Energy and Generating Electricity

Level: S1

Topic: Energy (Unit 4)

Introduction:

This set of ELA materials is designed for students whose academic ability is comparatively high. The whole unit, Energy, is selected to be taught in English. Three ELAs are designed and implemented at various points of the unit. They aim to provide students with reading and writing practice to prepare them to be able to read a relatively long passage and give extended answers in English.

The three ELAs are

ELA1	Different forms of energy and energy change
ELA2	Generating electricity
ELA3	Energy sources

Each ELA is designed to last for a double-period lesson. One set of materials are prepared for each ELA. They include a lesson plan, a reading passage, worksheets on sentence structure or on concept maps and short questions. Materials for ELA1 have to be used with the textbook, *Understanding Integrated Science for the 21st Century*, 2nd edition.

Acknowledgement
This set of materials was produced jointly by the teachers of T.W.G.Hs Li Ka Shing College and the ELA research team.

ELA1 Lesson Plan – Different forms of energy and energy changes

Description: This ELA covers Sections 4.1-4.2, Unit 4 of the CDC Science syllabus. The students have learned the importance of energy to our daily lives in the previous lesson. They are required to read a passage about different forms of energy and find out the different forms of energy from the passage. They will then work on the experiments and complete pp. 13-15 of the textbook. After that, they are asked to complete the writing exercises in the remaining part of the worksheets.

Content Objectives: After completing the activity, students should be able to identify the energy changes in simple mechanical processes.

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

- understand and use the English terms related to describing different forms of energy (e.g., *sound energy, chemical energy, kinetic energy, potential energy, heat energy, electrical energy, light energy, is changed into*);
- use an appropriate verb to connect an object to an energy form, e.g.,

  A moving bicycle has kinetic energy.
  A television uses electrical energy.
  A radio gives out sound energy.
  A match has chemical energy.
  A moving sportsman has kinetic energy.
  An electric iron gives out heat energy.
  A nuclear submarine uses nuclear energy.
  A computer uses electrical energy.
  A CD player gives out sound energy.
  A lamp gives out light energy.
  If you stretch an elastic band, it has potential energy.
- describe energy changes in complete sentences using the passive voice, e.g.,
  - *When you switch on an electric iron, electrical energy is changed into heat energy.*
  - *When you rub your hands quickly for about 20 times, kinetic energy is changed into heat energy and sound energy.*
  - *OR: When you rub your hands quickly for about 20 times, chemical energy is changed into kinetic energy and heat energy.*
  - *When you shake a can containing dry beans, kinetic energy is changed into sound energy.*

- show understanding of energy change by answering questions of *what happens when* … e.g.,
  - *What happens when you light a candle?*
    When I light a candle, chemical energy is changed to heat and light energy.
  - *What happens when you ride a bicycle with a dynamo?*
    When I ride a bicycle with a dynamo, kinetic energy is changed into electrical energy.
  - *What happens when you roll a ball down a slope?*
    When I roll a ball down a slope, potential energy is changed into kinetic energy.

Activities:
- Pre-reading activity – whole-class activity (5 min)
- Reading and identifying the different energy forms – individual work (13 min)
- Post-reading activity – individual work (12 min)
- Experiment 4.1 and writing – group work (35 min)
- Speaking activity – pair work (15 min)

Materials: Worksheet 1, Worksheet 2, Apparatus for experiment 4.1, Textbook (*Understanding Integrated Science for the 21st Century*, 2nd edn.)

Steps:

Pre-reading – Whole-class activity (5 min)

1. Using questioning, the teacher reviews what students learned in the previous lessons regarding the importance of energy in our daily lives. The questions should be designed to check students' understanding of the different forms of energy.
2. The teacher then distributes Worksheet 1 to each student, and tells students that the passage is about the different forms of energy and that each paragraph is about one energy form.
3. The teacher asks students to read through the first two paragraphs quickly and tell which forms of energy are discussed in the paragraphs. The teacher then asks them to write down the answers in the first two blanks of Part I of their worksheet.

Reading and identifying the different energy forms - Individual work (13 min)

4. The teacher asks students to read the remaining paragraphs and complete Part I of the worksheet.
5. The teacher provides guidance to individuals where necessary.
6. The teacher checks the answers briefly after the class has completed Part I.

Post-reading activity – Individual work (12 min)

7. Referring to the examples in the reading passage, the teacher points out the different meanings of *use(s), has/have*, and *give(s) out* in connecting an object to a form of energy in a sentence.
8. The teacher asks students to complete Part II, providing guidance to individuals where necessary.
9. The teacher checks the answers briefly after the class has completed Part II.

Experiment 4.1 and writing – Group work (35 min)

10. The teacher distributes Worksheet 2.
11. The teacher tells students that they are going to work on Experiment 4.1 in their textbook, asks them to rub their hands together quickly about 20 times, then asks them what form of energy is created by rubbing and what forms of energy are released through rubbing.
12. The teacher then directs students to write down the answers on p.13 of their textbook.
13. Based on the diagrammatic presentation of the energy conversion on p.13 of the textbook, the teacher then guides the students to describe the energy change in a complete sentence. The teacher may point out that "*is* chang*ed*" is used in the sentence to show that *something* makes the change. Then students complete Q1 of Part I of Worksheet 2.
14. Several stations are set up in the laboratory. Each group of students will carry out one experiment at a time. The teacher should ask them to write down the initial and final forms of energy on pp. 13-15 of their textbook and complete Part III of the worksheet.
15. The teacher may provide feedback on the answers on pp.13-15 of the textbook after all parts of the experiment have been completed. The worksheet can be collected from students after the lesson.

Speaking activity – pair work (15 min)

16. The teacher demonstrates the way to ask about an energy change using the phrase, "What happens when you…?", for example, by asking the class, "What happens when you switch on an electric iron?" and nominating a student to answer the question using a complete sentence.
17. When the class understands how to ask and answer questions about an energy change, the teacher should arrange students in pairs and have them practise Part II of Worksheet 2. Depending on the ability of the students, they may be asked to complete the speaking activity first before putting down the answers on the worksheet or to do the reverse.
18. The teacher should monitor the class and provide help where necessary.
19. The teacher may conclude the activity by giving more examples of energy change and asking students to state the changes.
20. The teacher should collect the worksheet for marking.

Note: Students who are less able may have difficulties in using the correct verb *have/use/give out* to connect a particular form of energy to an object (Part II of Worksheet 1). In this case, more examples may be needed to illustrate the differences in the use of the three verbs.

Worksheet 1

Different Forms of Energy

When John's alarm clock rings, it ***gives out*** sound energy. Sound is produced by the vibrations of an object. The louder the sound, the more energy it ***carries***.

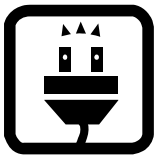
Food ***stores*** chemical energy. When John takes in the food, the chemical energy can be changed to other forms of energy for his activities. Fuels, such as coal and petrol, also ***store*** chemical energy.

Moving objects, such as buses or cable cars, ***have*** kinetic energy. The faster an object moves, the more kinetic energy it ***has***. When two objects are moving at the same speed, the heavier one ***has*** more kinetic energy.

When John goes up a hill in a cable car, his potential energy increases. When an object is raised, it gains potential energy. The potential energy in an object increases when it is raised higher.

Some objects ***have*** potential energy when they are compressed, stretched or bent. For example a jack-in-the box can store potential energy in its compressed spring. The pole used by a pole vaulter ***contains*** potential energy when it is bent.

When John is having a barbecue, the charcoal burns and ***gives out*** heat energy. Heat energy can increase the temperature of an object. The Sun ***gives out*** heat energy. That is why we usually feel hot in the sun.



Many electrical appliances, such as computers and televisions, ***use*** electrical energy. They change electrical energy to other forms of energy. Electrical energy for most appliances comes from the power station. Some appliances, such as toy cars or small radios, ***use*** cells to supply electrical energy.

The sun ***gives out*** light energy. We can see wherever there is light.

