

Elements, Mixtures and Compounds

Level: S3

Subject: Chemistry

Topic: Elements, Mixtures and Compounds

Introduction:

This set of ELA materials in Chemistry was developed for a class of 42 S3 students. The materials, consisting of a lesson plan and a worksheet, were designed for a double lesson of 70 minutes. The basic concepts of the topic, namely ‘Elements, Mixtures and Compounds’ had been taught in previous lessons, using Chinese as the medium of instruction. The subject matter was then revisited and further studied with experiments using English as the medium of instruction. The ELA materials include a passage comparing elements, mixtures and compounds; and a set of experiment guidelines for an investigation on this topic. Through the ELA, students learned how to describe the differences among elements, mixtures and compounds in English. They also learned how to follow guidelines, written in English, in carrying out an experiment.

ELA Lesson Plan – Elements, Mixtures and Compounds

Description: This ELA covers the basic knowledge of elements, mixtures and compounds, which is a prerequisite of Section 1 of the CDC S.4 – 5 Chemistry syllabus. (Some of the content is suggested in Section 13.2, Unit 13 of the CDC Science syllabus.) The students have been taught these concepts using Chinese as the medium of instruction. In the ELA, the subject matter is revisited and further studied with experiments. Through reading a passage on elements, mixtures and compounds; and through carrying out a guided experiment, students are provided with opportunities to practise reading, writing, speaking and listening in English by using the learned concepts and phrases. A quiz is designed to assess students’ understanding of the ELA content after the lesson.

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

- state the characteristics of an element, a mixture and a compound and to identify their differences;
- suggest some physical methods suitable for separating the constituent substances of a mixture; and
- suggest some chemical methods for decomposing a compound.

- Language Objectives:
- After completing the activity, students should be able to:
- understand and use the English terms related to this topic (e.g., *elements, pure substance, chemical methods, physical methods, compound, mixture, chemically bonded, properties, constituent elements, decompose, separate, retain, mixing*):
 - read an English text on elements, mixtures and compounds and use the information from the text to discuss the characteristics of elements, mixtures and compounds, e.g..
 - *An element is a pure substance that cannot be broken down into anything simpler by chemical methods.*
 - *Each element is different from another element.*
 - *A compound is a pure substance that consists of two or more elements chemically bonded together.*
 - *The properties of a compound are different from those of its constituent elements.*
 - *We may decompose a compound into its constituent elements using chemical methods such as heat or electricity.*
 - *A mixture consists of two or more pure substances, which are not chemically bonded together.*
 - *Each constituent substance in a mixture retains its own properties. Constituents can be separated by physical methods.*
 - draw on their prior knowledge and suggest in English some physical methods suitable for separating the constituents of a mixture
 - draw on their prior knowledge and suggest in English some chemical methods for decomposing a compound,
- In making suggestions, students should be able to use the sentence pattern: may + infinitive + by + present participle (e.g., We may separate a mixture of iron and sulphur by putting a magnet near the mixture, because iron will be attracted by the magnet but sulphur will not.);
[e.g., We may decompose iron (ii) sulphide by heating it at a very high temperature, say 1000°C].]

- Activities:
1. Reading a passage – whole-class activity (20 - 25 min)
 2. Experiment – group work (40 min)
 3. Discussion on experiment results – whole-class activity (5 - 10 min)

- Materials:
- 1 worksheet (WS1: Elements, Mixtures and Compounds)
 - 1 quiz
 - 1 homework assignment
 - Apparatus for the experiment: please refer to WS1

Steps:

Reading a passage – whole-class activity (20 - 25 min)

1. Ask students to read the passage on p.1 of WS1 and underline the words they do not understand.
Please refer to Teacher's note (TN1)

2. Monitor the class work and answer students' questions when necessary.
3. After 5 minutes, go through the passage with the whole class. Invite some students to read aloud parts of the passage (correct students' pronunciation if necessary) and to answer questions.

Refer to Teacher's note (TN2)

Experiment – group work (40 min)

4. Go over the experiment details on p.2 and 3 of WS1 with students.

Please refer to Teacher's note (TN3)

5. Monitor students' progress in the experiment and answer students' questions when necessary.

Please refer to Teacher's note (TN4)

Discussion on experiment results – whole – class activity (5 - 10 min)

6. Check and discuss experiment results with the whole class.

Please refer to Teacher's note (TN5)

Teacher's Notes

TN1: Teachers may explain to students that they will be asked to read aloud the passage and answer questions afterwards.

