S1 Topic 11

Water Purification and the Water Cycle

Level: S1
Topic: Water purification, further treatment of water, and the water cycle (Sections 5.1 – 5.3 of Unit 5)

Introduction:

For the topic ‘Water purification and the water cycle’, teachers may find that their students have some difficulty to master the large number of process names involved and to describe what happens during the processes in English. This set of ELA materials is designed to provide writing practices for students so that they will use the process names in context; students are also guided to describe in writing the various processes involved in water purification and the water cycle.

There are three ELAs in this set of materials:

ELA1 Water Purification
ELA2 Further Treatment of Water
ELA3 The Water Cycle.

Each ELA lasts for about one period.

ELA1 Lesson Plan – Water Purification

Description: This ELA covers Section 5.1 of Unit 5 of the CDC Science syllabus. It assumes that Chinese medium lessons have been conducted in which students carry out experiments to purify muddy pond water using sedimentation, filtration and distillation. Key terms in English were introduced as the Chinese terms when explained. In the first part of this lesson, the teacher consolidates the concepts about water purification in Chinese and revises all key terms in English. Then, students will be asked to suggest appropriate methods for separating the various components in different liquid mixtures, using English.

Content Objectives: After completing the activity, students should be able to:

- distinguish the purposes of sedimentation, filtration, and distillation;
- suggest appropriate methods for separating the various components in a liquid mixture.

Language Objectives: After completing the activity, students should be able to:

- understand and use the English terms related to water purification (e.g., *removing impurities from water, purification, purify, pure, sedimentation, settle, filtration, filter, distillation, distill, impurities, soluble, insoluble,*
- understand and use the English expressions for describing methods of water purification shown in pictures, e.g.,
  - *The process of removing impurities from water is called water purification.*
  - *Sedimentation, filtration and distillation are methods of water purification.*
  - *During the process of sedimentation, large or heavy insoluble impurities settle at the bottom of the container.*
  - *During the process of distillation, water is heated and becomes steam. Steam then cools down as water when it passes into another container. Both the soluble and insoluble impurities in water are left behind.*
  - *During the process of filtration, water passes through a filter and the insoluble impurities in water are left behind.*
- Discuss appropriate methods for separating the components in liquid mixtures, e.g.,

- *In what way can we remove only red beans from an iced red bean drink?*
  A suitable method to do so is by sedimentation. During the process, red beans settle at the bottom of the glass. Filtration is not a suitable method because it will also remove the ice.

- *In what way can we remove the flowers and leaves from a glass of flower tea?*
  A suitable method to do so is by filtration. During the process, flower tea passes through a filter and the flowers and leaves are left behind. Sedimentation is not a suitable method because the flowers float.

- *In what way can we obtain pure water from seawater?*
  A suitable method to do so is by distillation. During the process, seawater is heated and becomes steam. Steam then cools down as pure water when it passes into another container. Salt in seawater is left behind.

- *In what way can we remove the seeds from a glass of kiwi juice?*
  A suitable method to do so is by filtration. During the process, kiwi juice passes through a filter and the seeds in kiwi juice are left behind.

Activities:
1. Revision – whole-class activity and pair work (15 min)
2. Identifying and describing a suitable method for separating substances in various cases – pair work (25 min)

Materials: Worksheet, Slides which provide practice in identifying and describing the methods for separating substances from different liquid mixtures

Steps:

Revision – whole-class activity and pair work (15 min)

1. The teacher distributes the worksheet to the class and asks them to work in pairs to complete Part B of the worksheet.

(N.B. The part of speech is indicated for each word. During the consolidation, the teacher should help students to distinguish the use of the two forms of a word, such as 'purification' and 'purify'. The difference should be illustrated using sentences which show how the word is used, rather than asking students to memorise the part of speech each word belongs to.)

2. The teacher checks the answers and explains any difficult words.

3. The teacher asks some students to take turn to read aloud the descriptions. Each student should only read one description so that more students could be involved.