(Adapted from: Chan, W K, Luk, W Y and Kong, S W (2005) *Understanding Integrated Science for the 21st Century*, 2nd edn, Hong Kong: Aristo Educational Press, 6–10.)

(Worksheet 1)

I. ***Which forms of energy are mentioned in the passage?***

1._____ 2. _____

3. _____ 4. _____

5. _____ 6. _____

7. _____

II. Note the verbs which are used in the passage for connecting an object to a form of energy:

*A moving bicycle **has** kinetic energy.*
*A television **uses** electrical energy.*
*A radio **gives out** sound energy.*

Complete the sentences below with an appropriate verb** (has/uses/gives out)**:

1. A match _____ chemical energy.
2. A moving sportsman _____kinetic energy.
3. An electric iron _____heat energy.
4. A nuclear submarine _____nuclear energy.
5. A computer _____electrical energy.
6. A CD player _____sound energy.
7. A lamp _____light energy.
8. If you stretch an elastic band, it _____potential energy.

Worksheet 2

Energy Changes

I. We often use the ***passive voice*** to describe an energy change. For example:
When you switch on an electric iron, electrical energy ***<u>is changed</u>*** *into heat energy.*

Now use complete sentences to describe the energy changes in Experiment 4.1 (pp. 13-15 of your textbook):

1. When you rub_____,
   _____ energy is <u>changed</u> into _____ energy and
   _____ energy.
2. When you shake_____,
   _____ energy is <u>changed</u> into _____ energy.
3. When you turn on _____of a simple circuit with a bulb, _____ energy is _____ into _____ energy and _____ energy in the bulb.
4. When you replace the light bulb with _____ and _____, _____ energy is _____ into _____ energy.
5. a/ When you wind up the propeller of _____,
   _____ energy is _____ into _____ energy.
   b/ When you release _____,
   _____ energy is _____ into _____ energy.
6. When you_____,
   _____ energy is _____ into _____ energy.
7. When you_____,
   _____
8. When you_____
   _____

(Worksheet 2)

II. The question phrase—***What happens?***—is commonly used in questioning in science. It is often followed by a "***when***" structure. For example :

What happens when you switch on an electric iron?

Make similar questions for each of the following actions and then answer the questions accordingly.

1. light a candle

Q : What happens when you_____?

A : When I _____, chemical energy is changed to _____

2. ride a bicycle with a dynamo

Q : _____

A : _____

_____

3. roll a ball down a slope

Q : _____

A : _____

_____

(Worksheet 1)

Answers

Different Forms of Energy

I. ***Which forms of energy are mentioned in the passage?***

1. *sound energy*
2. *chemical energy*
3. *kinetic energy*
4. *potential energy*
5. *heat energy*
6. *electrical energy*
7. *light energy*

II. Note the verbs which are used in the passage for connecting an object and the energy form:

*A moving bicycle **has** kinetic energy.*
*A television **uses** electrical energy.*
*A radio **gives out** sound energy.*

Complete the sentences below with an appropriate verb** (has/uses/gives out)**:

1. A match *has* chemical energy.
2. A moving sportsman *has* kinetic energy.
3. An electric iron *gives out* heat energy.
4. A nuclear submarine *uses* nuclear energy.
5. A computer *uses* electrical energy.
6. A CD player *gives out* sound energy.
7. A lamp *gives out* light energy.
8. If you stretch an elastic band, it *has* potential energy.

Worksheet 2

Answers

Energy Changes

I. We often use the ***passive voice*** to describe an energy change. For example:
When you switch on an electric iron, electrical energy ***is changed*** *into heat energy.*

Now use complete sentences to describe the energy changes in Experiment 4.1 (pp. 13-15 of your textbook):

1. When you rub *your hands quickly for about 20 times*, *kinetic* energy is changed into *heat* energy and *sound* energy.
   OR: When you rub *your hands quickly for about 20 times*, *chemical* energy is changed into *kinetic* energy and *heat* energy.
2. When you shake *a can containing dry beans*, *kinetic* energy is changed into *sound* energy.
3. When you turn on *the switch* of a simple circuit with a bulb, *electrical* energy is *changed* into *light* energy and *heat* energy in the bulb.
4. When you replace the light bulb with *an electric bell* and *turn on the switch*, *electrical* energy is *changed* into *sound* energy.
5. a/ When you wind up the propeller of *a rubber band-powered plane*, *kinetic* energy is *changed* into *potential* energy.
   b/ When you release *the propeller*, *potential* energy is *changed* into *kinetic* energy.
6. When you *blow up a balloon and then release it*, *potential* energy is changed into *kinetic* energy.
7. When you *burn a magnesium ribbon in the Bunsen flame*, *chemical energy is changed into heat and light energy.*
8. When you *heat the open end of an iron tube with the Bunsen flame and then remove the flame, heat energy is changed into sound energy.*

(Worksheet 2)

II. The question phrase – ***What happens?*** – is very commonly used in science. It is often followed by a "***when***" structure. For example:

What happens when you turn the switch on an electric iron?

Make similar questions for each of the following actions and then answer the questions accordingly.

1. light a candle

Q : What happens when you *light a candle* ?

A : When I *light a candle*, chemical energy is changed to *heat and light energy.*

2. ride a bicycle with a dynamo

Q : *What happens when you ride a bicycle with a dynamo?*

A : *When I ride a bicycle with a dynamo, kinetic energy is changed into electrical energy.*

3. roll a ball down a slope

Q : *What happens when you roll a ball down a slope?*

A : *When I roll a ball down a slope, potential energy is changed into kinetic energy.*

ELA2 Lesson Plan – Generating Electricity

Description: This is a follow-up lesson on Section 4.4, Unit 4 of the CDC syllabus. The students have studied the generation of electricity and its related issues. Students will be required to read a passage about generating electricity and complete two concept maps relating to the passage. They will then be asked to retell the information based on the completed concept maps.

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

- explain how electricity is generated in Hong Kong; and
- explain the problems arising from electricity generation.

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

- understand and use the English terms related to electricity generation in Hong Kong (e.g., *fuels, oil, natural gas, coal, generate, electricity, power station, generator, boiling water, steam, drives, turbine, heat energy, chemical energy, electrical energy, energy conversion, kinetic energy, acid rain, sulphur dioxide, nitrogen oxides, gases, dissolve, rainwater, form, damages, affects, growth, living things, lakes and rivers, destroys, forests, global warming, increase, average air temperature of the Earth, carbon dioxide, traps heat, atmosphere, effect, environment, speeds up, melting of ice, the Poles, causing, rise sea level.*);
- read and understand an information text on generating electricity, which includes previously learned concepts, such as *energy forms, energy conversion, fuels, major parts in a power station, pollution problems, acid rain, global warming;*
- discuss and extract relevant information from the text to complete two concept maps;
- answer questions using the key terms from the concept maps, e.g.,
  - *What fuels are commonly used for generating electricity?*
    Oil, natural gas and coal
  - *What is the name of the machine that generates electricity in a power station?*
    Generator.
  - *Explain step by step how burning fuels in a power station can generate electricity.*
    In a power station, fuels are burnt to boil water. The boiling water produces steam. The steam drives a turbine. The turbine then drives a generator. The generator then produces electricity.
  - *What energy is stored in fuels?*
    Chemical energy
  - *Explain step by step how the energy stored in fuels is changed to electrical energy in a power station.*
    When the fuels are burnt, chemical energy of the fuels is changed

into heat energy. Then heat energy is used to boil water to produce steam. Steam carries the heat energy to the turbine. Then the turbine changes heat energy into kinetic energy. Finally, the generator changes kinetic energy into electricity energy.