TN2: To keep the whole class engaged in the activity, teachers should avoid interacting with one student for too long. If a student pronounces a word incorrectly, teachers may invite other students to suggest the correct pronunciation and ask the whole class to repeat after the correct pronunciation is demonstrated. Also, to encourage students to participate, teachers may ask other students to comment on their classmates' answers to the questions.

TN3: Check students' understanding of the procedure with questions such as

Teacher: (In Chemicals and Equipment) Which of the following materials is corrosive and needs to be handled carefully?

Teacher: (In Step 1) Show me which is the magnet.

Teacher: (In Step 8) Show me how to close a test tube with an inverted stopper.

Teacher: (In Step 9) Come out and draw a glowing splint on the board.

TN4: Teachers need to be prepared to answer students' questions on how they could describe certain experiment results in English. For a class of students with low language ability, teachers may put the useful words, phrases and expressions on the board prior to the experiment.

TN5: To encourage students to participate, teachers may ask students to comment on their classmates' experiment results. This also provides opportunities for students to practise speaking and listening skills.

ELEMENTS, MIXTURES AND COMPOUNDS

Elements

An element is a pure substance (純淨物質) that cannot be broken down into anything simpler by chemical methods (化學方法). Each element is different from another element.

Q: Are they elements?

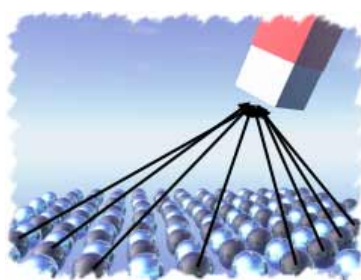
- ※ oxygen
- ※ water
- ※ bromine
- ※ carbon dioxide
- ※ nitrogen
- ※ salt



Compounds and Mixtures

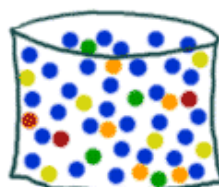
A **compound** is a pure substance that consists of two or more elements chemically bonded together. Its properties are different from those of its constituent elements. We may also decompose (分解) a compound into its constituent elements using chemical methods such as heat or electricity.

e.g. sodium chloride, water, carbon dioxide

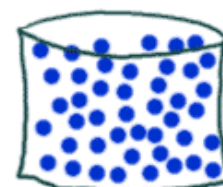


IN A MIXTURE OF SALT AND IRON, THE IRON CAN BE REMOVED WITH A MAGNET.

A **mixture** consists of two or more pure substances, which are not chemically bonded together. Each constituent substance (組成的物質) in a mixture retains its own properties (性質). Constituents can be separated by physical methods (物理方法).



Tap Water



Distilled

Water

Mixtures can be made by:

- elements + elements (i.e. mixing elements with elements)
- elements + compounds
- compounds + compounds

e.g. vinegar (water + ethanoic acid), sea water (water + salt + ...), air (nitrogen + oxygen + carbon dioxide + water vapour...)

Experiment Time:

In this experiment, we are going to investigate some physical and chemical properties of (i) a mixture of iron and sulphur; and (ii) a compound called iron (II) sulphide.

Chemicals and equipment needed:

Mixture of Iron and sulphur 鐵與硫粉混合物	X 2 g
Iron (II) sulphide 硫化鐵 (II)	X 2 g
Dilute hydrochloric acid (2M) 稀氫氯酸	X 6 cm ³
Lead Acetate Paper 乙酸鉛 (II) 試紙	X 1
Test tubes 試管	X 4
Splint 木條	X 1
Magnet 磁石	X 1

Steps:

A. Action of magnet:

1. Put a magnet near the mixture of iron and sulphur.
2. Repeat step 1 but with iron (II) sulphide.

What do you observe?

Mixture of iron and sulphur:	
Iron (II) sulphide:	

B. Action of Water:

3. Put 1 gram of the mixture of iron and sulphur into a test tube.
4. Pour 5 cm³ of water into the test tube.
5. Repeat steps 3-4 by using iron (II) sulphide with another test tube.

What do you observe?

Mixture of iron and sulphur:	
Iron (II) sulphide:	

C. Action of dilute hydrochloric acid:

6. Pour 3 cm³ of dilute hydrochloric acid into the test tube with 1 gram of the iron and sulphur mixture.
7. Put an inverted stopper over the mouth of the test tube. Wait for 3 minutes.
8. Test the gas given out with a burning splint.

