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★E-learning Platform Features★

★ Interactive e-learning platform

The content of the textbook is paired with the interactive activities designed by the University of Hong Kong, enabling teachers to conduct interactive teaching with images, texts, audio and videos through computers, tablets or mobile phones.



★ School-based content

Teachers can post teaching materials and create interactive activities on the platform to cater to the unique needs of the students.



★ Printed and online materials

In addition to printed textbooks, schools can also opt for paperless e-books. Students can get access to the interactive teaching materials by scanning the QR code on the textbooks.



★ Rich teaching and learning resources

Our books provide a wealth of teaching materials, including PowerPoint, practice questions, fun facts, educational videos and simulation tools to meet different learning needs.

★ Interactive MC question bank

Teachers will view the students' performance once they have completed their online tests to better understand the learning needs of the students.

整體統計										
	1	2	3	4	5	6	7	8	9	10
分數	1	2	3	4	5	6	7	8	9	10
4	D	D	D	D	D	D	D	D	D	D
5	D	D	C	A	C	C	C	B	B	D
5	D	B	C	B	B	C	C	A	B	D
6	D	D	C	D	B	C	A	D	B	D
5	D	B	C	D	C	C	B	A	B	B
6	D	D	C	D	A	B	A	A	A	D



Our Characters



KEN

“Knowledge is power!”

Interest Learning new things

Character Strengths Optimistic, Curious



MAY



PAUL

“Let me help you!”

Interest Helping others

Character Strengths Kind, Passionate



“Eating well is the key to your success!”

Interest Enjoying food

Character Strengths Insistent, Sincere



LILY



KARL

“I always can learn from reading.”

Interest Reading and painting

Character Strengths Love of learning

“Discussion can open our mind.”

Interest Exchanging knowledge

Character Strengths Leadership

1

Introduction to Planting



Goals

- ◆ Recognise what is hydroponics
- ◆ Name the main elements for plant growth
- ◆ Sow a seed



Warm-up

Hydroponics is used to grow lettuce in the International Space Station.

Online Resource

Space in 4K - First Lettuce Grown and Eaten in Space

<https://www.youtube.com/watch?v=RqtAK-FBtXU>

Why do astronauts use hydroponics instead of traditional soil-based planting?



Class Activities



We are going to grow plants using a hydroponic system.

What is hydroponics?



Hydroponics is a farming technique that grows plants in water without soil. The term was created from Latin, “hydro” for water and “ponics” for working.



Fig.1 Hydroponic system

Plants require the following elements to grow successfully:

- sunlight
- air
- water
- nutrients
- grow medium

Mission: Sowing

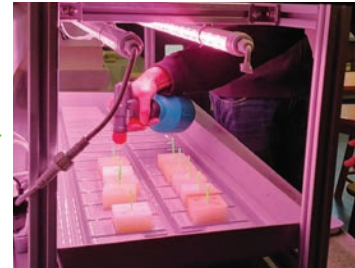
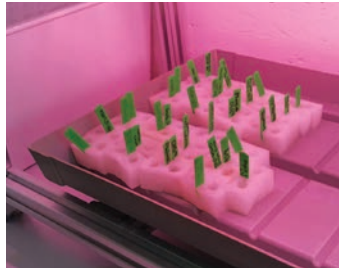
The first step of hydroponics is **sowing**. We put the seeds inside a suitable and stable environment, so that it will grow into a young plant.

Materials: sponge, seeds, clip, **germination system**



Fig.2 Germination system

- 1 Wet the sponge
- 2 Drop the seeds into the sponge
- 3 Put the sponge in the germination system
- 4 Spray the seeds with water



Consolidation

True or False Questions

Fill in a ✓ in ☐ next to a true statement and a ✗ in ☐ next to a false statement.

- ☐ Plants can grow without soil.
- ☐ Plants can grow without water.



Self-review

- ☒ I've learnt:
- ☐ To define what is hydroponics.
- ☐ To name the main elements for plant growth.



Self-review Exercise



2

Hydroponics System



Goals

- ◆ Identify components of a hydroponic system
- ◆ Recognise different types of hydroponic systems
- ◆ Distinguish different types of hydroponic grow media



Warm-up





Class Activities

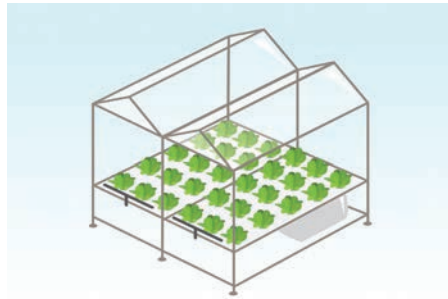






Fig.3 Hydroponic system

Component	Picture	Function
Raft		Hold the growth sponge. It is made of styrofoam so it floats on water.
Grow Bed		Hold the floating raft. It is run through by water.
Water Tank		Store all the water in the system.
Pump		Transfer water from the tank to the grow bed.