Identifying and describing a suitable method for separating substances in various cases – pair work (25 min)

4. The teacher asks students to complete Part C of the worksheet. They are asked to follow the sentence pattern found in Part B to complete the descriptions in Part C.

5. Depending on students' ability, the teacher may work together with the class using Question Item 1 as an example.

6. The teacher asks students to crosscheck the answers with their partner for any grammatical mistakes before checking the answers with the whole class.

7. The teacher provides students with more opportunity to practise by showing them pictures of some liquid mixtures (see the attached slides) and asks them to identify and describe orally the methods for separating the substances from the mixtures.

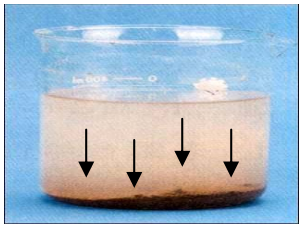
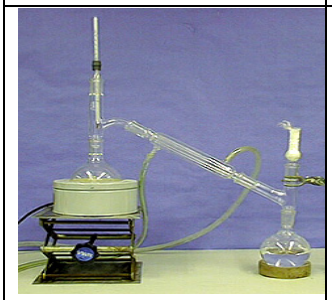
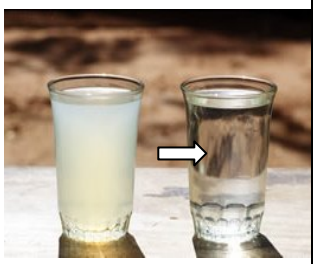
Water Purification 水的淨化

A. Vocabulary:

purification 淨化 (n.)	purify 淨化 (v.)	pure 純淨的 (adj.)
sedimentation 沈積法 (n.)	settle 沈澱 (v.)	
filtration 過濾法 (n.)	filter 過濾 (v.)	filter 過濾器 (n.)
distillation 蒸餾法 (n.)	distill 蒸餾 (v.)	
impurities 雜質 (n.)	soluble 可溶的 (adj.)	insoluble 不可溶的 (adj.)

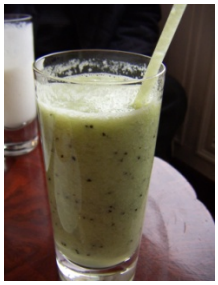
B. The following pictures are about water purification.

Complete the sentences next to each picture using the words provided above.

	1. This process (過程) is called _____. During the process, large or heavy _____ impurities _____ at the bottom of the container (容器).
	2. This process is called _____. During the process, water is heated and becomes steam. Steam then cools down into water when it passes into another container. Both the _____ and _____ impurities in water are left behind.
	3. This process is called _____. During the process, water passes through a _____ and the _____ impurities in water are left behind.
	4. The process of removing _____ from water is called water _____. Sedimentation, filtration and distillation are methods of water _____.

C. How are the substances separated in each of the following cases?

First, name a method for separating the substances in each case. Then, describe what happens during the process.

1. Removing only red beans from an iced red bean drink 	A suitable method to do so is by _____. During the process, red beans _____ _____
2. Removing the flowers and leaves from a glass of flower tea 	A suitable method to do so is by _____. During the process, flower tea _____ _____
3. Obtaining pure water from seawater 	A suitable method to do so is by _____. During the process, seawater _____ _____ _____
4. Removing the seeds from a glass of *kiwi juice*(奇異果果汁) 	A suitable method to do so is by _____. During the process, kiwi juice _____ _____

Water Purification 水的淨化

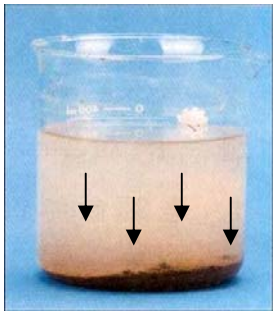
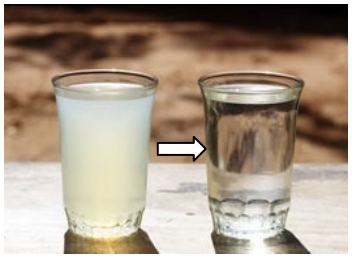
Answers