- *Explain how burning fuels in power stations can lead to acid rain.*
  When fuels are burnt in power stations, they produce sulphur dioxide and nitrogen oxides. These gases dissolve in rainwater and form acid rain.
- *What are the harmful effects of acid rain?*
  Acid rain damages buildings, affects the growth of living things in lakes and rivers, and destroys forests.
- *What is global warming?*
  Global warming is the increase in the average air temperature of the Earth.
- *Explain how burning fuels in power stations can lead to global warming.*
  When fuels are burnt in power stations, they produce carbon dioxide. Carbon dioxide traps heat in the atmosphere. This increases the average air temperature of the Earth.
- *Give one effect of global warming on the environment.*
  Global warming speeds up the melting of ice at the Poles, causing a rise in the sea level.

Activities:
- Pre-reading – Whole-class activity (10 min)
- Reading and completing concept maps – Group work (15 min)
- Post-reading activity – Whole-class activity (20 min)
- Writing – answering short questions – Group work (30 min)

Materials: Worksheet 3, Worksheet 4, Visualizer

Steps:

Pre-reading – Whole-class activity (10 min)

1. Using questioning, the teacher reviews the subject matter about electricity generation that students learned in the previous lessons. The questions should be designed to check students' understanding of the following key words: *fuels, power station, turbine, generator, sulphur dioxide, pollution, acid rain, greenhouse effect, global warming.*

2. The teacher then distributes the reading passage for Worksheet 3 to each student, telling the class that they are going to read a passage about electricity generation and that the key words in the passage have been learned before. The teacher asks students to read through the paragraphs quickly and say what each paragraph is about. The teacher tells them to ignore any difficult words in the paragraph as these will be dealt with later.
3. When students tell what each paragraph is about, the teacher may put the key words

down on the blackboard so that the class can have a rough idea of what each paragraph is about:

	Generating Electricity
Paragraph 1:	*Fuels*
Paragraph 2:	*Generating electricity*
Paragraph 3:	*Pollution problems*

Reading and completing concept maps – Group work (15 min)

4. The teacher distributes Diagrams 1 & 2 of Worksheet 3 to each student, telling them that they have to read the first two paragraphs carefully in order to complete Diagram 1 and the third paragraph to complete Diagram 2.

5. The teacher divides the class into groups of four or five and assigns some groups to work on Diagram 1 first and others to work on Diagram 2 first, telling them that they have to help each other to understand the passage and that each group will be asked to come out and present their answers (either Diagram 1 or Diagram 2).

6. The teacher provides guidance to individual groups where necessary.

Post-reading activity – Whole-class activity (20 min)

7. The teacher asks one group to come out and show the answers to Diagram 1 using a visualizer and then invites other groups to provide feedback on the answers.

8. After checking the answers to Diagram 1, the teacher asks the class to put aside the reading passage. Then the teacher nominates one or two students from each of the groups, who are responsible for Diagram 1, to explain part of the diagram in complete sentences.

   For example, for the part: "*Fuels*"-- "*for example*"--"*1. natural gas, 2. coal, 3. oil*", students can explain it as "*Some examples of fuels are natural gas, coal and oil.*"
   For the part, "*Fuels*"--"*are burned, boil*"--"*water*", the complete sentence can be "*Fuels are burned to boil water.*"

9. The teacher then repeats the same procedure for Diagram 2.

Writing – answering short questions – Group work (30 min)

10. The teacher distributes Worksheet 4 to the class, asking them to refer to Diagram 1 and Diagram 2 only, but not the reading passage, for answering the questions.

11. Questions 1 to 3 may be done together with the students so that they understand how to convert the information in the concept maps into sentences in answering the questions.

12. Question 3 demands a longer answer. It may be done with the students sentence by sentence. That is, the teacher may nominate a student to suggest the first sentence of the answer and write it down. Then nominate another student for the second sentence, and so on.

The teacher may ask students to pay attention to the use of simple present tense and passive voice in explaining a process.

13. The teacher then assigns some groups to work on Questions 4-5 first, some groups on Questions 6-7 first, and some groups on Questions 8-10 first.

14. The teacher provides guidance to individual groups where necessary.

15. When the students have completed the answers to the questions assigned to them, the teacher asks them to exchange worksheets among group members and check whether the answers given by their classmates are grammatically correct.

16. Then the teacher nominates some students to write down the answers (one question for each student) on the blackboard.

17. The rest of the class are invited to provide feedback to both the content and the grammar of the answers.

Note:

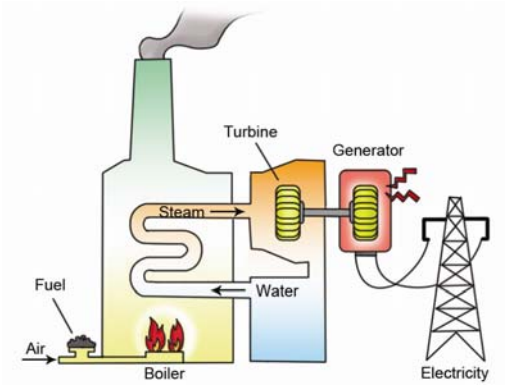
1. If this ELA is too long for students, it can be broken down into two activities. Each may include a reading passage that contains one major concept, a concept map, and questions based on that concept only.

2. Common student errors may be found in completing
   (a) the flow chart of generating electricity in the Diagram 1
      - Students may miss out the answer "electricity" after the box "generator" and the action verb "generates" if they have not developed the concept of generating electricity from a rotating generator in an experiment using a steam engine model.
   (b) the answer to Question 10 (explaining how burning fuels in power stations can lead to global warming)
      - Students may miss the point that carbon dioxide can trap heat in the reading passage as they have not learned the concept of how carbon dioxide can trap heat in the atmosphere.

Worksheet 3

Generating Electricity

In most power stations, electricity is generated by burning fuels. Coal, oil and natural gas are the common fuels for generating electricity.



Major parts of a power station

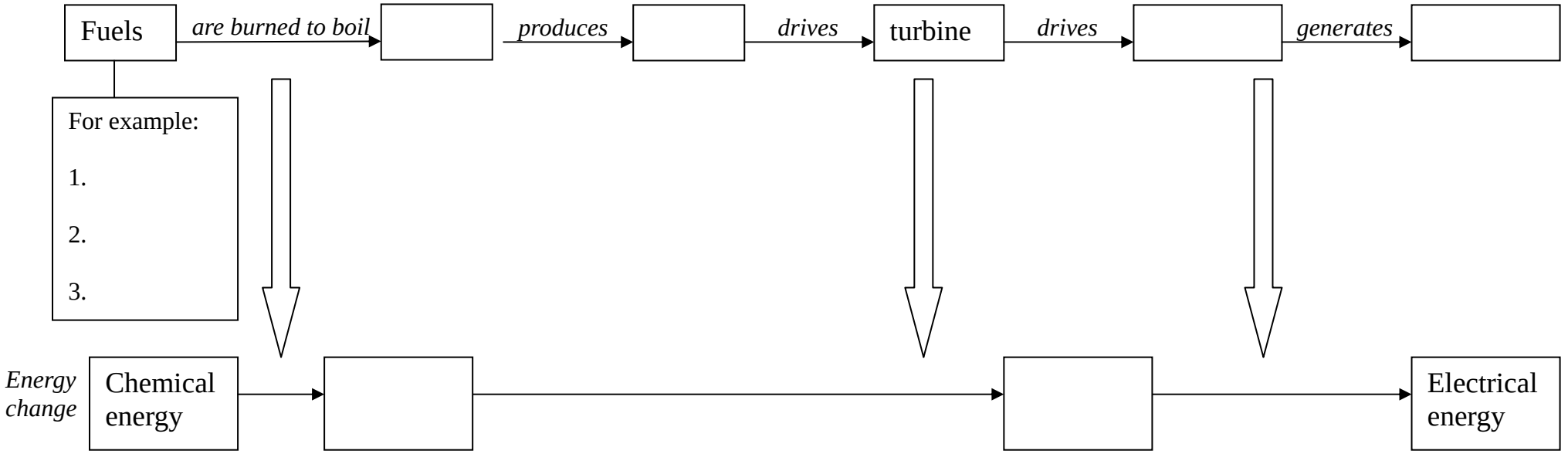
A power station has three major parts: a boiler, a turbine and a generator. Fuels are burnt in the boiler to boil water. The boiling water produces steam. The steam drives the turbine. The turbine rotates and drives the generator. Electricity is produced when the generator rotates. During this process, energy is converted from one form to another. The chemical energy of the fuels is changed into heat energy, which boils the water. The heat energy in steam is changed into kinetic energy in the turbine. Then the kinetic energy is changed into electrical energy by the generator.