We are using a **Deep Water Culture** hydroponic system.

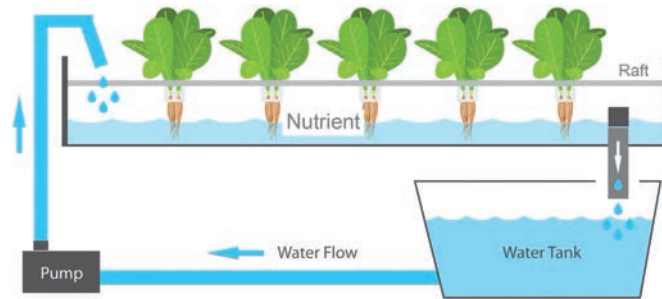


Fig.4 Deep Water Culture

There are other hydroponic systems as well, such as the **Nutrient Film Technique** (NFT) and the **Hydroponic Drip System**.



Fig.5 Examples of NFT



Fig.6 Example of Hydroponic Drip System

Besides choosing the hydroponic system, we also need to choose a grow medium for our plants.

Mission: Observing different grow media



Fig.7 Clay pebbles



Fig.8 Perlite(珍珠岩)



Fig.9 Rockwool(岩綿)



Fig.10 Cocopeat(椰糠)

Mission: Rebuilding the hydroponic system

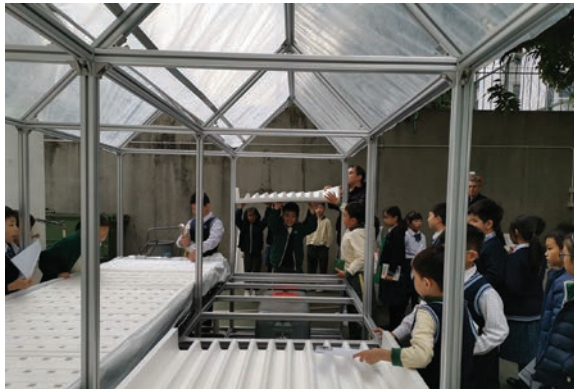


Fig.11 Rebuilding the hydroponic system

- 1 We are using as our grow medium.
- 2 This medium is hard / soft .



Consolidation

Matching

Water Tank	●	●	Hold the plants
Raft	●	●	Transfer water from water tank to grow bed
Pump	●	●	Hold the raft
Grow Bed	●	●	Store water



Self-review

☒ I've learnt:

- ☐ To identify components of a hydroponic system
- ☐ To recognise different types of hydroponic systems
- ☐ To distinguish different types of grow media



Self-review Exercise



3

Roots



Goals

- ◆ Recognise functions of seeds
- ◆ Identify parts of a seed



Warm-up

Online Resource <https://www.youtube.com/watch?v=pB4ASdELBbQ>

Unlike a fully grown plant, a seed cannot produce its own food. Where do seeds get their food from?



Class Activities

Seeds allow plants to make more plants like themselves, i.e. seeds allow **reproduction** of plants.

Seeds come in all shapes and sizes, it can be as tiny as a grain of salt or as large as your fingernail.



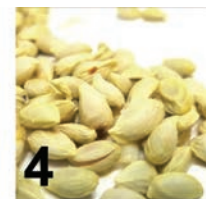
Lime



Tomato



Banana



Lemon



Starwberry



Pear



Mango



Star fruit

Fig.12 Examples of seeds

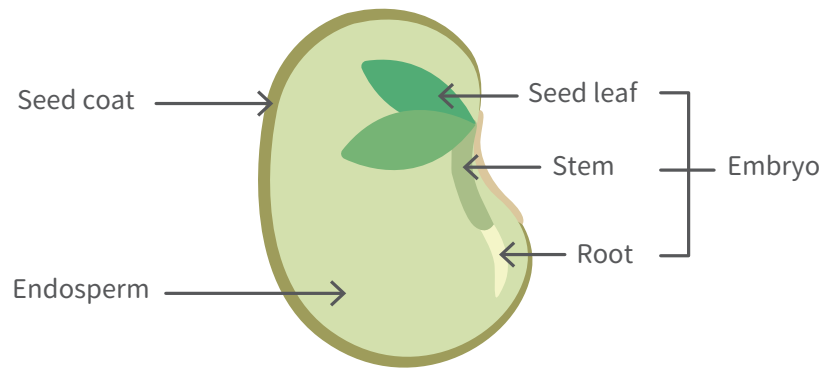


Fig.13 Inside a seed

	Function
Seed Coat	Protect the seed.
Embryo	The “baby plant”.
Food Store i.e. Endosperm	Store food for the baby plant.