A. Vocabulary:

purification 淨化 (n.)	purify 淨化 (v.)	pure 純淨的 (adj.)
sedimentation 沈積法 (n.)	settle 沈澱 (v.)	
filtration 過濾法 (n.)	filter 過濾 (v.)	filter 過濾器 (n.)
distillation 蒸餾法 (n.)	distill 蒸餾 (v.)	
impurities 雜質 (n.)	soluble 可溶的 (adj.)	insoluble 不可溶的 (adj.)

B. The following pictures are about water purification.

Complete the sentences next to each picture using the words provided above.

	1. This process (過程) is called *sedimentation*. During the process, large or heavy *insoluble* impurities *settle* at the bottom of the container (容器).
	2. This process is called *distillation*. During the process, water is heated and becomes steam. Steam then cools down as water when it passes into another container. Both the *soluble* and *insoluble* impurities in water are left behind.
	3. This process is called *filtration*. During the process, water passes through a *filter* and the *insoluble* impurities in water are left behind.
	4. The process of removing *impurities* from water is called water *purification*. Sedimentation, filtration and distillation are methods of water *purification*.

C. ***How are the substances separated in each of the following cases?***
First, name a method for separating the substances in each case. Then, describe the process briefly.

1. Removing only red beans from an iced red bean drink 	A suitable method to do so is by *sedimentation*. During the process, red beans *settle at the bottom of the glass.* *Note: Filtration is not a suitable method because it will also remove the ice.*
2. Removing the flowers and leaves from a glass of flower tea 	A suitable method to do so is by *filtration*. During the process, flower tea *passes through a filter and the flowers and leaves are left behind.* *Note: Sedimentation is not a suitable method because the flowers float.*
3. Obtaining pure water from seawater 	A suitable method to do so is by *distillation*. During the process, seawater *is heated and becomes steam. Steam then cools down as pure water when it passes into another container. Salt in seawater is left behind.*
4. Removing the seeds from a glass of *kiwi juice*(奇異果果汁) 	A suitable method to do so is by *filtration*. During the process, kiwi juice *passes through a filter and the seeds in kiwi juice are left behind.*

ELA1: Slides which provide opportunities for students to practise identifying and describing the methods for separating substances from different liquid mixtures.

Methods of Water Purification

ELA Research Team, OUHK
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- How are the substances separated in each of the following cases?
  - First, name a method for separating the substances in each case.
  - Then, describe what happens during the process.

2

Obtaining water from a cup of coffee

3

Removing beans from
a bowl of sweet green bean soup

4

Removing tea leaves from a cup of tea

Credit: Wikimol; available at http://commons.wikimedia.org/wiki/File:Tea_leaves_steeping_in_a_zhong_%C4%8Daj_05.jpg

Removing pulp (果肉) from orange juice

6

ELA2 Lesson Plan –Further Treatment of Water

Description: This ELA covers Section 5.2 of Unit 5 of the CDC Science syllabus. At the beginning of the lesson, students are asked to watch part of an ETV programme for junior secondary science. The programme is in Cantonese and introduces some methods to kill micro-organisms in drinking water and explains why fluoride is added to water. After the ETV programme is shown, the lesson is conducted in English. Students are asked to complete a worksheet and state the purpose of each type of water treatment.

Content Objectives:

After completing the activity, students should be able to:

- list the ways of killing micro-organisms in water;
- list the advantages and disadvantages of treating drinking water with chlorine and ozone; and
- explain why fluorides are added to drinking water.