Generating electricity causes pollution. When fuels are burnt in power stations, sulphur dioxide, nitrogen oxides and carbon dioxide are given out. Sulphur dioxide and nitrogen oxides then dissolve in rainwater and form acid rain. Acid rain damages buildings, affects the growth of living things in lakes and rivers, and destroys forests. Carbon dioxide traps heat in the atmosphere. This effect is called the greenhouse effect. Too much carbon dioxide in the atmosphere will increase the average air temperature of the Earth and cause global warming. Global warming will speed up the melting of ice at the Poles, causing a rise in sea level.

(Worksheet 3)

I. Use the information of Paragraphs 1 and 2 to complete the diagram below.

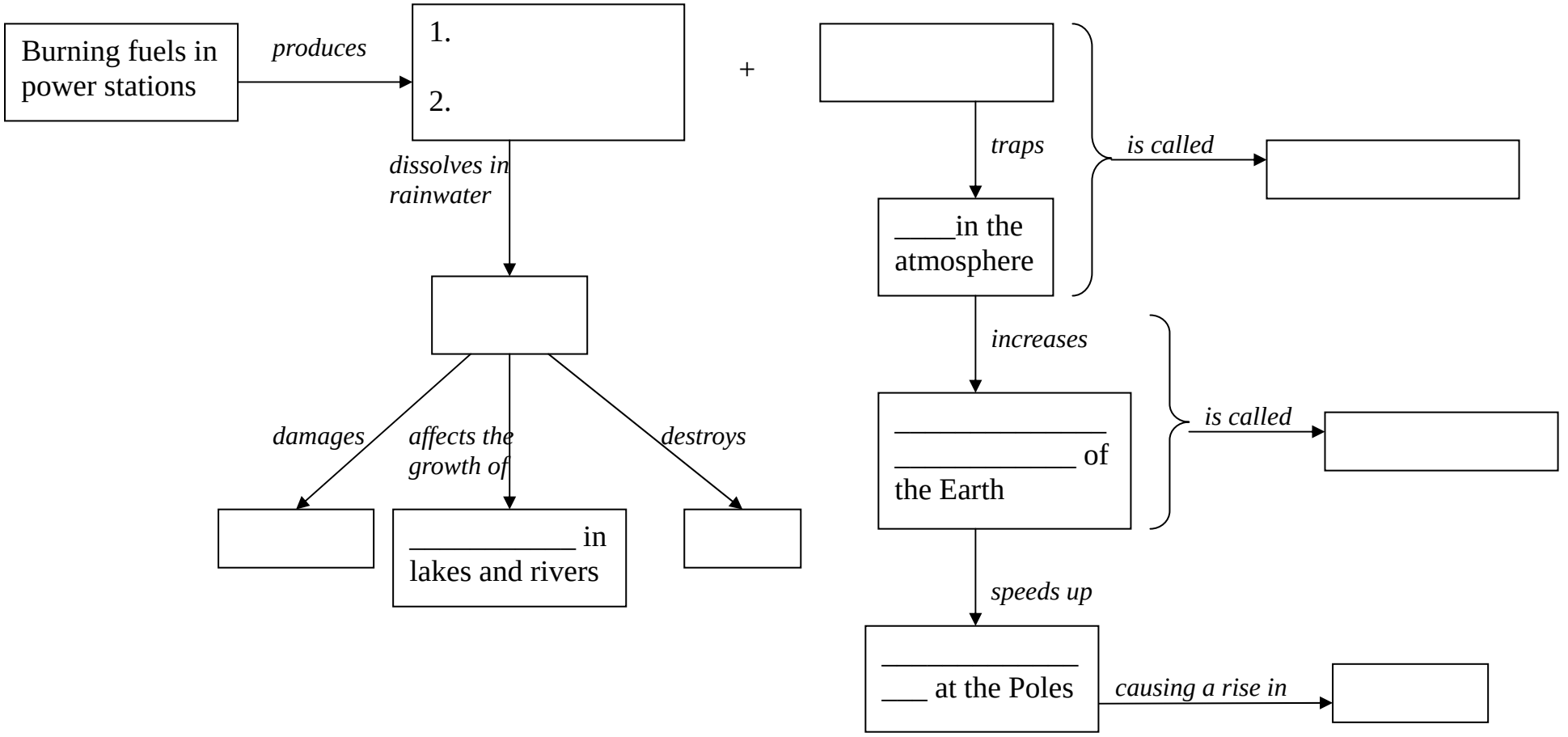
Diagram 1: How is electricity generated?



(Worksheet 3)

II. Use the information of Paragraph 3 to complete the diagram below.

Diagram 2: What problems arise from electricity generation?

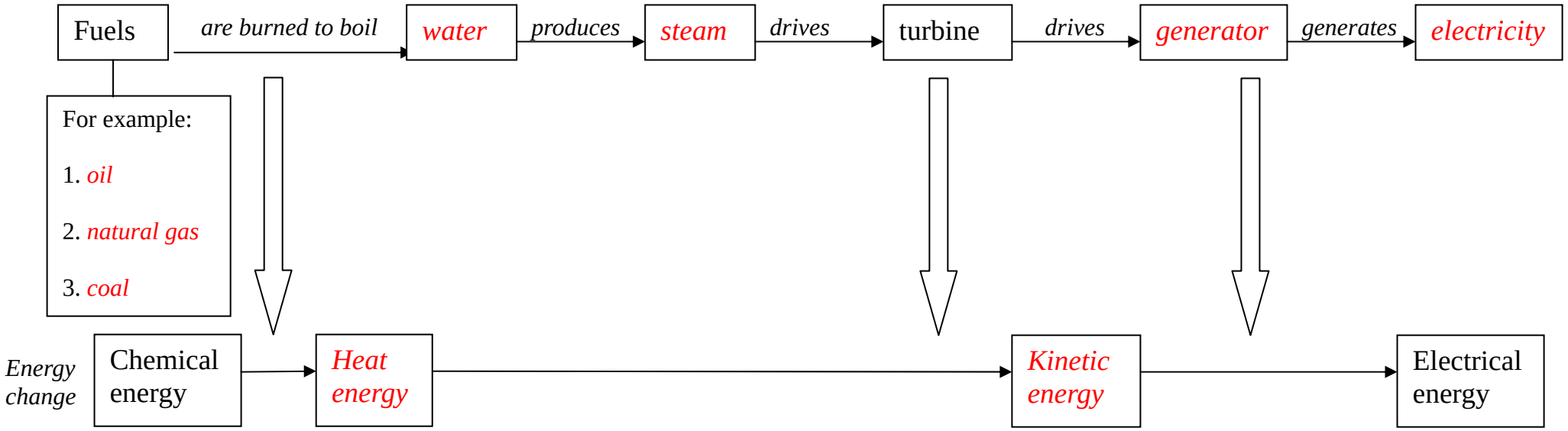


(Worksheet 3)

I. Use the information of Paragraphs 1 and 2 to complete Diagram 1.

Answer

Diagram 1: How is electricity generated?

