S1 Topic 13

States of Matter and the Particle Model

Level: S1

Topic: States of matter, and the particle model for the three states of matter (Sections 6.1 & 6.3 of Unit 6)

Introduction:

This set of ELA materials is designed to help students consolidate what they have learned about the properties of solids, liquids and gases. Activities are also designed in which students will be asked to describe the three states of matter using the particle model.

The set comprises three ELAs, namely:
ELA1 States of matter
ELA2 The particle model for the three states of matter
ELA3 Connect-four

Students acquire the English vocabulary and key points about the subject content in ELA1 and ELA2. Then in ELA3, students have to practise using the vocabulary they have learned to play the game ‘connect-four’.

ELA1 Lesson Plan—States of Matter

Description: This activity is an extension of Section 6.1 – States of matter – in the CDC syllabus. The topic is first taught using Chinese as the medium of instruction and with English terms in the vocabulary list being introduced at the same time. In the ELA, students are asked to complete the worksheet making use of what they have learned about the topic in the Chinese medium lessons. The worksheet has been designed so that the non-scientific vocabulary is relatively simple and students can complete the tasks using the English terms they have learned without much difficulty. The teacher then provides feedback on the answers and highlights the sentence patterns used for description.

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

- use English to describe the macroscopic properties of matter in the three states;
- identify some common examples of solids, liquids and gases.

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

- understand and use the English terms related to states of matter (e.g., *states of matter, solid, liquid, gas, fixed volume, fixed shape, heat, melt, turn into, boil, condense, freeze, properties, fixed volume, shape*);
- name the three states of matter in English: *solid*, *liquid* and *gas*;
- name some common examples of solids, liquids and gases, e.g.,
  - *solids: glass rod, salt, a rubber stopper, ice, a coin, a candle*
  - *liquids: water, petrol, oil*
  - *gases: air, steam, hydrogen, oxygen, town gas, camping gas.*
- understand and use appropriate English expressions for describing the macroscopic properties of matter in the three states, e.g.,
  - *The three states of matter are solid, liquid and gas.*
  - *Solids have a fixed volume and shape.*
  - *Liquids have a fixed volume but no fixed shape.*
  - *Gases have no fixed volume and shape.*
- understand and use appropriate English expressions for describing changes in states of matter, e.g.,
  - *What happens when we heat a solid and a liquid?*
    A solid will melt and turn into a liquid.
    A liquid will boil and turn into a gas.
  - *What happens when we cool a liquid and a gas?*
    A liquid will freeze and turn into a solid.
    A gas will condense and turn into a liquid.

Activities:

1. 複習 – 全班活動 (10 min)
2. Completing a worksheet – pair work (20 min)
3. Speaking practice – pair work (10 min)

Materials: Worksheet

Steps:

複習 – 全班活動 (10 min)

1. 老師利用提問方式跟學生重溫物質三態、各物態的特質及物態的變化。英文關鍵詞已在之前教學的時候引入，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。

Completing a worksheet – pair work (20 min)

2. The teacher should first distribute the worksheet to the class and ask them to work in pairs to complete it.

   (As the worksheet is usually printed in black and white, it may be difficult for students to identify the solids, liquids and gases in the pictures shown in Q5 to Q7. The teacher can project the worksheet with coloured pictures onto a screen while students are working on it.)

3. The teacher should then check the answers and explain any difficult words in the worksheet.

Speaking practice – pair work (10 min)

4. Students will work in pairs; each will take turns to read aloud the questions and the answers in Part B of the worksheet.

5. The teacher should monitor the class while students are working in their pairs and provide guidance where necessary.

6. As a round-up of the activity, two or three pairs of students should be asked to read aloud to the class the questions and the answers.

7. Finally, the teacher should ask the class to review the pronunciation of the difficult words in the worksheet at home and inform them that they are going to play a game a couple of lessons later, using the English terms they have learned.

States of Matter 物態

A. Vocabulary:

Solid 固體 Liquid 液體 Gas 氣體	Fixed volume 固定體積 Fixed shape 固定形狀	Melt (v.) 熔化 Boil (v.) 沸騰 Condense (v.) 凝結 Freeze (v.) 凝固

B. Answer the following questions by filling in the blanks

1. What are the three states of matter?

The three states of matter are _____, _____ and _____.

