S2 Topic 1

Air Composition and Gas Properties

Level: S2

Topic: What is air made up of? (Section 7.1 of Unit 7)

Introduction:

This set of ELA materials is designed to consolidate what students have learned about the composition of air and the properties of some common gases. It consists of two ELAs. They are:

ELA1 Air Composition and Gas Properties

ELA2 The Memory Game and Quiz

ELA2 consists of a game and a quiz. The game aims to provide speaking practice for students in an enjoyable atmosphere; and the quiz is designed to assess the extent to which students have mastered the major subject content in English. Rewards can be given to students who achieve a certain mark or above in the quiz for positive reinforcement and to make the process of learning through English more enjoyable.

Each ELA lasts for one period.

Acknowledgement

The teaching materials were provided by the teachers of Pui Ying Secondary School and revised by the ELA research team.

ELA1 Lesson Plan— Air composition and Gas Properties

Description: The ELA is designed to consolidate what students have learned about the composition of air and the properties of some common gases in air, using English.

In the teaching of this topic through the medium of Chinese, English terms (see vocabulary list in the worksheet) were introduced together with their Chinese equivalents. In this lesson, the teacher first reviews the subject content in English, with the aid of PowerPoint slides. Then students are asked to carry out a writing task by completing a passage in a worksheet. After that, they are asked to read out the passage (speaking practice), which prepares them for the memory game and quiz that will be organized in the next lesson.

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

- state the percentage of the main gases which are found in air
- state the tests for nitrogen, oxygen, carbon dioxide and water;
- compare the composition of breathed and unbreathed air.

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

- understand and use the English terms related to this topic (e.g., air composition, gas properties, nitrogen, oxygen, carbon dioxide, water vapour,
- name the main gases in air: *nitrogen, oxygen, carbon dioxide and water vapour*; *breathed air, unbreathed air, mixture, glowing splint, relight, hydrogencarbonate indicator, lime water, milky, dry cobalt chloride paper, food packages, living cells, alive, soft drinks, fire extinguishers, variable, remains the same*
- understand and use the English expressions and phrases of *mixture of, % by volume, can be tested with, changes from __ to __*) to describe or explain air composition and tests for common gases in air, e.g.,
  - *Air is a mixture of gases, including nitrogen, oxygen, carbon dioxide, water vapour and some other gases present in air.*
  - *Nitrogen is about 78% by volume in air. It is used to fill up food packages in order to exclude oxygen and extend their shelf life. Liquid nitrogen is used to store living cells. There is no simple test for nitrogen.*
  - *Oxygen is about 21% by volume in air. It keeps all living things alive. It can be tested with a piece of glowing splint, which relights in oxygen.*
  - *Carbon dioxide is about 0.03% by volume in air. It is used to make soft drinks and fire extinguishers. It can be tested with a hydrogencarbonate indicator or lime water. The hydrogencarbonate indicator changes from red to yellow, whereas the lime water changes from colourless to milky in carbon dioxide.*
  - *The amount of water vapour in air is variable. Water also keeps all living things alive. Water or water vapour can be tested with a piece of dry cobalt chloride paper, which changes from pink to blue in water.*

- understand and use the comparative terms *more than* and *less than* to describe the differences in gas content between breathed and unbreathed air, e.g.,
  - *When we breathe, we take oxygen from air and release carbon dioxide and water vapour to air. There is less oxygen, more carbon dioxide, and more water vapour in breathed air than unbreathed air. The amount of nitrogen in breathed and unbreathed air remains the same.*

Activities:
1. Revision – whole class activity (15 min)
2. Completing a worksheet – individual work (15 min)
3. Speaking practice – group work (10 min)

Materials: Slides for revisionD:\data\Extended Learning Activities\Final Report\Final Report 13 December 2010\Final Report 13 December 2010\ELA Materials\Science\S2 Air Composition and Gas Properties.ppt, Worksheet

Steps:

Revision – whole class activity (15 min)

1. With the aid of PowerPoint slides, the teacher should first revise the composition of air and properties of some common gases with the class. Students should then be given opportunities to practise constructing sentences which show the differences in terms of gas content between breathed and unbreathed air.
2. At the end of the revision, the teacher should make sure that students can pronounce the key terms listed in the vocabulary list correctly.