Language Objectives:

After completing the activity, students should be able to:

- understand and use the English terms related to water treatment (e.g., *water purification methods, add, chlorine, chlorination, fluoride, fluoridation, ozone, ultraviolet light, micro-organism, tooth decay*);
- name the substance or treatment that can be used to kill the micro-organisms in water (e.g., *chlorine, ozone, and ultraviolet light*); and
- state the purpose of each type of water treatment, e.g.,
  - *Chlorination is the process of adding chlorine to tap water to kill the micro-organisms.*
  - *Fluoridation is the process of adding fluoride to tap water to prevent tooth decay.*
  - *Ultraviolet light is used to kill the micro-organisms water of drinking fountains.*
  - *Ozone is added to water in swimming pools to kill the micro-organisms in it.*

Activities:

1. 觀看教育電視節目(部分片段)及討論 — 全班 (25 分鐘)
2. Completing the worksheet – pair work (20 min)

Materials: 教育電視【初中科學科】節目「食水處理」(可在「香港教育城」的教育資源庫網頁下載 http://resources.hkedcity.net/resource_detail.php?rid=1298022783), Worksheet, Textbook

Steps:

觀看教育電視節目(部分片段)及討論 — 全班 (25 分鐘)

1. 老師利用提問方式跟學生溫習淨化食水的三個方法，並引導學生指出香港的濾水廠是使用沉積法和過濾法來淨化食水。
2. 老師可帶領學生討論以下問題：
    1. 怎樣保證食水處於無菌狀態？
    2. 為甚麼要使用含氟化物的牙膏？

    老師不必提供答案，只著學生留心觀看節目從中找出答案。

3. 老師播放「食水處理」0:00 – 2:10 及 5:51 – 19:25 兩部分片段。這兩部分的片段包括了四部份內容：(1) 食水處理的兩個階段--「前期處理」及「後期處理」、(2) 氯氣殺菌、 (3) 臭氧殺菌 及 (4) 食水加氟。(2:21 – 5:50 一段是介紹在實驗室和工業上製造氯氣的方法及濾水廠內處理氯氣的安全措施。因為內容比較技術性和深奧，故可省略播放。)
4. 老師簡單地跟學生重溫節目中的要點，然後著他們閱讀教科書內相關的章節，並邀請學生指出書本中哪一項為食水殺菌的方法是電視節目中沒有提到的。
5. 老師指出使用紫外線殺菌能有效、快速殺死水中的細菌，但因為系統要求食水緩慢地流經紫外光燈，故此只適合使用作飲水機消毒食水之用。
6. 為配合下一節的 ELA，每當介紹一種處理食水的方法時，老師可將中、英文關鍵詞寫在黑板上，並讀出該詞彙。

Completing the worksheet – pair work (15 min)

7. The teacher distributes the worksheet and goes through the vocabulary in Part A again to make sure that students can pronounce the words correctly.
8. Students are asked to complete Part B and Part C of the worksheet in pairs. They can refer to their textbook for information.
9. The teacher checks the answers with the class. In the process, some students are asked to write the answers of Part C on the blackboard, and the class judge whether each answer is acceptable in terms of content and grammar.
10. The teacher may round up the activity by asking questions similar to those found in the worksheet, and some students are asked to answer them without referring to the worksheet. Examples of the questions are:
    - What can be added to tap water to kill micro-organisms?
    - What is the purpose of adding fluoride to tap water?