2. What are the properties (特性) of solids, liquids and gases?

Solids have _____ volume and shape.

Liquids have _____ volume but _____ shape.

Gases have _____ volume and shape.

(*Write "**a fixed**" or "**no fixed**" in the above blanks.*)

3. What happens when we heat a solid and a liquid?

A solid will _____ and turn into a liquid.

A liquid will _____ and turn into a gas.

4. What happens when we cool a liquid and a gas?

A liquid will _____ and turn into a solid.

A gas will _____ and turn into a liquid.

(For Q5 to Q7, write the name under each picture.)

5. What are the following solids?

		
a.	b.	c.
		
d.	e.	f.

6. What are the following liquids?

g.

(What is pumped into the car?)

h.

i.

j.

k.

l.

7. What are the following gases?

m.

(What is the gas inside the balloons?)

n.

o.

煤氣 Towngas

p.

(What is the gas inside the can?)

q.

r.

States of Matter 物態

Answers

A. Vocabulary:

Solid 固體 Liquid 液體 Gas 氣體	Fixed volume 固定體積 Fixed shape 固定形狀	Melt (v.) 熔化 Boil (v.) 沸騰 Condense (v.) 凝結 Freeze (v.) 凝固

B. Answer the following questions by filling in the blanks

1. What are the three states of matter?
The three states of matter are *solid*, *liquid* and *gas*.

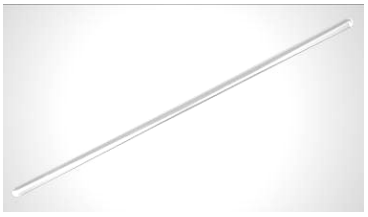
2. What are the properties (特性) of solids, liquids and gases?
Solids have *a fixed* volume and shape.
Liquids have *a fixed* volume but *no fixed* shape.
Gases have *no fixed* volume and shape.
(*Write "**a fixed**" or "**no fixed**" in the above blanks.*)

3. What happens when we heat a solid and a liquid?
A solid will *melt* and turn into a liquid.
A liquid will *boil* and turn into a gas.

4. What happens when we cool a liquid and a gas?
A liquid will *freeze* and turn into a solid.
A gas will *condense* and turn into a liquid.

(For Q5 to Q7, write the name under each picture.)

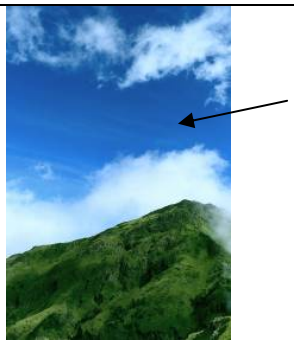
5. What are the following solids?

<table>
<tr>
<td> 
a. glass rod</td>
<td> 
b. salt</td>
<td> 
c. rubber stopper</td>
</tr>
<tr>
<td> 
d. ice</td>
<td> 
e. coin</td>
<td> 
f. candle</td>
</tr>
</table>

6. What are the following liquids?

 g. *water*	 *(What is pumped into the car?)* h. *petrol*	 i. *corn oil*
 j. *alcohol*	 k. *milk*	 l. *tea*

7. What are the following gases?

 m. *steam*	 (What is the gas inside the balloons?) n. *hydrogen*	 o. *oxygen*
煤氣 Towngas p. *town gas*	 (What is the gas inside the can?) q. *camping gas*	 r. *air*

ELA2 Lesson Plan—The particle model for the three states of matter

Description: This activity is an extension of Section 6.3 – The particle model for the three states of matter – in the CDC syllabus. The English terms in the vocabulary list in the worksheet may have been introduced in immediately after the concepts had been taught in the Chinese medium Science lessons, or at the end of the lesson or of the section. The ELA activity worksheet will be given to students at the end of Section 6.3 as a way of consolidating their understanding of the English terms and for general revision.