True leaves are formed after the plant germinates. By then, most plants will perform photosynthesis and start producing food by themselves. It's important to remember not to transplant seedlings until they have some true leaves.



Fig.14 True leaves

Mission: Transplanting

After germination, we can transfer our seedlings from the sponge to the raft.

1 Carefully split the sponge



2 Observe the roots



3 Insert all roots into the hole



Fig.15 Transplanting



Consolidation

True or false questions

Fill in a ✓ in ☐ next to a true statement and a ✗ in ☐ next to a false statement.

- ☐ Seeds can germinate without soil.
- ☐ Plants can grow without water.
- ☐ True leaves can carry out photosynthesis to produce food for plants.



Self-review

- ☒ I've learnt:
- ☐ The functions of seeds
- ☐ To identify parts of a seed



Self-review Exercise



4

Nutrients



Goals

- ◆ Recognise main plant nutrients: NPK
- ◆ Recognise the importance of nutrients to plants
- ◆ Recognise the imbalance of nutrients through their leaves
- ◆ Test the Nutrient level in the hydroponic system
- ◆ Adjust the Nutrient level

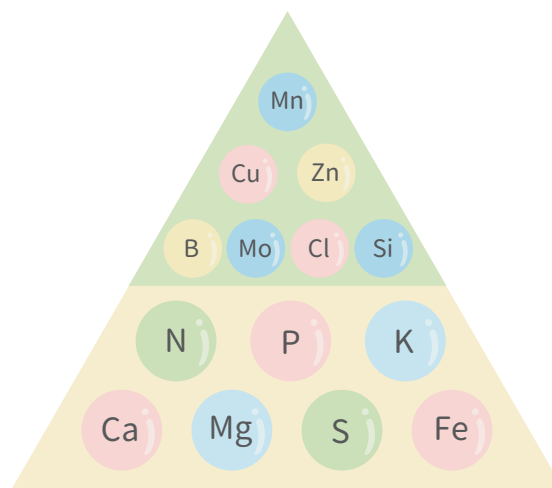


Warm-up

For Human



For Plants





Class Activities

Plants need seven major nutrients to grow healthily.

Major nutrients
Nitrogen Phosphate Potassium Calcium Magnesium Sulphate Iron

Among the major nutrients, the 3 most important nutrients are Nitrogen, Phosphate and Potassium.

	Nitrogen (N)	Phosphate (P)	Three (K)
Function	Supports growth of stems and leaves	Supports growth of roots	Supports growth of flowers and fruits

It is unhealthy for plants to have too much or too little nutrients. If we observe the following problems from their leaves, we may need to adjust our fertilizers.



Fig.16 Nutrient deficiency

If we do not provide a suitable amount of nutrients, fruits may be damaged.



Fig.17 Tomatoes and capsicum with not enough Calcium

Mission: Testing the Nutrient level in the hydroponic system

We can measure the Nutrient level by measuring the electrical conductivity (EC) of the water. Higher EC means more nutrient content. To grow lettuce, our target reading is 1.3.



Fig.18 Device for measuring electrical conductivity

- 1 Insert the bottom part of the device into the water
 - 2 It will display the EC reading in 2-3 seconds.
- 1 Colour of leaves: green / yellow / brown
 - 2 Structure: straight and upright / too soft, withering
 - 3 EC reading: The EC reading is lower than / equal to / higher than our target.

Mission: Adjusting the Nutrient level

- 1 Add Nutrient solution A and B
- 2 Let the pump runs for 10 minutes
- 3 Measure the EC again

- 1 Volume of Nutrient solution A added: mL
- 2 Volume of Nutrient solution B added: mL
- 3 New EC reading: The EC reading is lower than / equal to / higher than our target.



Consolidation

Matching

<u>Nutrients</u>		<u>Supports the growth of...</u>
Nitrogen (N)	●	● Stems and leaves
Phosphate (P)	●	● Flowers
Potassium (K)	●	● Roots



Self-review

- ☒ I've learnt:
- ☐ The main plant nutrients
 - ☐ The importance of nutrients to plants
 - ☐ The consequences of having not enough or too much nutrients
 - ☐ To measure and adjust the Nutrient level in hydroponic system



Self-review Exercise



5

Pests and Beneficial Insects



Goals

- ◆ Identify common pests and beneficial insects
- ◆ Recognise the importance of beneficial insects
- ◆ Recognise the damages brought by pests
- ◆ Identify tools for pest control
- ◆ Observe pests and beneficial insects



Warm-up

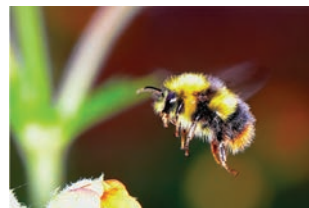
Online Resource

<https://www.youtube.com/watch?v=hsmmUFMmxVw&t=3s>

What can bees do?

