a local farmer preferrably one who grows tomatoes or strawberries and visit their farm.If feasible or invite the farmer to your classroom. Encourage students to present their questions to the expert and gain as much information they can. Stress that talking to experts is a good way of obtaining knowledge gained by someone else.

From the information gathered, draw up a large table with two columns headed 'What strawberries need' and 'What tomatoes need'. Brainstorm a list of the materials you will need to grow these plants.

Assessment

Sources of evidence could include:

- observation of students' participation in planned activities
- anecdotal records
- consultation with students to verify the evidence gathered.

Introductory activities: Hydroponics

Focus

TP 3.1 Students examine knowledge, ideas and data from a range of sources and establish the relevance of this information when meeting design challenges.

INF 3.1 Students describe advantages and disadvantages of different sources and forms of information.

INF 3.2 Students select and use techniques for generating, modifying and presenting information for different purposes.

Activities

Introduce the activity by conducting a brainstorming session to find out what the students know about hydroponics. Ask how we could learn more.

Search for information on hydronponics using the library and internet.Record this information in Technology project folios.

Divide the students into small groups and give each group an article on hydroponics. Ask the students to select facts from their article and write them on a slip of paper and place them in a pile. Sort out all the facts and group them under subheadings. Display all the information around the classroom for reference during the design challenge.

Visit a hydroponics farm if feasible to obtain information.Alternatively, invite someone with knowlegde and expertise in hydroponics to visit the class and work with the students. Look for similarities and differences between the traditional and hydroponic methods of growing strawberries and tomatoes.

Take note of the different methods of growing strawberries hydroponically.Discuss the positive and negative impacts and consequences of both systems. Use the Internet to email hydroponic farmers to gather more information.

Ask students to use the knowledge they have gained to design a hydroponic system for tomatoes and strawberries.

Assessment

Sources of evidence could include:

- anecdotal records
- consultation with students to verify the evidence gathered
- observation of students' participation in planned activities
- Technology project folios.

Developmental activities: Traditional growing of plants

Design challenge 1
Design and create a hydroponic system for growing strawberries and tomatoes.

Design challenge 2
Design and create an irrigation system for watering ground strawberries and tomatoes.

Focus

TP 3.2 Students collaboratively generate design ideas and communicate these using presentations, models and technical terms.

TP 3.3 Students cooperatively develop and follow production procedures to make products that reflect their design ideas.

TP 3.4 Students test and judge how effectively their own and others' processes and products meet the design challenge.

Select a patch of ground for growing the strawberries and tomatoes. Obtain seedlings (strawberries and tomatoes).

Assist students to work out how much ground they will need. They should know from their research that strawberries need to be more than 30 cm apart.

Pose a range of questions — for example, How many rows will you need? Should the rows be raised and why? How deep should you plant the seedlings? Students should compile a written report that includes as much of the information they have gathered as possible.

Repeat this investigation process for the irrigation system.Collect and record as much information as possible. The design of the irrigation system needs to be incorporated into the design of the garden bed.The irrigation system will need to be established before planting the seedlings.

Collect and discuss the written reports. Ask each student to use all the information they have to design a landscaping plan. Include a top-view to-scale plan of the patch that shows the layout of the plants and the irrigation system.

As a class, design a system for growing tomatoes and strawberries. Invite an expert from a local farm and an irrigation company (if available) to look at the system and offer advice. Stress to the students that advice from experts will help them in any project.

Once the design process is complete, construct the irrigation system and prepare and plant the strawberries and tomatoes.

Discuss any information the students discovered about disease and pests. Discuss and design a plan to combat these problems. Consider whether or not to use pesticides. Discuss the positive and negative impacts and consequences and invite the class to decide what would be best to use. Present the findings to the local farmer and ask for advice.

Establish and implement a plan to solve the problem of diseases and pests.

Design a system for monitoring the patch that includes watering and weeding and picking the strawberries and tomatoes.

Discuss what to do with the strawberries and tomatoes — for example, eat them or sell them.

Assessment

Sources of evidence could include:

- detailed design proposals
- feedback sheets
- observation of students' participation in planned activities
- consultation with students to verify the evidence gathered
- students' products.

Developmental activities: Hydroponics

Focus

SYS 3.1 Students identify and describe relationships between inputs, processes and outputs in systems.

SYS 3.2 Students assemble and trial systems they design by considering inputs, processes and outputs.