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

- state that all matter is made up of particles;
- compare the differences in the arrangement of particles in solids, liquids and gases;
- compare the difference in the movement of particles in solids, liquids and gases.

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

- understand and use the English terms related to the particle model for the three states of matter (e.g., *particles, vibrate, a regular pattern, slide, close together, far apart, move freely,*
- understand and use the appropriate English expressions for discussing the particle model for the three states of matter, e.g.,
  - *What is matter made up of?*
    Matter is made up of particles.
  - *How are the particles arranged in a gas, a liquid and a solid?*
    The particles of a solid are in a regular pattern, but the particles of a liquid and a gas are not in a regular pattern.
    The particles of a solid and a liquid are close together, but the particles of a gas are far apart.
  - *How do the particles move in a gas, a liquid and a solid?*
    The particles of a gas move freely in all directions.
    The particles of a liquid slide over each other.
    The particles of a solid vibrate at a fixed position.

Activities:

1. 複習 – 全班活動 (5 min)
2. Completing a worksheet – individual work (10 min)
3. Speaking practice – pair work (5 min)

Materials: Worksheet

Steps:

複習 – 全班活動 (5 min)

1. 老師利用提問方式跟學生重溫粒子理論的幾個要點: 物質是由粒子所組成；粒子之間存有空間；粒子是不停地運動著… 等等。英文關鍵詞已在之前教學的時候引入，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。

Completing a worksheet – individual work (10 min)

2. The teacher should first distribute the worksheet to the class and ask them to complete it.

3. Then the teacher should check the answers and explain any difficult words in the worksheet.

Speaking practice – pair work (5 min)

4. Students will work in pairs; each will take turns to read aloud the questions and the answers in Part B of the worksheet.

5. The teacher should monitor the class while students are working in their pairs and provide guidance where necessary.

6. As a round-up of the activity, two to three pairs of students should be asked to read aloud to the class the questions and the answers.

7. Finally, the teacher should tell the class to review the pronunciation of the difficult words in the worksheet at home as they are going to play a game in class next lesson, using all the English terms and phrases that they have learned today.

The particle Model for the Three States of Matter 模擬物質三態的粒子模型

A. Vocabulary:

particles 粒子 a regular pattern 有規則的模式 close together 相距很近 far apart 相距很遠	vibrate 振動 slide 滑動 move freely 自由移動

B. Answer the following questions by filling in the blanks

1. What is matter made up of?

Matter is made up of _____.

2. How are the particles arranged (編排) in a gas, a liquid and a solid?

The particles of a solid _____ (*are/ are not*) in a regular pattern, but the particles of a liquid and a gas _____ (*are/ are not*) in a regular pattern.

The particles of a solid and a liquid are _____ (*close together/ far apart*), but the particles of a gas are _____ (*close together/ far apart*).

3. How do the particles move in a gas, a liquid and a solid?

The particles of a gas _____ (*vibrate/ slide/ move freely*) in all directions.

The particles of a liquid _____ (*vibrate/ slide/ move freely*) over each other.

The particles of a solid _____ (*vibrate/ slide/ move freely*) at a fixed position.

Answers

The Particle Model for the Three States of Matter 模擬物質三態的粒子模型

A. Vocabulary:

particles 粒子 a regular pattern 有規則的模式 close together 相距很近 far apart 相距很遠	vibrate 振動 slide 滑動 move freely 自由移動

B. Answer the following questions by filling in the blanks

1. What is matter made up of?

Matter is made up of *particles*.

2. How are the particles arranged (編排) in a gas, a liquid and a solid?

The particles of a solid *are* (*are/ are not*) in a regular pattern, but the particles of a liquid and a gas *are not* (*are/ are not*) in a regular pattern.

The particles of a solid and a liquid are *close together* (*close together/ far apart*), but the particles of a gas are *far apart* (*close together/ far apart*).

3. How do the particles move in a gas, a liquid and a solid?

The particles of a gas *move freely* (*vibrate/ slide/ move freely*) in all directions.

The particles of a liquid *slide* (*vibrate/ slide/ move freely*) over each other.

The particles of a solid *vibrate* (*vibrate/ slide/ move freely*) at a fixed position.

