

Facilitator Guide

Certificate I in Climate Change and Disaster Risk Reduction

Units 4 and 5: CGCC0416 and CGCE0516

Demonstrate knowledge of the
causes of climate change

Demonstrate knowledge of the
effects of climate change



Facilitator:

Organization:

Date:

Before you get started...

Dear Facilitator,

This Facilitator Guide (together with the relevant Learner Guide) is aimed at facilitators/trainers who will be assisting learners wishing to complete the following units:

Title:	Demonstrate knowledge of the causes of climate change		
VQA code:	CGCC0416	VQA Level: 1	Credits: 3

Title:	Demonstrate knowledge of the effects of climate change		
VQA code:	CGCE0516	VQA Level: 1	Credits: 3

This guide contains all necessary instructions to ensure that learners will attain the expected competencies required by the above-mentioned units. This guide is designed to be used during the presentation of learning sessions for these units. Learners are advised to read the unit of competency outlines in their own time.

Please discuss the unit of competency outlines with the learners to ensure that they understand what they must do to achieve the required outcomes of these units.

There are three guides, namely the Learner Guide, the Learner Workbook and the Facilitator Guide.

These guides have been developed to address specific aspects of the learning experience. Each of the guides complements the others.

Make this an enjoyable learning experience!

Context of learning

Nowadays everyone is talking about climate change. A lot of information is available but is not always easy to obtain for people living in rural areas of Vanuatu. Some of us do not pay attention to the topic of climate change and some don't even believe that it is happening.

But we are all aware of natural hazards that destroy our lives and our property - cyclones, earthquakes, volcanic eruptions, long periods of drought, floods, landslides, fires, etc. When the effects of a natural hazard become so great that the community cannot handle them by itself, and needs help from outside, the hazard becomes a “disaster”.

These two units are the fourth and fifth in a course of eleven units entitled “Climate Change and Disaster Risk Reduction”. This course helps us to understand more about climatic changes and disasters that have affected us in the past and at present, and are likely to affect us in the future. Many people say that we cannot do much about these changes and disasters, but this is not true. We can do a great deal to reduce the impacts of climate change and natural hazards, both as individuals and in our local communities, and to adapt to these changes in the future. In fact our communities already have a lot of traditional knowledge that can help in reducing the risks and adapting to change. You will learn more about this as we proceed through the course.

The fourth unit helps us to understand more about the causes of climate change. We shall see that the Earth's climate has always changed throughout its history, through natural causes, but that the recent observed rise in global temperatures is related to human activities, particularly since the Industrial Revolution. We shall study the differences between the natural greenhouse effect and the enhanced greenhouse effect. In the fifth unit, we shall see how increasing quantities of greenhouse gases (GHGs) are linked to global warming, climate change, rising sea levels and ocean acidification. We shall examine climate change projections for Vanuatu.

You, as the facilitator, have the challenge to ensure that the learning materials can be applied to the learners' own context, in other words, to their own situations, their own communities and their own islands. As much as possible, you must help them to refer to local examples of everything that is in the course.

The contextualization of the learning material is a very important step in facilitating the learning experience. You must ensure that enough time and effort is put into this.

How to use this guide...

Throughout the guide information is given specifically aimed at you, the facilitator, to **assist** in the actual presentation of the learning material and/or facilitation of the learning process. Although this guide contains all the information required for attaining competency in these two units, references to additional resources, both printed and electronic, are provided for additional reference by the facilitator and further study by the learner.

Please note that the purpose of this information is merely to **guide** you, the facilitator, and is provided as a suggestion of possibilities. It remains the responsibility of every facilitator to re-assess the learner/s in each learning situation throughout the learning process in order to stay in touch with his or her specific learning needs. The needs of each learner must come first!

As you go through this guide, you will come across certain code words and boxes that will help you to facilitate learning more clearly. They are as follows:



Instructions regarding **activities**, whether to be done in a group or individually, will be provided in this type of box.



Facilitator's 'tip' to give you additional information or to help you and the learners with the answer.

My Notes...

(You can use this box for your own notes/comments.)