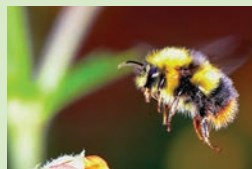


Class Activities



Bumble bees are one of the main pollinators for crops in greenhouses

Bumble bees



On the other hand, pests are harmful to plants. For example, aphids weaken the plant by sucking sap (樹汁); whiteflies transmit disease and cause sooty mould to grow on leaves.

Aphid	Caterpillar	Whiteflies
		

Table 1 Photo of crops damage by these Pests

There are some beneficial insects that can help us control pests in farming. For example,

Mantis	Green Lacewings	Lady bugs
		

Table 2 Beneficial insects



Fig.21 A weakened plant



Fig.22 Mouldy leaves cause by Whiteflies

To prevent pests from harming plants, farmers may use pesticides or fungicides, such as tree oil, mineral oil and chemical pesticide. In our case, we will be using yellow sticky traps to capture pests.



Fig.23 Yellow sticky traps in a Tomato green house



Fig.24 Pests captured in the trap

Pesticides

Pesticides are chemical substances that are meant to kill pests



Fig.25



Fig.26

Natural pesticides are organic pesticides that are derived from plants



Fig.27 Neem Oil



Fig.28

Mission: Observing pests and insects



Consolidation

True or false questions

Fill in a ✓ in ☐ next to a true statement and a ✗ in ☐ next to a false statement.

- ☐ All insects are harmful to plants.
- ☐ We can only use chemical pesticides to control pests.



Self-review

- ☒ I've learnt:
- ☐ To identify common pests and beneficial insects
- ☐ The importance of beneficial insects
- ☐ The damages brought by pests
- ☐ Common pest control techniques
- ☐ To observe pests and beneficial insects



Self-review Exercise



6

Seeds



Goals

- ◆ Recognise the functions of roots
- ◆ Identify two types of roots
- ◆ Name common root vegetables
- ◆ Distinguish between roots and tubers
- ◆ Transplant a young plant / Harvest



Warm-up



How does the plant stay upright absorb water and nutrients?



Class Activities

Most of the time, the roots of a plant are buried in the soil. In some cases, roots can also be aerial (located above the ground or above water).



Fig.29 Example of roots in soil



Fig.30 Example of aerial roots

Functions of roots include:

- 1 Absorbing water and nutrients
- 2 Storing food and nutrients
- 3 Fixing plants to the ground

There are two main types of roots: tap root and fibrous root.

Tap Root	Fibrous Root
One main root growing down from the plant's stem	No main root
Lots of smaller secondary roots branching off from the main root	Lots of roots growing in many directions.

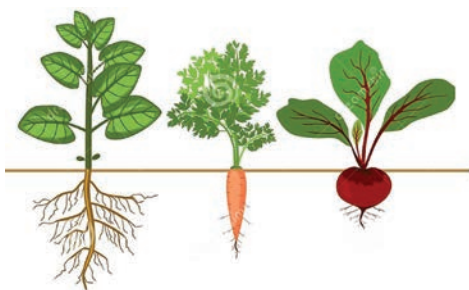


Fig.31 Tap root system



Fig.32 Fibrous root system

Some common vegetables are roots that grow underground, such as carrots and onions.



Are potatoes roots as well?



No, potatoes are tubers.

Tubers are enlarged structures in plant to store nutrients. Tubers and roots look similar, but they are not the same!

Mission: Harvest

- 1 Grab the bottom part of the lettuce with both hands
- 2 Gently pull the lettuce out
- 3 Wrap up the root around the bottom
- 4 Observe the roots
- 5 Put the lettuce in the bag



KIND REMINDER

- Do not cut or remove the root, otherwise the lettuce will dehydrate quickly
- Do not eat the root
- The best way to enjoy the lettuce is to make a salad with it; if you stir fry the lettuce, it will shrink because water content is removed by the high heat

Mission: Observing the root's structure

Take a picture / draw your observation below:

- 1 Length: cm
- 2 Width: cm
- 3 Our plants have tap root / fibrous root.



Consolidation

True or False Questions

Fill in a ✓ in ☐ next to a true statement and a ✗ in ☐ next to a false statement.