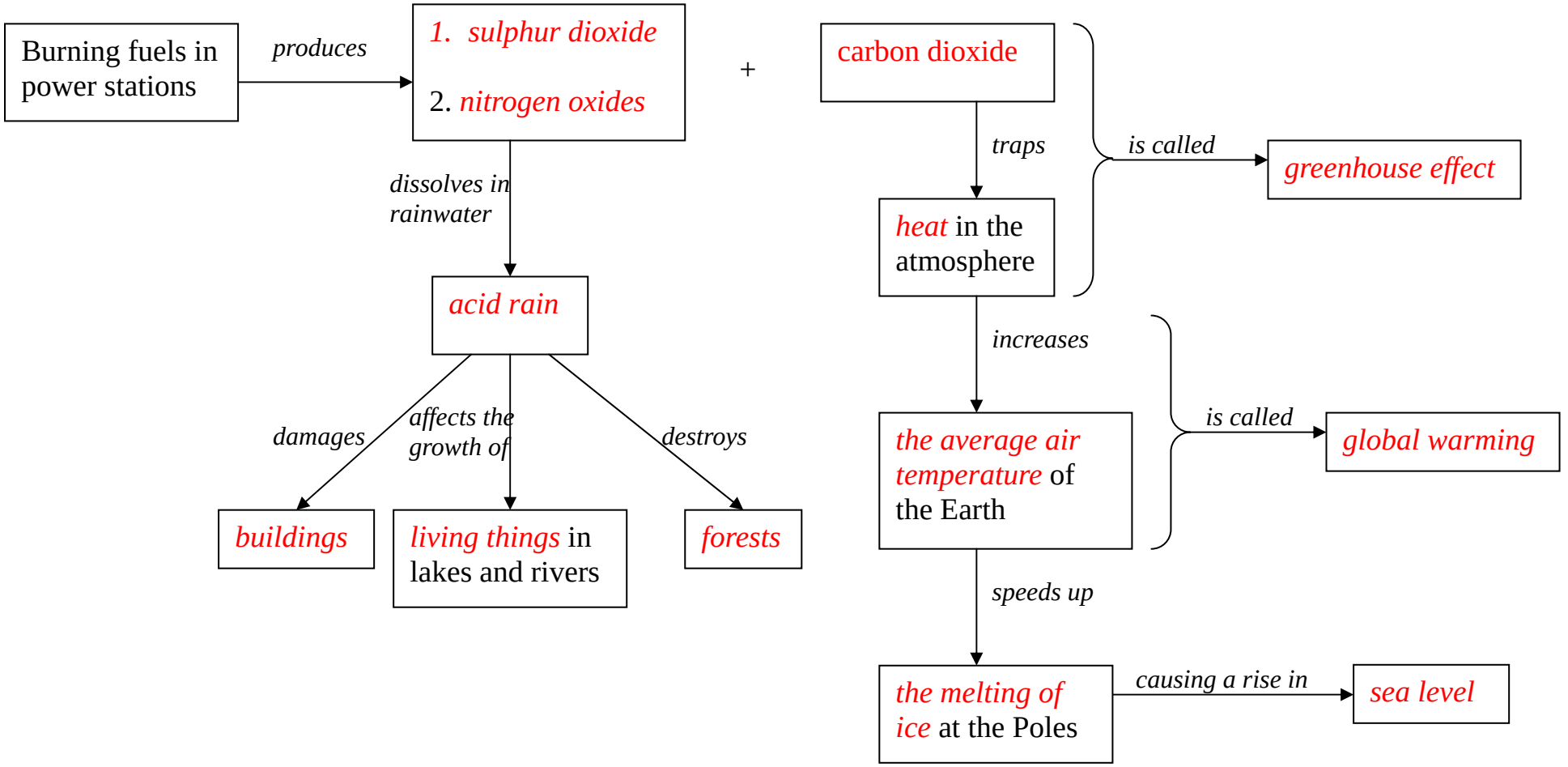


(Worksheet 3)

II. Use the information of Paragraph 3 to complete Diagram 2.

Answer

Diagram 2: What problems arise from electricity generation?



Worksheet 4

I. Answer the following questions by referring to Diagram 1. Do not look at the passage. You must answer Q3 and Q5 in complete sentences.

1. What fuels are commonly used for generating electricity?

_____

2. What is the name of the machine that generates electricity in a power station?

_____

3. Explain step by step how burning fuels in a power station can generate electricity.

In a power station, fuels are burnt to boil water. The boiling water

_____

_____

_____

_____

4. What energy is stored in fuels?

_____

5. Explain step by step how the energy stored in fuels is changed to electrical energy in a power station.

When the fuels are burnt, chemical energy of the fuels is changed into heat energy. Then the heat energy is used to boil water to produce steam. Steam

_____

_____

_____

II. Answer the following questions by referring to Diagram 2. Do not look at the passage. You must answer in complete sentences.

6. Explain how burning fuels in power stations can lead to acid rain.

When fuels are burnt in power stations, they produce _____

_____

_____

7. What are the harmful effects of acid rain?

Acid rain damages _____

_____

_____

8. What is global warming?

Global warming is the increase in _____

_____

9. Explain how burning fuels in power stations can lead to global warming.

When fuels are burnt in power stations, they produce _____

_____

_____

_____

10. Give one effect of global warming on the environment.

Global warming speeds up _____

_____

_____

Worksheet 4

Answer

I. Answer the following questions by referring to Diagram 1. Do not look at the passage. You must answer Q3 and Q5 in complete sentences.

Note: Alternative answers are accepted as long as the answers are correct in terms of content

1. What fuels are commonly used for generating electricity?

Oil, natural gas and coal

2. What is the name of the machine that generates electricity in a power station?

Generator

3. Explain step by step how burning fuels in a power station can generate electricity.

In a power station, fuels are burnt to boil water. The boiling water *produces steam. The steam drives a turbine. The turbine then drives a generator. The generator then produces electricity.*

4. What energy is stored in fuels?

Chemical energy

5. Explain step by step how the energy stored in fuels is changed to electrical energy in a power station.

When the fuels are burnt, chemical energy of the fuels is changed into heat energy. Then heat energy is used to boil water to produce steam. Steam *carries the heat energy to the turbine. Then the turbine changes heat energy into kinetic energy. Finally, the generator changes kinetic energy into electricity energy*.

Answer

(Worksheet 4)

II. Answer the following questions by referring to Diagram 2. Do not look at the passage. You must answer in complete sentences.

6. Explain how burning fuels in power stations can lead to acid rain.

When fuels are burnt in power stations, they produce *sulphur dioxide and nitrogen oxides. These gases dissolve in rainwater and form acid rain.*

7. What are the harmful effects of acid rain?

Acid rain damages *buildings, affects the growth of living things in lakes and rivers, and destroys forests.*

8. What is global warming?

Global warming is the increase in *the average air temperature of the Earth.*

9. Explain how burning fuels in power stations can lead to global warming.

When fuels are burnt in power stations, they produce *carbon dioxide. Carbon dioxide traps heat in the atmosphere. This increases the average air temperature of the Earth.*

10. Give one effect of global warming on the environment.

Global warming speeds up *the melting of ice at the Poles, causing a rise in the sea level.*

ELA3 Lesson Plan – Renewable Energy

Description: This is a follow-up lesson on Section 4.8, Unit 4 of the CDC syllabus. The students have studied issues related to non-renewable and renewable energy sources. Students will be required to read a passage about non-renewable and renewable energy sources and complete two concept maps relating to the passage. They will then be asked to answer questions in complete sentences related to the topic.

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

- explain the difference between renewable and non-renewable energy sources;
- explain how we can use the different energy sources for generating electricity.

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

- understand and use the English terms related to renewable and non-renewable energy sources (e.g., *renewable, energy sources, water, geothermal power, steam, steam turbines, generators, produce electricity, hydro-electric power, tidal power, water flow, water turbines, wind power, moving wind, wind turbines, solar power, sunlight, solar cells, non-renewable, energy sources, used up, faster than, replaced, fossil fuels, dead plants and animals, buried, millions of years ago, nuclear fuels, radioactive materials, release, large amount, particles, break down*);
- read and understand an information text on energy sources which includes previously learned concepts such as *non-renewable energy sources, renewable energy sources, fossil fuels, nuclear fuels, solar power, wind power, tidal power, hydroelectric power, geothermal power*;
- discuss and extract relevant information from the text to complete two concept maps;
- use the key terms in the concept maps to answer questions related to renewable and non-renewable energy sources:
  - *What is the difference between renewable energy sources and non-renewable energy sources?*
    Renewable energy sources can be replaced faster than they are used, but non-renewable energy sources are used faster than they can be replaced.
  - *Explain why people need to find other new methods to generate electricity.*
    Most of our energy comes from non-renewable energy sources. These energy sources will be used up soon.
  - *Give an example where solar power is used.*
    Calculator or any other example
  - *What are the geographical features of the country which uses wind power to generate electricity?*
    The country should be windy and have a lot of space.
  - *Where should a dam be built in order to make use of the tidal power?*
    A dam is built across a river mouth in order to use the tidal power.
  - *What are the bad effects on the environment when we use*

hydroelectric power or tidal power to generate electricity?
The cultural sites along the river are destroyed. Wildlife living along and in the river are affected.