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What will you be facilitating, and how will you do it?

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The learning experience...

On completion of these two units, the learner will be able to:

- demonstrate that the earth's climate has been constantly changing during geological history;
- explain some of the natural forcings (factors) that cause climate change;
- describe the natural greenhouse effect and its importance for life
- show how human activities in the last 200 years are contributing to the enhanced greenhouse effect
- differentiate between the natural greenhouse effect and the enhanced greenhouse effect
- demonstrate the connection between increased quantities of “greenhouse gases” (GHGs), global warming and climate change
- explain how increasing levels of GHGs and increasing temperatures are leading to rising sea levels and oceanic acidification
- summarize future climate change projections for Vanuatu

Before starting these two units, the learner is expected to have:

- knowledge and experience of some of the factors that influence climate change (deforestation, volcanic eruptions, burning of fossil fuels, etc.) and of the links between the atmosphere and the oceans (evaporation, precipitation, heating of surface water by solar radiation, etc.);
- basic graphicacy skills - graph construction and interpretation, mapping skills;
- knowledge and skills acquired from the preceding units of competency, CGHR0116, CGCK0216 and CGCV0316.

In general, upon completion of a unit at Certificate I level, the learner will be able to:

- perform a defined range of routine activities, usually under supervision;
- demonstrate basic practical skills;
- apply thinking skills such as induction and evaluation;
- participate in a team or working group;
- communicate effectively and convey information and ideas.

My notes:

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Time frame

Section of Unit	Hours allocated for tutorials (theoretical learning)	Hours allocated for practical activities and personal study	Hours allocated for field work	Total hours
Orientation	1	1	-	2
Introduction to Learner Guide	3	-	-	3
Section 1	3	6	-	9
Section 2	2	2	-	4
Section 3	2	4	-	6
Section 4	2	5	4	11
Section 5	1	3	1	5
Section 6	4	5	-	9
Section 7	2	6	4	12
Section 8	2	4	-	6
Preparation for test	-	2	-	2
Summative test	-	1	-	1
Whole unit	22	39	9	70

Facilitator's checklist

Use this checklist to ensure that you are properly prepared and have all the materials needed for the facilitation of successful learning:

Tick this box when you are ready

PREPARATION

Knowledge of the qualification	I have familiarized myself with the qualification that the learners are aiming to obtain	
Knowledge of the unit standard	I have familiarized myself with the required level of this unit standard	
Knowledge of the unit content	I have sufficient knowledge of the unit content to enable me to facilitate with ease	
Application	I have done enough preparation to be able to deliver the programme	
Contextualization	I am ready to include information that is specific to the local community and to Vanuatu	

ABILITY TO RESPOND TO LEARNERS' BACKGROUND AND EXPERIENCE

Understanding of learners	I know something about my learners' gender, age, background and experience and am ready to deliver the programme accordingly	
Enthusiasm and commitment	I am enthusiastic about this subject and am committed to creating an environment that motivates learning	

MATERIALS AND EQUIPMENT

Learner guides	One for each learner	
Learner workbook	One for each learner	
Facilitator guide	One	
Copy of <i>Learning about climate change the Pacific way</i>	One Visual Guide (set of "toolkit" pictures) One Teacher's Guide	
Writing materials	Notebook, pen, pencil, graph paper & rubber per learner	
Other materials	Plastic water bottles, straws, blu-tak, natural dyes, ice, large container, pieces of shell/coral, lemons/limes	
Butcher paper	One roll. Alternatively, large sheets of flip chart paper.	
Whiteboard & pens	One whiteboard & set of coloured whiteboard markers	
Blackboard & chalk	One blackboard and coloured chalk	
Data projector	Optional. To be used for power point presentations	
Laptop	Optional. To be used for power point presentations and internet connection. USB flash drive useful.	
Internet connection	Desirable but not always possible	
Attendance register	One	
Course evaluation	One sheet for each learner (copied from Learner workbook)	
Portfolio of evidence	One portfolio holder for each learner	
Summative test	One copy for each learner	

Contextualization of content

At this stage, it will be useful for you to go through these two units and think about the specific information and local examples that should be included in the learning.