MAT 3.1 Students choose materials according to various characteristics that best suit the product and user.

MAT 3.2 Students select and use suitable equipment and techniques to combine materials accurately in order to meet design requirements.

Activities

Ask students to present their the hydoponic system design ideas, as an oral report and justify each decision they have made. Discuss the ideas and look for good points or potential problems.

As a class, design a hydroponic system for growing strawberries and tomatoes. Invite local hydroponic farmers (if available) to examine the designs and make comments or suggestions.

Students need to draw up a cross-section view of the design. Label all the parts and describe how the system will work.

Small groups of students should be involved in the construction of the strawberry and tomato systems. Involve the students in as much of the construction as possible.

Design a watering system. Over the first week, work out how long to set the digital timer for and how often.(if one is included in the plan) The plants should not be too dry, but too much water is a waste of valuable (and expensive) nutrients. Check that the potting medium is constantly moist and that the leaves are not yellow or curling, which indicates a lack of water or nutrients. As the plants get bigger, they will require more water and nutrients. If you are not sure how much they need, consult an expert.

Discuss any information the students discovered about disease and pests. Discuss and design a plan to combat these problems. Consider whether or not to use pesticides. Discuss the positive and negative impacts and consequences and invite the class to decide what would be best to use. Present the findings to the local farmer and ask for advice. If a local expert is not available, consider contacting an expert using the Internet.

Establish and implement a plan to solve the problem of diseases and pests.

Design a system for monitoring the patch that includes watering and weeding and picking the strawberries and tomatoes.

Assessment

Sources of evidence could include:

- observation of students' participation in planned activities
- Technology project folios
- students' work samples and products
- peer and self-assessment.

Culminating activities

Focus

In this phase students test and judge how effectively their own and others' processes and products meet the design challenge.

Activities

Brainstorm ways in which the success of the project can be measured.

Collect information about the strawberries and tomatoes. Once a week, count the flowers and green strawberries and record the data (Student resource 1). Graph this information using a comparative line graph and a spreadsheet. Grade the tomatoes and strawberries by mass and record how many are picked and how many are lost to pests or disease.

Assess the quality of the strawberries and tomatoes. Students can be encouraged to assess taste, appearance, size and weight. For example, mass all the strawberries and tomatoes that are picked and work out the mean, medium and mode.

Record any disease and pest problems. Outline the action that was taken and the results of the action.

Design and construct a survey to give to the people who eat the strawberries and tomatoes. Arrange the questions so that they allow a comparison of the traditional and hydroponic systems.

Once all the strawberries and tomatoes have been harvested, discuss ways in which the success of the various projects can be assessed. Consider comparing numbers and weight of fruit harvested, taste of fruit, length of harvest time, loss of fruit and to what pests and disease. Look at sales of fruit and when the fruit was most popular. Encourage students to design a survey for customers to determine what worked well and what could be improved — for example, packaging and presentation. Ask students to make inferences and recommendations for future projects.

Assessment

Sources of evidence could include:

- peer and self-assessment sheets
- student presentations
- Technology project folios.

Data collection sheet

Student resource 1

F — flowers **G** — green fruit **P** — picked fruit

	Hydroponic						**Ground**					
	Strawberries			**Tomatoes**			**Strawberries**			**Tomatoes**		
Week	F	G	P	F	G	P	F	G	P	F	G	P
1												
2												
3												
4												
5												
6												
7												
8												

Acknowledgments and support materials

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Resh, H. 1993, *Hydroponic Tomatoes for the Home Gardener,* Woodbridge Press Santa Barbara, California.

Taylor, J.D. 1983, *Grow More Nutritious Vegetables Without Soil*, Parkside Press Publishing, Santa Anna, California.

Websites

(All websites listed were accessed in September 2002.)

Ask an Expert, www.cln.org/int_expert.html/ Links to 'expert' websites.

Homegrown Hydroponics Inc, www.hydroponics.com/ General hydroponics information and resources.

Home Hydroponics, www.ext.vt.edu/pubs/envirohort/426-084/426-084.html/ Detailed information on hydroponics.

Pipe Dreams Hydroponics www.hydroponicsonline.com/ General information and hydroponics links.

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This sourcebook module should be read in conjunction with the following Queensland Studies Authority materials:

Years 1 to 10 Technology Syllabus

Years 1 to 10 Technology Sourcebook Guidelines

Technology Initial In-service Materials

Technology CD-ROM

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