ELA3 Lesson Plan—Connect-four

Description: Connect-four is a game similar to tic-tac-toe, in which a player has to get four checkers in a row in order to win the game. This game acts as a revision activity for the topic 'States of matter and the particle model'. Students have learned the English terms and English key points already; they have to apply the language and the concepts they have learned in the previous two lessons to complete the game.

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

- describe the macroscopic properties of matter in the three states;
- classify matter into solids, liquids and gases;
- compare the arrangement of particles in solids, liquids and gases;
- compare the movement of particles in solids, liquids and gases.

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

- understand and use the English terms related to the particle model for the three states of matter (e.g., *solid, condense, liquid, particles, close together, move freely in all directions, regular pattern, fixed shape, slide over each other, melt, fixed volume, vibrate at a fixed position, boil, gas, far apart, freeze.*)
- name common examples of solids, liquids and gases in English;
- describe in simple English the macroscopic properties of matter in the three states, e.g.,
  - *How are the particles arranged in a gas, a liquid and a solid?*
    The particles of a solid are in a regular pattern, but the particles of a liquid and a gas are not in a regular pattern.
    The particles of a solid and a liquid are close together, but the particles of a gas are far apart.
  - *How do the particles move in a gas, a liquid and a solid?*
    The particles of a gas move freely in all directions.
    The particles of a liquid slide over each other.
    The particles of a solid vibrate at a fixed position.
- understand instructions in English on how to play the 'Connect-four' game, e.g.,
  - *The class will be divided into two groups for a competition using the Connect-four Game.*
  - *The game board is placed on a visualizer so that the whole class can see the game and participate in the competition.*
  - *The picture cards are placed in two piles (pink cards and yellow cards) face down.*
  - *Each group takes turns to pick up one of their cards and match it to the description written on the board. Before they place a card on a description written on the board, they have to read aloud (correctly) the English term written on the card and the description written on the board.*
  - *The first player to get four cards in a row wins. The row can be vertical, horizontal or diagonal.*
  - *If time allows and there are eight sets of game boards and picture*

cards ready, the game can be played again in groups, with half of the group members playing against the other half.

Activity: Game – Whole-class or group work (40 min)

Materials: Connect-four game board, picture cards–sets A & B (in pink and yellow colours or two other colours), visualizer

Steps:

Game – Whole-class or group work (40 min)

1. The teacher should first briefly revise with students the worksheets, *States of Matter* and *Particle Model for the Three States of Matter*.

2. The teacher should then explain that the class will be divided into two groups for a competition using the Connect-Four Game. He/she may show the game board and the picture cards to the class using a visualizer.

3. The teacher should then explain the steps for playing Connect-four:
   a. The game board is placed on a visualizer so that the whole class can see the game and participate in the competition.
   b. The picture cards are placed in two piles (pink cards and yellow cards) face down.
   c. Each group should take turns to pick up one of their cards and match it to the description written on the board. Before they place a card on a description written on the board, they have to read aloud (correctly) the English term written on the card and the description written on the board.
   d. The first player to get four cards in a row wins. The row can be vertical, horizontal or diagonal.

4. If time allows and there are eight sets of game boards and picture cards ready, the game can be played again in groups, with half of the group members playing against the other half.

Connect-four Game Board

It is a solid.	**It can condense.**	**It is a liquid.**	**The particles are close together.**	**The particles move freely in all directions.**
The particles are not in a regular pattern.	**It has a fixed shape.**	**It has no fixed shape.**	**It is a solid.**	**The particles slide over each other.**
It can melt.	**It has a fixed volume.**	**It has no fixed volume.**	**The particles vibrate at a fixed position.**	**It is a liquid.**
The particles are in a regular pattern.	**It can boil.**	**It is a gas.**	**The particles are far apart.**	**It can freeze.**

Picture cards – Set A

*(Print this set of picture cards on a piece of **yellow** paper.)*

 glass rod	 coin	 rubber stopper	 water	 milk
 corn oil	 steam	 camping gas	 oxygen	

Picture cards – Set B

*(Print this set of picture cards on a piece of **pink** paper.)*