Treatment of Water 食水的進一步處理

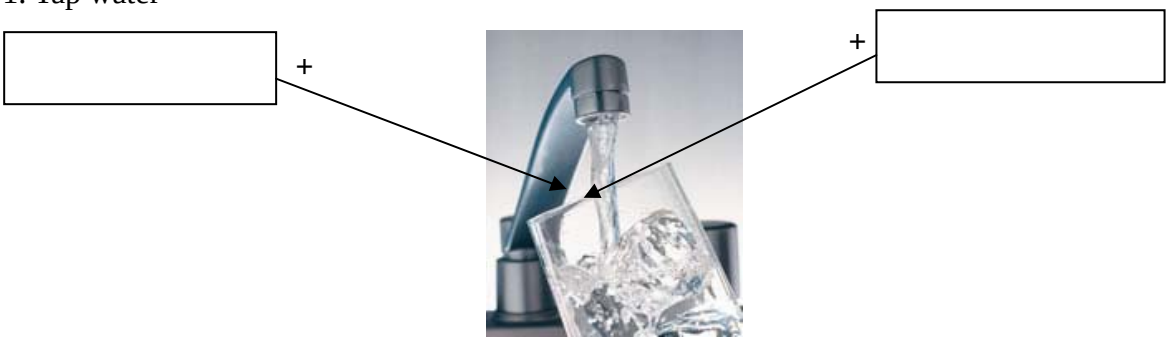
A. Vocabulary:

chlorine 氯	fluoride 氟化物	ozone 臭氣	ultraviolet light 紫外光
chlorination 加氯處理	fluoridation 加氟處理	micro-organisms 微生物	tooth decay 蛀牙

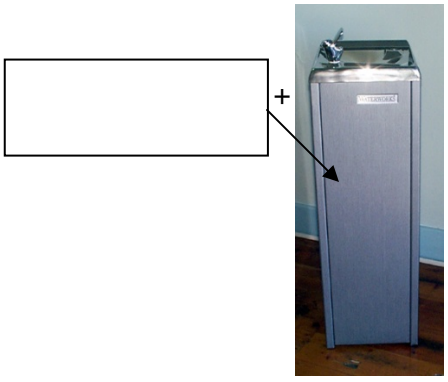
B. What kind of treatment is done to water in the following pictures?

In each box, put down the substance or treatment that is added to the water.

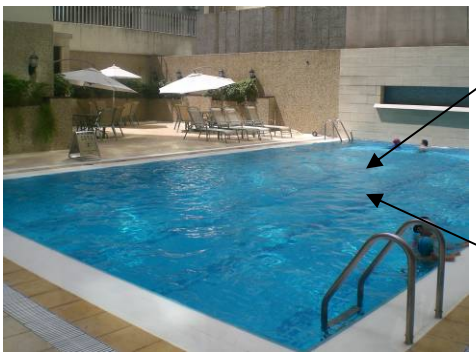
1. Tap water



2. Water in drinking fountains



3. Water in swimming pools



C. What is the purpose (目的) of each of the above types of water treatment?

What is added?	***Where?***	***Purpose?***
Chlorine	tap water water in drinking fountains water in swimming pools	kill the micro-organisms
Fluoride		
Ozone		prevent tooth decay
Ultraviolet light		

E.g. *Chlorine **is added to** water in swimming pools **to** kill the micro-organisms.*

Write four sentences to explain the purpose of adding different substances in water. The first answer has been written for you. Write the other sentences using the same sentence pattern of example 1.

1. Chlorine ***is added to*** *water in swimming pools* ***to*** *kill the micro-organisms.*

2. _____

3. _____

4. _____

Further Treatment of Water 食水的進一步處理

Answers

A. Vocabulary:

chlorine 氯	fluoride 氟化物	ozone 臭氣	ultraviolet light 紫外光
chlorination 加氯處理	fluoridation 加氟處理	micro-organisms 微生物	tooth decay 蛀牙

B. What kind of treatment is done to the following water?

In each box, put down the substance or treatment that is added to the water.

1. Tap water

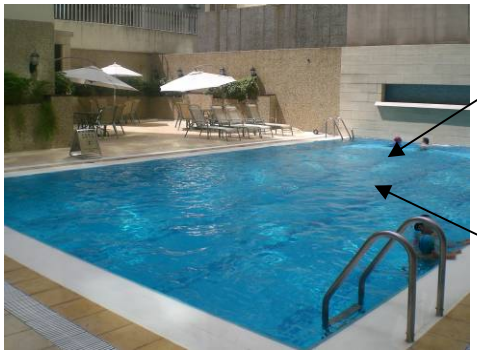
chlorine OR chlorination +

+ *fluoride OR fluoridation*

2. Water in drinking fountains

ultraviolet light +

3. Water in swimming pools



chlorine OR chlorination

+

OR

+

ozone

C. What is the purpose (目的) of each of the above types of water treatment?

What is added?	***Where?***	***Purpose?***
Chlorine	tap water water in drinking fountains water in swimming pools	kill the micro-organisms
Fluoride		
Ozone		prevent tooth decay
Ultraviolet light		