Activities:
- Pre-reading – Whole-class activity (10 min)
- Reading and completing concept maps – Group work (15 min)
- Post-reading activity – Whole-class activity (20 min)
- Writing – answering short questions – Group work (30 min)

Materials: Worksheet 5, Worksheet 6, Visualizer

Steps:

Pre-reading – Whole-class activity (10 min)

1. Using questioning, the teacher reviews the subject matter about non-renewable and renewable energy sources that students learned in the previous lessons. The questions should be designed to check students' understanding of the following key words: *fossil fuels, non-renewable energy sources*.

2. The teacher distributes the reading passage for Worksheet 5 to each student. telling them that they are going to read a passage about energy sources and that the key words in the passage have been learned before. The teacher asks students to read through the paragraphs quickly and say what each paragraph is about, telling them to ignore any difficult words in the paragraph as they will be dealt with later.

3. When students say what each paragraph is about, the teacher may put the key words on the blackboard so that the class can have a rough idea of what each paragraph is about:

	Energy sources
Paragraph 1:	*Energy sources*
Paragraph 2:	*Renewable energy*
Paragraph 3:	*Non-renewable energy*

Reading and completing concept maps – Group work (15 min)

4. The teacher distributes Diagrams 3 & 4 of Worksheet 5 to each student, telling them that they have to read the first and the last paragraphs carefully in order to complete Diagram 4 and the second paragraph to complete Diagram 3.

5. The teacher divides the class into groups of four or five and assigns some groups to work on Diagram 3 first and others to work on Diagram 4 first, telling them that they have to help each other to understand the passage and that each group will be asked to come out and present their answers (either Diagram 3 or Diagram 4).

6. The teacher provides guidance to individual groups where necessary.

Post-reading activity – Whole-class activity (20 min)

7. The teacher asks one group to come out and show the answers to Diagram 3 using a visualizer, and invites other groups to provide feedback on the answers.

8. After checking the answers to Diagram 3, the teacher asks the class to put aside the passage and then nominates one or two students from each of the groups, which are responsible to Diagram 3, to explain part of the diagram in complete sentences.

9. The teacher repeats the same procedure for Diagram 4.

Writing – answering short questions – Group work (30 min)

10. The teacher distributes Worksheet 6 to the class and asks students to answer the questions without referring to the passage. She/he may tell students that some of the questions (Q2, Q6 & Q9) ask for extended information that is not found in the passage. Students have to use the phrases provided to construct their own answers.

11. In order to help students to construct their own sentences from the key phrases provided for answering questions, the teacher may work with the class together on Questions 1 and 2. The teacher may ask some students to come out and put down the answers one by one on the blackboard. When errors (in terms of content or grammatical structure) are found in an answer, they can be pointed out and other students invited to give suggestions for corrections.

12. The teacher then assigns some groups to work on Questions 3-6 first and some on Questions 6-9.

13. The teacher provides guidance to individual groups where necessary.

14. When the students have completed the answers to the questions assigned to them, the teacher asks them to exchange the worksheets among the group members and check whether the answers of their classmates are grammatically correct.

15. Some students are nominated to write down the answers (each student for one question) on the blackboard.

16. The rest of the classes are invited to provide feedback to both the content and the grammar of the answers.

Note:

If this ELA is too long for students, it can be broken down into two activities. Each may include a reading passage that contains one major concept (renewable energy sources or non-renewable energy sources), a concept map, and questions based on that concept only.

Worksheet 5

Energy Sources

Energy sources are either renewable or non-renewable. Renewable energy sources are those that can be replaced faster than they are used. Non-renewable energy sources are those that are used faster than they can be replaced. Therefore, non-renewable energy sources could be used up eventually.

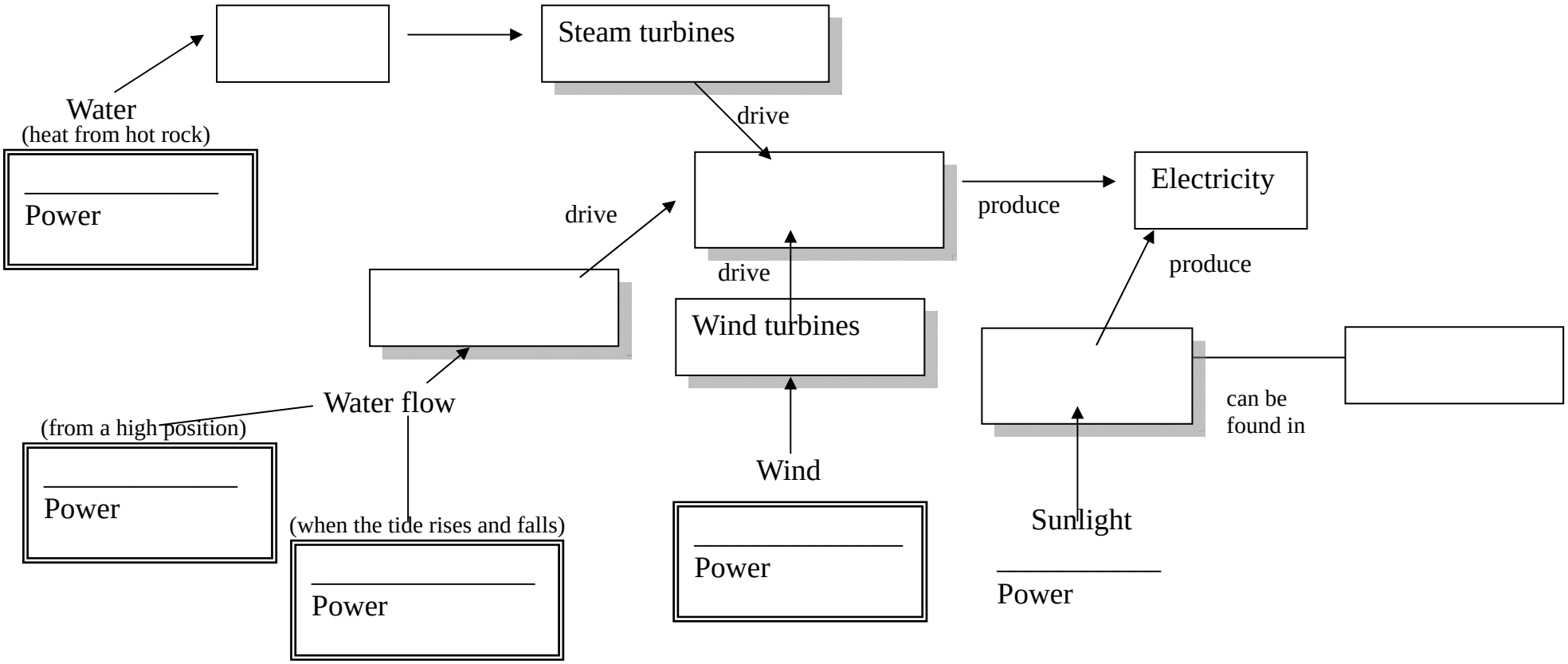
Renewable energy sources include solar power, wind power, tidal power, hydroelectric power and geothermal power. They can be used to generate electricity:

1. Solar power is the light and heat energy from the sun. Solar cells convert sunlight into electrical energy. Solar cells can be found in calculators.
2. Wind power is the kinetic energy of the wind. Wind turns large wind turbines. The wind turbines then drive generators to generate electricity.
3. Tidal power is found in the rise and the fall of tide. A dam is built across a river mouth. When the tide rises and falls, water flows through water turbines in the dam. The water turbines then drive generators to produce electricity.
4. Hydroelectric power is found in the water when it flows down from a high position. A dam is built at a high position in a mountain to hold water. When water is released from the dam, water flows down quickly and drives water turbines at the base of the dam, which in turn drive generators to produce electricity.
5. Geothermal power is the heat energy in hot rocks under the surface of the earth. Water is pumped down to the hot rocks. The heat turns water into steam. Steam is then used to turn steam turbines for producing electricity.