- ☐ A plant with fibrous roots has no main root.
- ☐ Carrots are root vegetables.



Self-review

- ☒ I've learnt:
- ☐ The functions of roots
- ☐ To Identify two types of roots
- ☐ To name common root vegetables
- ☐ To distinguish between roots and tubers



Self-review Exercise



7

pH Value



Goals

- ◆ Recognise the importance of pH value and water temperature to plants
- ◆ Measure pH value



Warm-up



We can replace soil with water, how about soft drinks?

No, soft drinks are unhealthy for both humans and plants!



Soft drink tastes salty / sour .



Class Activities

In terms of chemistry, sour liquids are acidic. We use **pH value** to measure how acidic or basic a liquid is, it ranges from 0 to 14.

	Acidic	Neural	Basic / Alkaline
pH value	0-6	7	8-14
Taste	Sour	Tasteless	Soapy
Example	Coca-cola, vinegar	Pure water	Soap water

pH value affects the availability of plant nutrients. Availability of nutrients depends on the pH value of the grow medium.

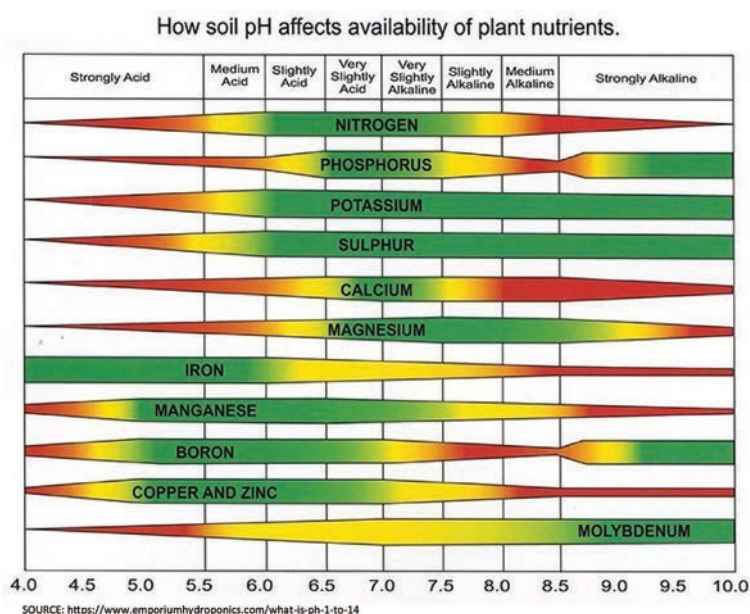


Fig.37 Availability of plant nutrients under different pH values

The ideal pH level for our hydroponic system is 5.5 to 6. If the pH level deviates from the ideal level, plants may not be able to grow successfully.

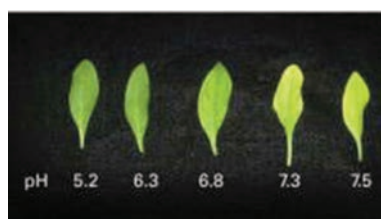


Fig.38 Leaves grown under different pH values



Fig.39 Flower grown under different pH values

Mission: Measuring pH value

We will use pH testing strip to measure pH value of the water.



Fig.40 pH testing strip

- 1 Dip the pH testing strip into water
- 2 Compare the testing strip's colour with the sample.

1 pH value of water:

2 This is suitable / not suitable for plants because .

Mission: Measuring water temperature



Consolidation

True or false questions

Fill in a ✓ in ☐ next to a true statement and a ✗ in ☐ next to a false statement.

- ☐ pH value does not affect availability of plant nutrients.
- ☐ Distilled water (pH value = 7) is the best for growing plants.
- ☐ The ideal environment for plants is slightly acidic.



Self-review

- ☒ I've learnt:
- ☐ The importance of pH value to plants
- ☐ The consequences of imbalance pH value
- ☐ To measure pH value and water temperature



Self-review Exercise

.....○

8

Harvest, Discussion and Reflection



What have you learnt from hydroponic?

1 How did you cook your vegetables? How does it taste?

2 If you were to sell your vegetables, what would be the price?

3 Have you done grocery shopping before? Do you remember how much does lettuce cost?

4 Can we grow food at home? Why and how?

5 How can we improve our hydroponic system, so that we can grow more vegetables at school?

6 Is it fun to grow? What vegetable or plant would you like to grow in the future?

7 Did you learn more about farming? Will you treasure your food from today onwards?

Other Questions

- How long does it take to grow a lettuce?
- What is the difference between our hydroponic system, and the hydronic system in the International Space Station?