Completing a worksheet – individual work (15 min)

3. The teacher should distribute the worksheet to the class and ask them to complete the passage using the information they have just revised. Students should be asked to cross-check their answers with their classmates after they have finished the worksheet.
4. The teacher should then check the answers and explain any difficult words in the descriptions. He/she may ask some students to write the answers on the blackboard and have the class check the spellings.

Speaking practice – group work (10 min)

5. The teacher should ask some students to take turns to read part(s) of the passage in the completed worksheet.
6. In groups of two or three, students should then be asked to take turns to read parts of the passage to one another.
7. The teacher should monitor the class and provides guidance where necessary.

8. The teacher should round up the lesson by going through terms that most students have difficulty in pronouncing and by telling them to revise the worksheet at home because they will play a game and have a quiz in the next lesson, based on the content of the worksheet.

Air Composition and Gas Properties 空氣的成份及氣體的特性 – Worksheet

A. Vocabulary:

mixture 混合物	glowing splint 帶星火木條	food packages 食品包裝
nitrogen 氮	relight(s) 重燃	living cells 活細胞
oxygen 氧	hydrogencarbonate indicator 碳酸氫鹽指示劑	alive 活著的
carbon dioxide 二氧化碳		soft drinks 汽水
water vapour 水蒸氣	lime water 石灰水	fire extinguishers 滅火器
breathed air 經呼吸的氣體	milky 乳濁	Variable 可變的
unbreathed air 未經呼吸的氣體	dry cobalt chloride paper 乾燥氯化鈷試紙	remains the same 保持一樣

B. Complete the following passage by filling in the blanks

(Note: Some of the words may not be found in the above table, and you may need to use some words more than once.)

What is air made up of?

Air is a (1)_____ of gases, including (2) _____, (3) _____, (4) _____, and (5) _____. There are also other gases present in air, but their quantities are very small.

Nitrogen is about (6)_____% by volume in air. It is used to fill up (7) _____ in order to exclude (排除) oxygen and extend their *shelf life* (儲存期限). Liquid nitrogen is used to store (8) _____. There is no simple test for nitrogen.

Oxygen is about 21 % (9) _____ in air. It keeps all living things (10) _____. It can be tested with a piece of (11) _____, which (12) _____ in oxygen.

Carbon dioxide is about 0.03 % (13) _____ in air. It is used to make (14) _____ and (15) _____. It can be (16) _____ a hydrogencarbonate indicator or (17) _____. The hydrogencarbonate indicator changes from red to (18) _____, and lime water (19) _____ colourless to milky in carbon dioxide.

The amount of water vapour in air is (20) _____. Water also keeps all living things (21) _____. Water or water vapour (22) _____ a piece of dry cobalt chloride paper, which changes (23) _____ _____ _____ _____in water.

When we breathe, we take (24)_____ from the air and release (25)_____ and (26)_____. There is (27) _____ oxygen, (28) _____ carbon dioxide, and (29) _____ water vapour in breathed air than unbreathed air. The amount of nitrogen in breathed and unbreathed air (30)_____.

Answers

Air Composition and Gas Properties 空氣的成份及氣體的特性 – Worksheet

A. *Vocabulary:*

mixture 混合物	glowing splint 帶星火木條	food packages 食品包裝
nitrogen 氮	relight(s) 重燃	living cells 活細胞
oxygen 氧	hydrogencarbonate indicator 碳酸氫鹽指示劑	alive 活著的
carbon dioxide 二氧化碳		soft drinks 汽水
water vapour 水蒸氣	lime water 石灰水	fire extinguishers 滅火器
breathed air 經呼吸的氣體	milky 乳濁	variable 可變的
unbreathed air 未經呼吸的氣體	dry cobalt chloride paper 乾燥氯化鈷試紙	remains the same 保持一樣

B. *Complete the following passage by filling in the blanks*

(Note: Some of the words may not be present in the above table, and you may need to fill in the same word more than once.)

What is air made up of?

Air is a (1)*mixture* of gases, including (2)*nitrogen*, (3)*oxygen*, (4)*carbon dioxide*, and (5)*water vapour*. There are also other gases present in air, but their quantities are very small.

Nitrogen is about (6)*78*% by volume in air. It is used to fill up (7)*food packages* in order to exclude (排除) oxygen and extend their *shelf life* (儲存期限). Liquid nitrogen is used to store (8)*living cells*. There is no simple test for nitrogen.

Oxygen is about 21% (9) *by volume* in air. It keeps all living things (10)*alive*. It can be tested with a piece of (11)*glowing splint*, which (12)*relights* in oxygen.