The non-renewable energy sources include fossil fuels and nuclear fuels. Fossil fuels are coal, oil and natural gas. They were formed from dead plants and animals that were buried millions of years ago. Nuclear fuels are materials that can release a large amount of heat energy when the particles of the fuels break down. In power stations, fossil fuels or nuclear fuels are used to produce heat energy for boiling water. The water then produces steam to drive steam turbines. Steam turbines then drive generators to produce electricity.

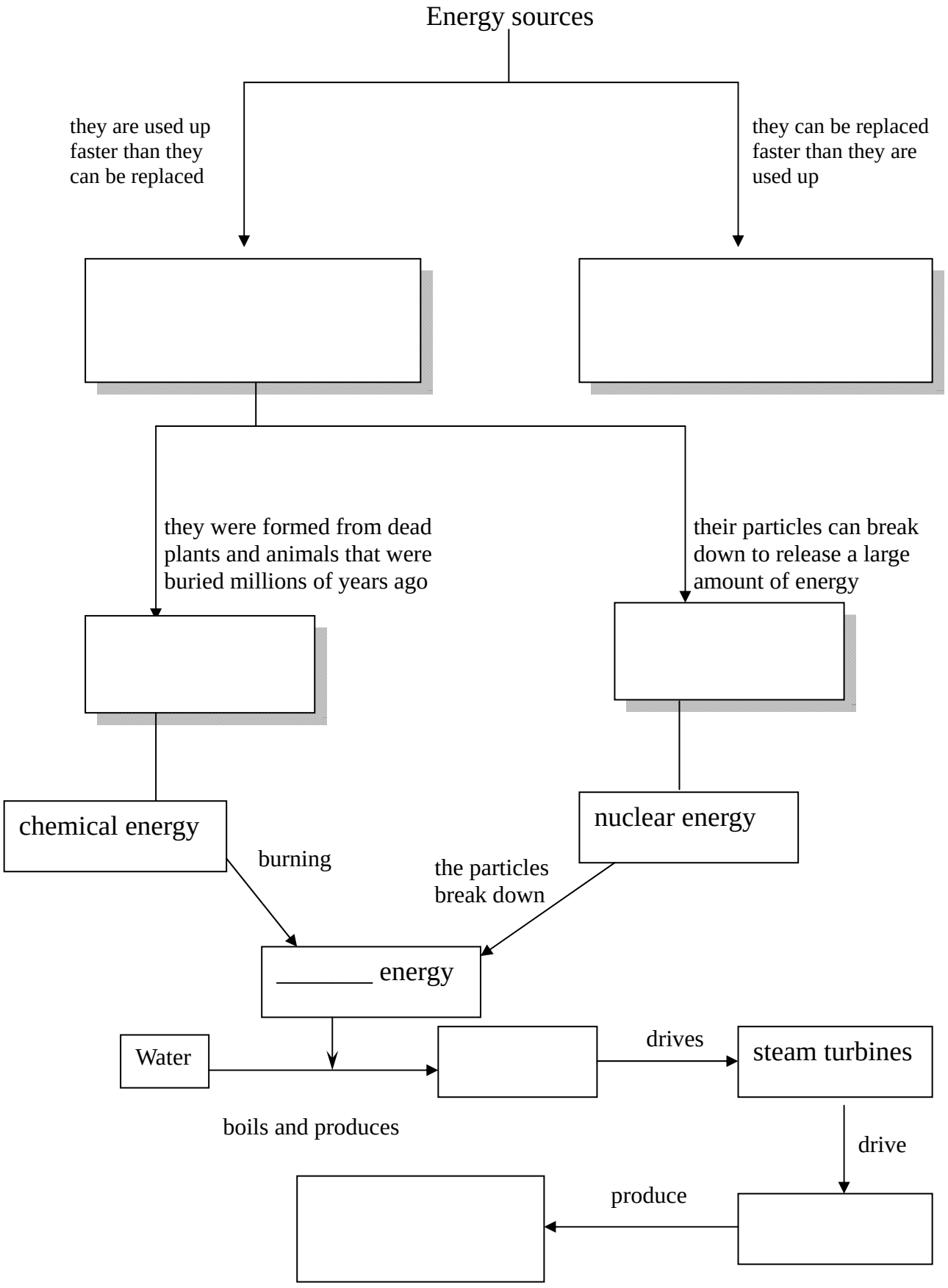
(Worksheet 5)

Diagram 3: Renewable Energy Sources for Generating Electricity



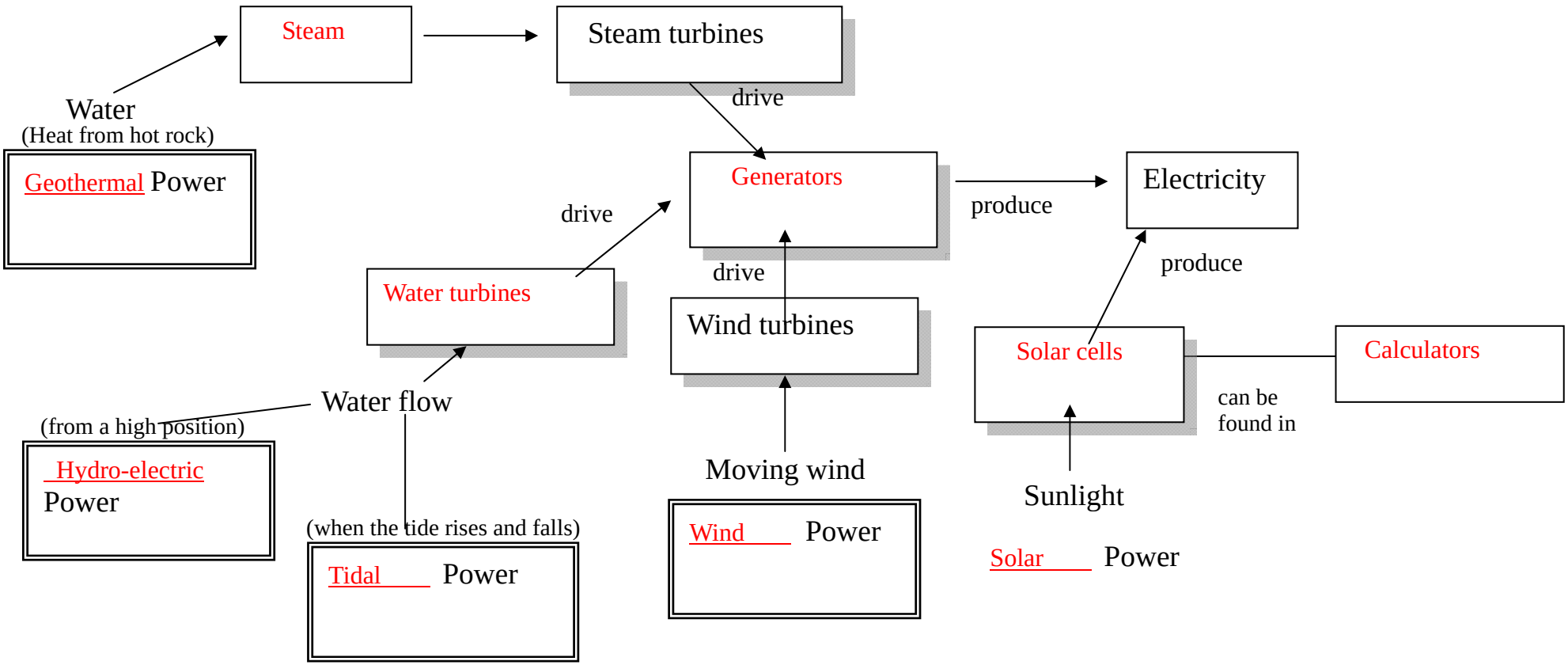
(Worksheet 5)