Write four sentences to explain the purpose of adding different substances in water. The first answer has been written for you. Write the other sentences using the same sentence pattern of example 1.

1. *Chlorine is added to tap water to kill the micro-organisms.*

2. *Fluoride is added to tap water to prevent tooth decay.*

3. *Ultraviolet light is added to water in drinking fountains to kill the micro-organisms.*

4. *Ozone is added to water in swimming pools to kill the micro-organisms.*

ELA3 Lesson Plan – The Water Cycle

Description: This ELA covers Section 5.3 of Unit 5 of the CDC Science syllabus. Chinese medium lessons have been used to introduce the process of rain formation, using an experimental approach. In the follow-up discussion to the experiment, English key terms, such as *evaporation* and *condensation*, were introduced together with their Chinese equivalents. In this ELA lesson, students will work in pairs to complete a worksheet about the water cycle. Then, some students are asked to present in English the steps in the water cycle, based on hints in the picture provided.

Content Objectives: After completing the activity, students should be able to describe the water cycle.

Language Objectives: After completing the activity, students should be able to:

- understand and use the English terms related to the water cycle (e.g., *evaporation, evaporate, condensation, condense, raining, rain, water vapour, water droplets, heat, cool*
- name the processes in the water cycle in English: evaporation, condensation, and raining;
- describe the water cycle in simple English, e.g.,
  - *The sun heats up the earth.*
  - *Water evaporates from seas, lakes, rivers, ground surfaces and plants to form water vapour.*
  - *Water vapour rises to the upper part of the sky.*
  - *Because the upper part of the sky is cooler, water vapour condenses to form water droplets.*
  - *Water droplets gather together and form clouds.*
  - *When the water droplets in the clouds grow bigger, they may fall to the ground as rain.*

Activities:

1. Revision – whole-class activity (10 min)
2. Worksheet completion – pair work (20 min)
3. Oral presentation of the water cycle – whole-class activity (10 min)

Materials: Worksheet, Slides which serve as prompts for students to describe the water cycle

Steps:

Revision – whole-class activity (10 min)

1. 老師利用提問方式跟學生溫習之前進行的實驗「雨的形成」的要點。英文關鍵詞已在之前做實驗的時候引入，在複習的時候，老師再跟學生重溫一次這些關鍵詞的串法及讀音。

Worksheet completion – pair work (20 min)

2. The teacher asks students to work in pairs to complete the worksheet.

3. The teacher checks the answers and explains any difficult words in Part C of the worksheet.

4. The teacher tells the class that they will be asked to describe to the class the water cycle in English without referring to the worksheet. Students are asked to practise reading out the paragraph in Part C to each other in the pairs.

5. The teacher monitors the class while students work in pairs and provide guidance where necessary.

Oral presentation of the water cycle – whole-class activity (10 min)

6. The teacher shows the class some pictures of the water cycle, each highlighting a process in the cycle (see the attached slides). Students are asked to describe orally the processes in the cycle based on the hints provided by the picture to their neighbours. The teacher provides guidance during supervision.

7. After practice by pair work, the teacher asks a few students each to present one part of the water cycle to the class.