What happens when the gas is tested with a burning split? _____

What gas is it? _____. Does iron react with dilute hydrochloric acid? _____
_____. Does sulphur react with dilute hydrochloric acid? _____

9. Pour 3 cm³ of dilute hydrochloric acid into the test tube with iron (II) sulphide.
10. Put a wet lead acetate paper near the mouth of test tube.

What do you observe? _____. Is there any color change in the lead acetate paper? _____

Elements, Mixtures and Compounds

Quiz

Name: _____

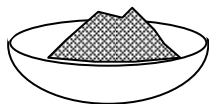
Class: _____ ()

Score: _____ / 15

A. Read the passage below and answer the questions that follow:



Substance A



Substance B



Substance C



Substance D

There are four substances, *A*, *B*, *C* and *D*. *A* and *C* are pure substances. They cannot be broken down into anything simpler by chemical methods. *B* consists of *A* and *D*, which are not chemically bonded together. *D* is a pure substance. We can decompose *D* into *A* and *C* using chemical methods.

1. Which substance is a compound? [2]

2. Which substance is a mixture? What kind of methods can be used to separate its constituents? [4]

3. A student says that all pure substances are elements. Do you agree? Why or why not? [4]

B. Short questions

1. Suggest a way to separate iron and sulphur from their mixture. Describe what you will observe. [4]

2. What can you smell when you pour some dilute hydrochloric acid into the test tube with iron (II) sulphide? [1]

Quiz (II)

Name: _____

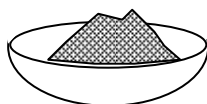
Class: _____ ()

Score: _____ / 15

A. Read the passage below and answer the questions that follow:



Substance A



Substance B



Substance C



Substance D

There are four substances, A, B, C and D. A and C are pure substances. They cannot be broken down into anything simpler by chemical methods. B consists of A and D, which are not chemically bonded together. D is a pure substance. We can decompose D into A and C using chemical methods.

1. Which substance is a compound? [2]

D

2. Which substance is a mixture? What kind of methods can be used to separate its constituents? [4]

B. Physical methods

3. A student says that all pure substances are elements. Do you agree? Why or why not? [4]

No. A compound is also a pure substance. / Pure substances can be compounds. /

D is a pure substance but it is not an element / D is a pure substance but it is a compound.

Or Any other reasonable answers.

B. Short questions

1. Suggest a way to separate iron and sulphur from their mixture. Describe what you will observe. [4]

We may put a magnet near the mixture of iron and sulphur. Iron will be attracted by the magnet but sulphur will not. / We may pour water into a test tube containing the mixture of iron and sulphur. Iron will sink while sulphur will float.

2. What can you smell when you pour some dilute hydrochloric acid into the test tube with iron (II) sulphide? [1]

The smell of rotten eggs.

Name: _____ Class: _____ ()

Elements, Mixtures and Compounds Homework Assignment

Sulphur 硫 , Iron 鐵 , Iron (II) Sulphide 硫化鐵(II)

1. What are the colors of sulphur, iron, mixture of sulphur and iron, and iron (II) sulphide?



2. There are 3 test tubes, containing iron, sulphur and iron (II) sulphide separately. Suggest a method to identify 鑑別 them. You may answer with the aid of a diagram.

How can you separate iron from sulphur in their mixture?

3. Suggest a method to decompose iron (II) sulphide?

Name: _____

Class: _____ ()

Elements, Mixtures and Compounds Homework Assignment

Teacher's version

Sulphur 硫 , Iron 鐵 , Iron (II) Sulphide 硫化鐵(II)

1. What are the colors of sulphur, iron, mixture of sulphur and iron, and iron (II) sulphide?

Sulphur is yellow.

Iron is black.

Mixture of sulphur and iron is black and yellow.

Iron (II) sulphide is brownish black



2. There are 3 test tubes, containing iron, sulphur and iron (II) sulphide separately. Suggest a method to identify 鑑別 them. You may answer with the aid of a diagram.

We can simply observe the color of the substances in the test tubes.

Sulphur is a yellow powder.

Iron is a black solid.

Iron (II) sulphide is a brown solid.

OR

We can add dilute hydrochloric acid into the test tubes.

Sulphur floats on top of the acid.

Iron sinks and gives out colorless bubbles.

And iron (II) sulphide gives a strong irritating smell.

3. How can you separate iron from sulphur in their mixture?

Magnets attract iron but not sulphur. Therefore, we can use a magnet to separate iron from sulphur in their mixture.

4. Suggest a method to decompose iron (II) sulphide?

Heating iron (II) sulphide at a very high temperature (about 1000°C).