Diagram 4: Energy Sources



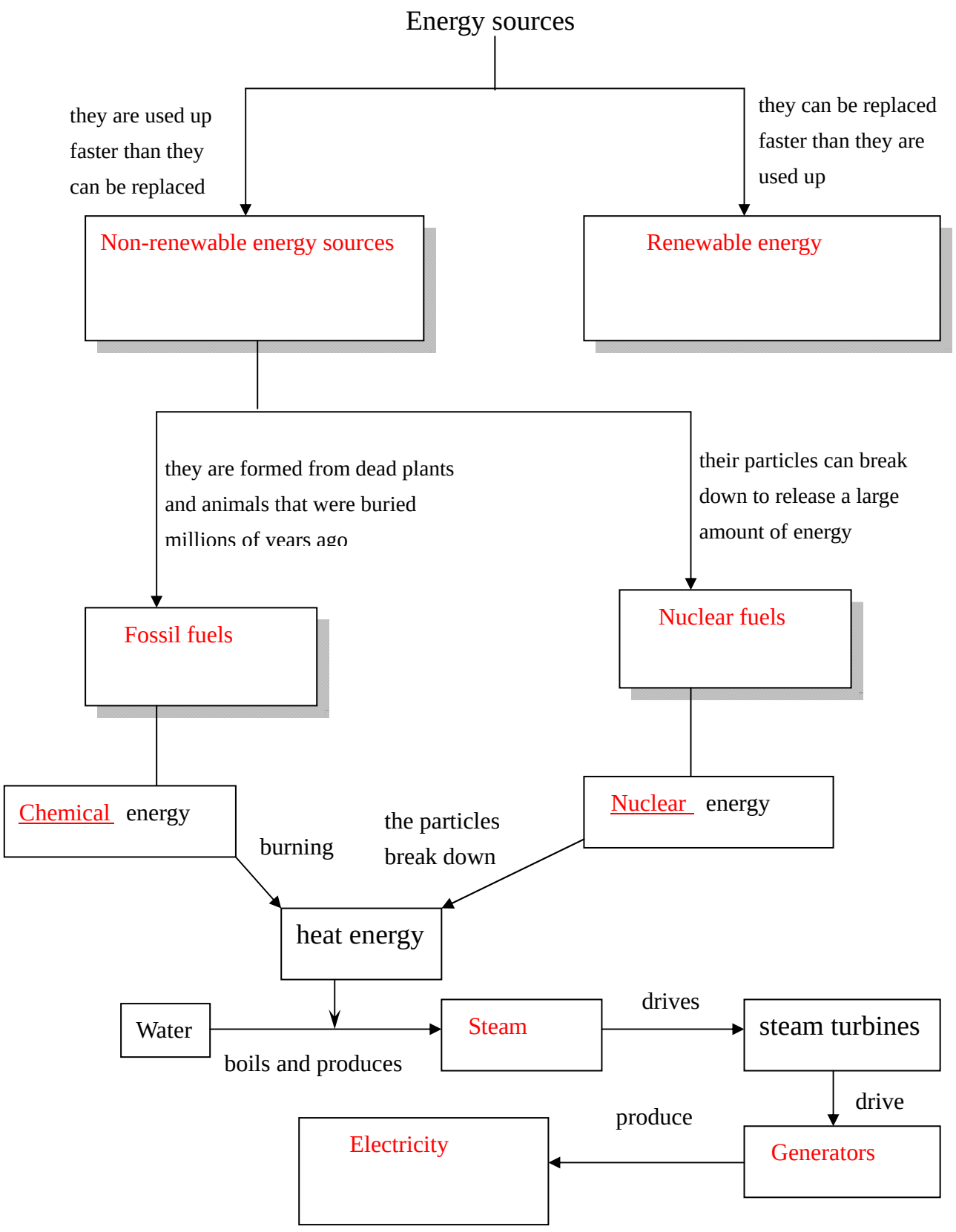
(Worksheet 5)

Diagram 3: Renewable Energy Sources for Generating Electricity



(Worksheet 5)

Diagram 4: Energy Sources



Worksheet 6

The questions below are about renewable and non-renewable energy sources.

Use the phrases provided to answer the following questions in complete sentences (except Q3 and Q7). Do not look at the passage.

(Paragraph 1)

1. What is the difference between renewable energy sources and non-renewable energy sources?
   (can be replaced/ are used/ faster)
   _____
   _____
   _____
2. Explain why people need to find other new methods to generate electricity.
   (most of our energy/ non-renewable energy sources/ will be used up)
   _____
   _____

(Paragraph 2)

3. Give an example where solar power is used.
   _____
4. What are the geographical features of a country which uses wind power to generate electricity?
   (windy/ a lot of space)
   _____
   _____
5. Where should a dam be built in order to make use of the tidal power?
   (across/a river mouth)
   _____
   _____
6. What are the bad effects on the environment when we use hydroelectric power or tidal power to generate electricity?
   (cultural sites along the river/ wildlife living along and in the river)
   _____
   _____
   _____

(Worksheet 6)

(Paragraph 3)

7. Give one example of fossil fuels.

   _____

8. Explain how fossil fuels are formed.

   (plants and animals/ died/ were buried deep underground / millions of years ago)

   _____

   _____

   _____

9. Give one advantage and one disadvantage of using nuclear fuels for generating electricity.

   (a large amount of heat energy/ nuclear wastes/ dangerous radiation)

   _____

   _____

   _____

   _____

Answer

Worksheet 6

The questions below are about renewable and non-renewable energy sources.

Use the phrases provided to answer the following questions in complete sentences (except Q3 and Q7). Do not look at the passage.

Note: Alternative answers are accepted as long as the answers are correct in terms of content and

(Paragraph 1)

1. What is the difference between renewable energy sources and non-renewable energy sources?
   (can be replaced/ are used/ faster)
   Renewable energy sources can be replaced faster than they are used, but non-renewable energy sources are used faster than they can be replaced.
   _____

2. Explain why people need to find other new methods to generate electricity.
   (most of our energy/ non-renewable energy sources/ will be used up)
   Most of our energy comes from non-renewable energy sources. These energy sources will be used up soon.

(Paragraph 2)

3. Give an example where solar power is used.
   Calculator or any other example

4. What are the geographical features of the country which uses wind power to generate electricity?
   (windy/a lot of space)
   The country should be windy and have a lot of space.
   _____

5. Where should a dam be built in order to make use of the tidal power?
   (across/a river mouth)
   A dam is built across a river mouth in order to use the tidal power.
   _____

6. What are the bad effects on the environment when we use hydroelectric power or tidal power to generate electricity?
   (cultural sites along the river/ wildlife living along and in the river)
   The cultural sites along the river are destroyed. Wildlife living along and in the river are affected.

(Worksheet 6)

(Paragraph 3)

7. Give one example of fossil fuels.

   Coal/ oil/ natural gas

8. Explain how fossil fuels are formed?

   (plants and animals/ died / were buried deep underground / millions of years ago)

   Fossil fuels are formed from plants and animals that died and were buried deep underground millions of years ago.

   _____

9. Give one advantage and one disadvantage of using nuclear fuels for generating electricity?

   (a large amount of heat energy/ nuclear wastes/ dangerous radiation)

   Nuclear fuels produce a large amount of energy for generating electricity, but they also produce nuclear wastes. The nuclear wastes give out dangerous