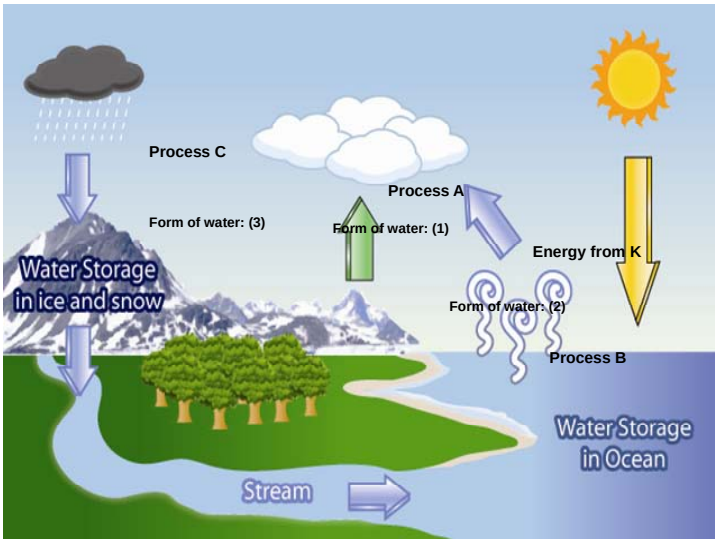
The Water Cycle 水循環

A. Vocabulary:

evaporation 蒸發 (n.)	condensation 凝結 (n.)	raining 降雨 (n.)	water vapour 水汽 (n.)
evaporate 蒸發 (v.)	condense 凝結 (v.)	rain 雨水 (n.)	water droplets 小水滴 (n.)

B. Label the following diagram of the water cycle.

Choose the words provided above to label Processes A-C and Forms of Water (1)-(3).



Energy form	K:		
Process	A:	B:	C:
Form of water	(1)	(2)	(3)

C. Complete the following paragraph about the water cycle.

In the following paragraph, the second half of each sentence is missing. Use the phrases provided below to complete the paragraph.

bigger	the earth	to the upper part of the sky	to form water vapour
cooler	form clouds	to the ground as rain	to form water droplets

The sun heats up _____. Water evaporates from seas, lakes, rivers, ground surfaces and plants _____. Water vapour rises _____ _____. Because the upper part of the sky is _____, water vapour condenses _____. Water droplets gather (聚集) together and _____. When the water droplets in the clouds grow _____, they may fall _____.

The Water Cycle 水循環

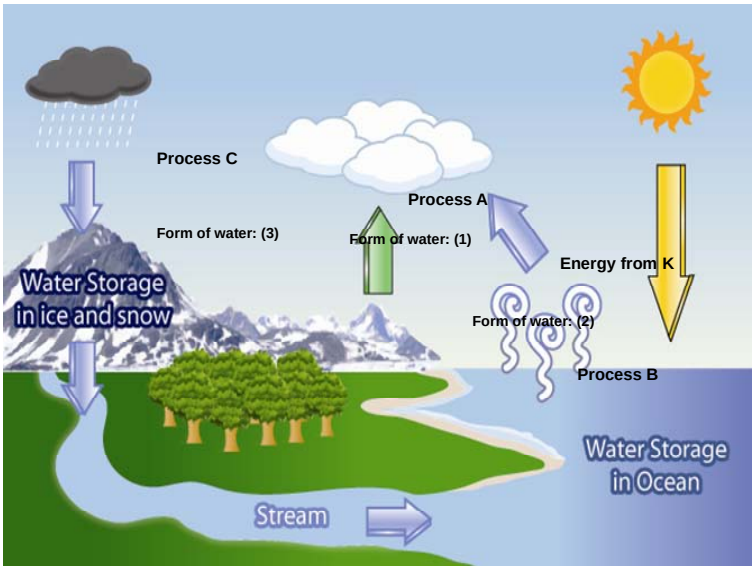
Answers

A. Vocabulary:

evaporation 蒸發 (n.)	condensation 凝結 (n.)	raining 降雨 (n.)	water vapour 水汽 (n.)
evaporate 蒸發 (v.)	condense 凝結 (v.)	rain 雨水 (n.)	water droplets 小水滴 (n.)

B. Label the following diagram of the water cycle.

Choose the words provided above to label Processes A-C and Forms of Water (1)-(3).