Carbon dioxide is about 0.03% (13) *by volume* in air. It is used to make (14)*soft drinks* and (15)*fire extinguishers*. It can be (16) *tested with* a hydrogencarbonate indicator or (17)*lime water*. The hydrogencarbonate indicator changes from red to (18)*yellow*, and lime water (19)*changes from* colourless to milky in carbon dioxide.

The amount of water vapour in air is (20)*variable*. Water also keeps all living things (21)*alive*. Water or water vapour (22) *can be tested with* a piece of dry cobalt chloride paper, which changes (23)*from pink to blue* in water.

When we breathe, we take (24) *oxygen* from air and release (25) *carbon dioxide* and (26) *water vapour* to air. There is (27) *less* oxygen, (28) *more* carbon dioxide, and (29) *more* water vapour in breathed air than unbreathed air. The amount of nitrogen in breathed and unbreathed air (30) *remains the same*.

ELA1 – Slides for Revision

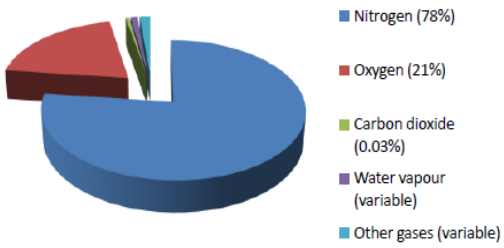
Composition of Air and Gas Properties
空氣的成份及氣體的特性

ELA Research Team, OUHK
January 2010

1

Air is a mixture of gases

The normal composition of air



2

Nitrogen is used to ...

- fill up food packages

- store living cells (liquid nitrogen)

Plant shoot tips are stored in liquid nitrogen.

3

Oxygen keeps all living things alive

4

Carbon dioxide is used to make ...

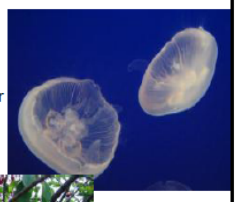
- soft drinks

- fire extinguishers

Water keeps all living things alive

Human body:
60 - 70% water

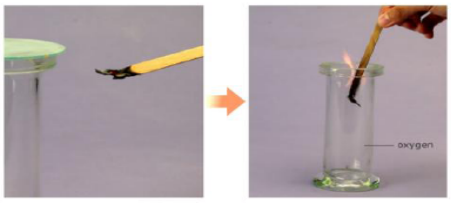
Jellyfish:
94 – 98% water



Plant body:
up to 90% water

(Source of information: Wikipedia)

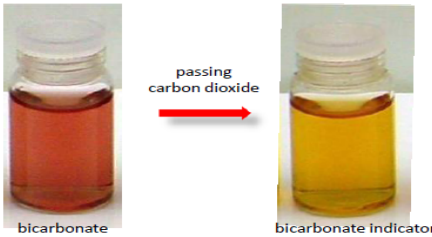
Test for oxygen



A glowing splint

The glowing splint relights

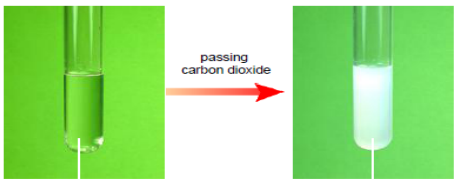
Test for carbon dioxide (1)



bicarbonate indicator

bicarbonate indicator turns yellow

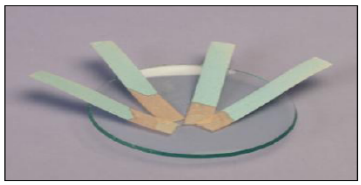
Test for carbon dioxide (2)



limewater

limewater turns milky

Test for water



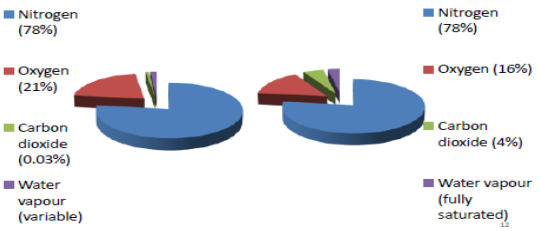
Dry cobalt chloride paper changes from blue to pink

Test for nitrogen

- There is no simple test for nitrogen

Comparing the gas content between

Unbreathed air and **Breathed air**



Comparing the gas content between unbreathed and breathed air

- Which one, unbreathed or breathed air, contains:
  - More oxygen;
  - More carbon dioxide;
  - More water vapour?
- What is the difference in the amount of nitrogen between unbreathed and breathed air?