Energy form	K: *heat (energy)*		
Process	A: *condensation*	B: *evaporation*	C: *raining*
Form of water	(1) *water droplets*	(2) *water vapour*	(3) *rain*

C. Complete the following paragraph about the water cycle.

In the following paragraph, the second half of each sentence is missing. Use the phrases provided below to complete the paragraph.

bigger	the earth	to the upper part of the sky	to form water vapour
cooler	form clouds	to the ground as rain	to form water droplets

The sun heats up *the earth*. Water evaporates from seas, lakes, rivers, ground surfaces and plants *to form water vapour*. Water vapour rises *to the upper part of the sky*. Because the upper part of the sky is *cooler*, water vapour condenses *to form water droplets*. Water droplets gather (聚集) together and *form clouds*. When the water droplets in the clouds grow *bigger*, they may fall *to the ground as rain*.

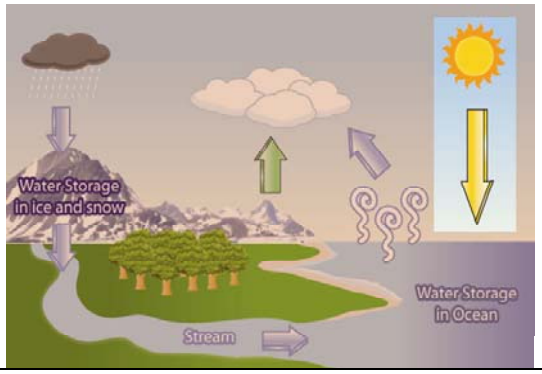
ELA3: Slides which serve as prompts for students to describe the water cycle

The Water Cycle

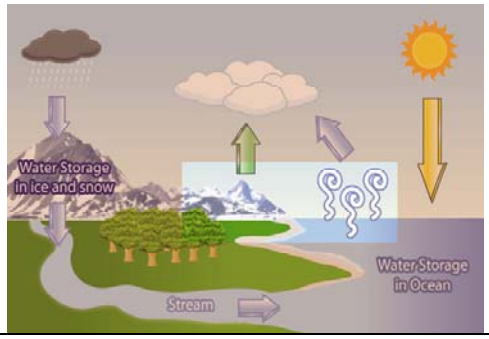
- Describe the processes involved in the water cycle based on the hints from the following pictures.

2

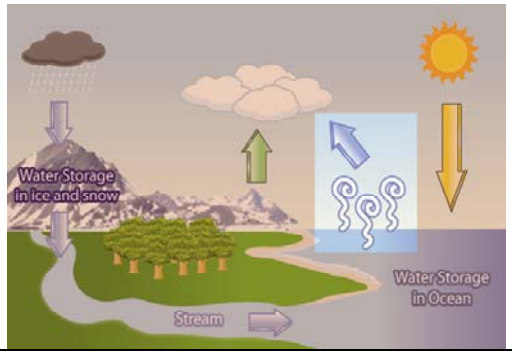
(1) the sun / the earth



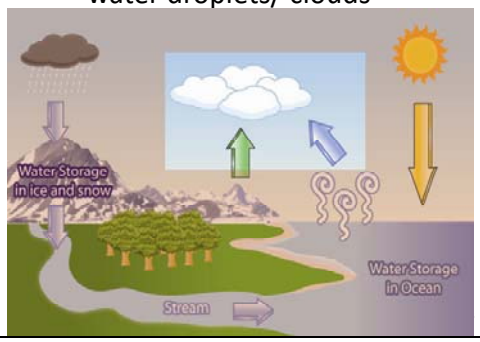
(2) water/ from seas, lakes, rivers, ground surfaces and plants / water vapour



(3) water vapour/ upper part of the sky



(4) upper part of the sky/ cooler; water vapour/ water droplets; water droplets/ clouds



(5) water droplets in the clouds/ bigger; the droplets/ rain