Vocabulary

mixture混合物	glowing splint 帶星火木條	food packages 食品包裝
nitrogen 氮	relight 重燃	living cells 活細胞
oxygen 氧	hydrogencarbonate indicator 碳酸氫鹽指示劑	alive 活著的
carbon dioxide 二氧化碳		soft drinks 汽水
water vapour 水蒸氣	limewater 石灰水	fire extinguishers 滅火器
breathed air 經呼吸的氣體	milky 乳濁	variable 可變的
unbreathed air 未經呼吸的氣體	dry cobalt chloride paper 乾燥氯化鈷試紙	

ELA2 Lesson Plan—Memory Game and Quiz

Description: ELA2 is an activity to revise all English terms students have learned in ELA1. It consists of a game and a quiz. The game, called 'The memory game', requires students to pick up game cards which contain information about the properties of some common gases and match them with another card showing the name of the gas. After playing the game, there will be a quiz to assess students' achievement in using English to express key points in this topic.

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

- state the percentage of main gases in air
- state the tests for nitrogen, oxygen, carbon dioxide and water;
- compare the composition of breathed and unbreathed air.

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

- understand and use the English terms related to this topic (e.g., air composition, gas properties, nitrogen, oxygen, carbon dioxide, water vapour,
- name the main gases in air: *nitrogen, oxygen, carbon dioxide and water vapour*; *breathed air, unbreathed air, mixture, glowing splint, relight, hydrogencarbonate indicator, lime water, milky, dry cobalt chloride paper, food packages, living cells, alive, soft drinks, fire extinguishers, variable, remains the same*
- understand and use the English expressions and phrases of *mixture of, % by volume, can be tested with, changes from __ to __*) to describe or explain air composition and tests for common gases in air, e.g.,
  - *Air is a mixture of gases, including nitrogen, oxygen, carbon dioxide, water vapour and some other gases present in air.*
  - *Nitrogen is about 78% by volume in air. It is used to fill up food packages in order to exclude oxygen and extend their shelf life. Liquid nitrogen is used to store living cells. There is no simple test for nitrogen.*
  - *Oxygen is about 21% by volume in air. It keeps all living things alive. It can be tested with a piece of glowing splint, which relights in oxygen.*
  - *Carbon dioxide is about 0.03% by volume in air. It is used to make soft drinks and fire extinguishers. It can be tested with a hydrogencarbonate indicator or lime water. The hydrogencarbonate indicator changes from red to yellow, whereas the lime water changes from colourless to milky in carbon dioxide.*
  - *The amount of water vapour in air is variable. Water also keeps all living things alive. Water or water vapour can be tested with a piece of dry cobalt chloride paper, which changes from pink to blue in water.*
- understand and use the comparative terms *more than* and *less than* to describe the differences in gas content between breathed and unbreathed air, e.g.,
  - *When we breathe, we take oxygen from air and release carbon*

dioxide and water vapour to air. There is less oxygen, more carbon dioxide, and more water vapour in breathed air than unbreathed air. The amount of nitrogen in breathed and unbreathed air remains the same.

Activities:
1. Revision of prior knowledge and introducing the game – whole-class activity (10 min)
2. Playing the memory game – group activity (20 minutes)
3. Quiz – individual work (10 minutes)

Materials: The memory game – Instruction sheet, Game cards, Score sheet, Information sheet
Quiz – question paper

Steps:

Revision of prior knowledge and introducing the game – whole-class activity (10 min)

1. Using questioning, the teacher should first review the content of the worksheet 'Air Composition and Gas Properties'.

2. The teacher should tell the class that they are going to play a game called 'The memory game'.

3. The teacher should then distribute the instruction sheet for 'The memory game' to students and explain the rules of the game (Chinese can be used for explanation if necessary).

Playing the memory game – group activity (20 minutes)

4. After students are familiar with the rules, the teacher should divide them into groups of four or five and give each group a score sheet, an information sheet and a set of cards. Students should be asked to record the score each student obtains at the end of each round.

5. While the groups are playing the game, the teacher can provide guidance to individuals or groups where necessary.

6. The teacher should reward the winner in each group. He/she may also go through the common mistakes that the class made when they were playing the game.

Quiz – individual work (10 minutes)

7. The class completes the quiz.

8. The teacher can also reward some students who achieve a certain mark or above in the quiz for positive reinforcement.

The Memory Game – Instruction Sheet

You are going to play a card game—'The memory game' — with your group members. This game is about the properties of the gases: nitrogen, oxygen, carbon dioxide and water vapour.

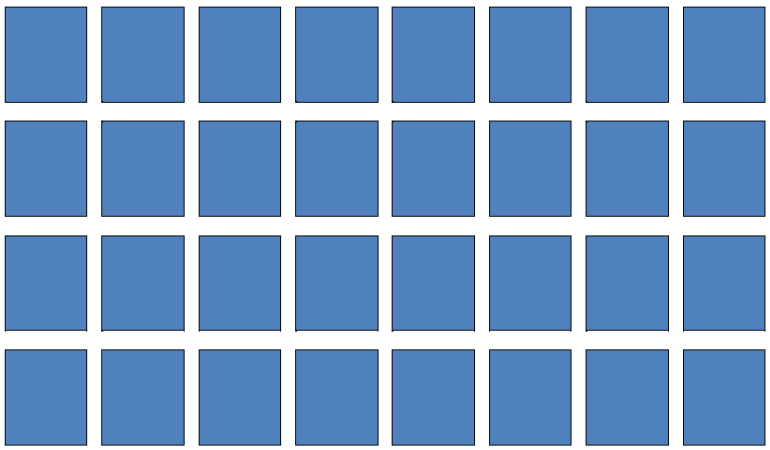
Your teacher will give you a set of 32 cards and an information sheet about the properties of the gases. Play the game according to the rules below.

Rules:

1. Put the information sheet face down near the edge of the bench.
2. Shuffle (洗牌) all the cards and lay them on the bench, face up, in 8 columns by 4 rows, like this:

It is about 21% by volume in air.	Oxygen	Nitrogen	*It* is about 78% by volume in air.	Nitrogen	Water vapour	*It* turns dry cobalt chloride paper form blue to pink.	Carbon dioxide
Water vapour	*It* is used to make soft drinks and fire extinguishers.	*It* keeps all living things alive.	Carbon dioxide	There is no simple test for *It*.	*It* keeps all living things alive.	The amount of *this gas* in breathed air is more than that in unbreathed air.	Nitrogen
It is used to fill up food packages.	Oxygen	Water vapour	The amount of *this gas* in breathed and unbreathed air is the same.	Nitrogen	Carbon dioxide	Oxygen	The amount of *this gas* in air is variable.
Carbon dioxide	*It* relights a glowing splint.	*It* is about 0.03% by volume in air.	The amount of *this gas* in breathed air is less than that in unbreathed air.	Oxygen	*It* turns lime water from colourless to milky.	Water vapour	The amount of *this gas* in breathed air is more than that in unbreathed air.

3. Spend five minutes to remember the location of each card.
4. Turn all the cards face down, and begin the game.



5. Take turns to turn over two cards. Your aim is to remember where the matching cards are – the card which shows the name of a gas and the card which describes this gas. If the cards match, you have to read out the name of the gas and its property in a complete sentence. For example, with the following matching pair, you should say:

<u>Carbon dioxide</u> is used to make soft drinks and fire extinguishers.

<u>It</u> is used to make soft drinks and fire extinguishers.	Carbon dioxide

If you find a match, you keep the pair of cards and score one point.
If your cards do not match, return them face down to their original positions.

6. If you are not sure whether any two cards match, you should refer to the information table for the correct answer. The pairs of cards should then be returned, face down, to their original position.

7. Once the game is completed, i.e. all the cards have been taken off the bench, you should count the number of pairs of cards you have and enter the number on your group's score sheet. Whoever gets the most cards after three rounds is the winner.

The Memory Game – Score Sheet **Group: _____**

Name	Score for Round 1 (第一回合)	Score for Round 2 (第二回合)	Score for Round 3 (第三回合)	Total score

Score (得分) after each round: Count the number of cards you get: 1 card = a score of 1

Composition of Air and Gas Properties – Information Sheet

Properties \ Gases	Nitrogen	Oxygen	Carbon dioxide	Water vapour
Percent by volume in air	about 78%	about 21%	about 0.03%	variable
Test	No simple test	A glowing splint relights	Hydrogencarbonate indicator changes from red to yellow Lime water changes from colourless to milky	Dry cobalt chloride paper changes from blue to pink
Uses	(liquid nitrogen) store living cells fill up food packages	keep all living things alive.	make soft drinks and fire extinguishers	(water) keep all living things alive.
Comparing the amount of the gas in breathed and unbreathed air	same in breathed air and unbreathed air	less in breathed air than in unbreathed air	more in breathed air than in unbreathed air	more in breathed air than in unbreathed air

The Memory Game – Game Cards:
Note: Colour backing paper can be added to the cards before laminating them.

Nitrogen	Nitrogen	Nitrogen
Nitrogen	*It* is about 78% by volume in air.	There is no simple test for *it*.
It is used to fill up food packages.	The amount of *this gas* in breathed and unbreathed air is the same.	Oxygen

Oxygen	Oxygen	Oxygen
It is about 21% by volume in air.	*It* relights a glowing splint.	*It* keeps all living things alive.
The amount of *this gas* in breathed air is less than that in unbreathed air.	Carbon dioxide	Carbon dioxide

Carbon dioxide	Carbon dioxide	*It* is about 0.03% by volume in air.
It turns lime water from colourless to milky.	*It* is used to make soft drinks and fire extingusihers.	The amount of *this gas* in breathed air is more than that in unbreathed air.
Water vapour	Water vapour	Water vapour

Water vapour	The amount of *this gas* in air is variable.	*It* turns dry cobalt chloride paper form blue to pink.
It keeps all living things alive.	The amount of *this gas* in breathed air is more than that in unbreathed air.	

Composition of Air and Gas Properties – Quiz

Name : _____ ( ) Class : _____ Date : _____

Section A: True or False

Write a 'T' in the bracket if the statement is true and an 'F' if it is false.

( ) 1. Breathed air contains more carbon dioxide but less water vapour than unbreathed air does.

( ) 2. Breathed air turns lime water milky.

( ) 3. Breathed air contains more carbon dioxide than oxygen.

( ) 4. We can use the hydrogencarbonate indicator to test for water vapour.

( ) 5. The largest amount of gas in air is nitrogen.

( ) 6. There is no simple test for the presence of nitrogen.

( ) 7. The amount of nitrogen is the same in breathed and unbreathed air.

( ) 8. A glowing splint goes out (熄滅) immediately when it is put into a jar of breathed air.

( ) 9. Nitrogen is added in food packages to exclude oxygen and extend their shelf life.

( ) 10. Liquid carbon dioxide is used to store living cells.

Section B: Fill in the blanks

1. Air is a (a)_____ of gases. It contains 21% of (b)_____ , 78% of (c)_____ , 0.03% of (d)_____ and variable amount of (e)_____.
2. A glowing splint (f)_____ in oxygen.
3. (g)_____ paper changes from blue to (h)_____ if water is added to it.
4. Carbon dioxide turns (i)_____ from colourless to (j)_____.

Composition of Air and Gas Properties – Quiz

Answers

Name : _____ ( ) Class : _____ Date :_____

Section A: True or False

Write a 'T' in the bracket if the statement is true and an 'F' if it is false.

(*F*) 1. Breathed air contains more carbon dioxide but less water vapour than unbreathed air does.

(*T*) 2. Breathed air turns lime water milky.

(*F*) 3. Breathed air contains more carbon dioxide than oxygen.

(*F*) 4. We can use the hydrogencarbonate indicator to test for water vapour.

(*T*) 5. The largest amount of gas in air is nitrogen.

(*T*) 6. There is no simple test for the presence of nitrogen.

(*T*) 7. The amount of nitrogen is the same in breathed and unbreathed air.

(*F*) 8. A glowing splint goes out (熄滅) immediately when it is put into a jar of breathed air.

(*T*) 9. Nitrogen is added in food packages to exclude oxygen and extend their shelf life.

(*F*) 10. Liquid carbon dioxide is used to store living cells.

Section B: Fill in the blanks

1. Air is a [(a)] *mixture* of gases. It contains 21% of [(b)] *oxygen*, 78% of [(c)] *nitrogen*, 0.03% of [(d)] *carbon dioxide* and variable amount of [(e)] *water vapour*.
2. A glowing splint [(f)] *relights* in oxygen.
3. [(g)] *(Dry) cobalt chloride paper* changes from blue to [(h)] *pink* if water is added to it.
4. Carbon dioxide turns [(i)] *lime water* from colourless to [(j)] *milky*.