Section	Specific examples from the local area, Vanuatu or the Pacific region
1	
2	
3	
4	
5	
6	
7	
8	

Section 1 Demonstrate that the Earth's climate has been constantly changing

Learner

Guide:

Page 15

After completing this section, the learner should be able to:

- 1.1 identify examples of periods in the Earth's history when temperatures were warmer and cooler than those of today;
- 1.2 demonstrate changes in world-wide sea levels during the last Ice Age.

Concepts 1.1 and 1.2	Time frame	Activities related to the concepts
Examples of periods in the Earth's history when the climate was much warmer or cooler than today	9 hours	Activities 1.1a, 1.1b, 1.2a and 1.2b
Drop in world-wide sea levels during the last Ice Age, when temperatures were much cooler		

Please allow learners to complete activities 1.1a and 1.1b in their workbooks:



Type of activity	Resources
1.1a Pair work - short answer questions	Learner guide
Instructions to give to the learners	
Activity 1.1a: In pairs, discuss the following questions and write your answers in the spaces provided.	

Type of activity	Resources
1.1b Individual work - drawing two imaginary pictures	Learner guide and own ideas
Instructions to give to the learners	
Activity 1.1b: Imagine you were living in the north of Russia at the start of the Eocene epoch. Now create an imaginary picture of what the environment might have looked like. Then pretend that you were in the same place during a glacial period of the Pleistocene Ice Age. Draw a picture to show what the environment would have been like.	

**Activity 1.1a**

1.

Name of time period	How many years before today ?	Were temperatures warmer or cooler than today ?	Were sea levels higher or lower than today ?
Time when the Earth was formed	4.6 billion years ago	Much warmer	No oceans or seas. All water was in the form of water vapour.
Start of Carboniferous	360 million years ago	Warmer	Higher
End of Carboniferous	300 million years ago	Cooler	Lower
Start of Eocene epoch	49 million years ago	Much warmer	Much higher
Last glacial period during the recent Ice Age	20,000 years ago	Cooler	Lower
Last interglacial period during the recent Ice Age	125,000 years ago	Warmer	Higher

2. a) T b) F c) T d) F e) T f) T

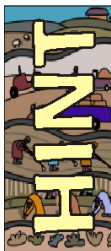
**Activity 1.1b**

The top picture should be like the pictures on page 15 and 16 of the Learner Guide, with thick green rain forests, palm trees and crocodiles. The bottom picture would be like the picture on page 18 of the Learner Guide, with the land covered in ice and snow and a few woolly mammoths present.

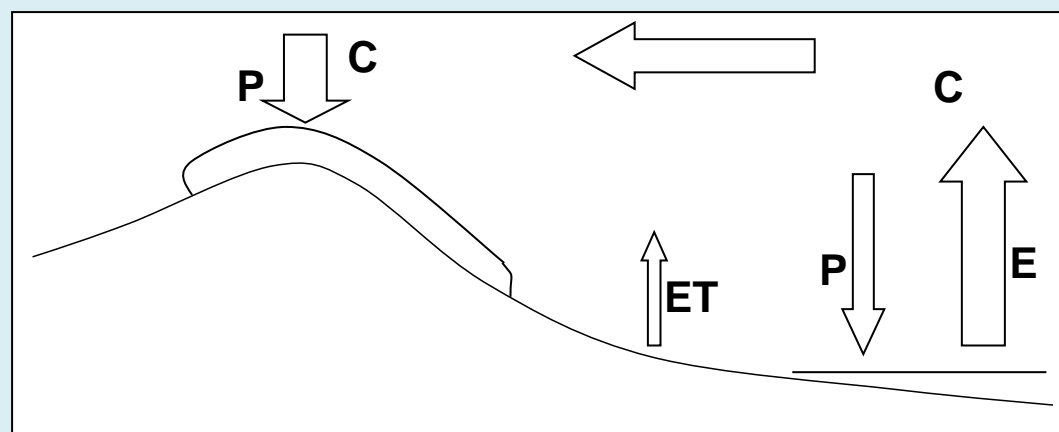
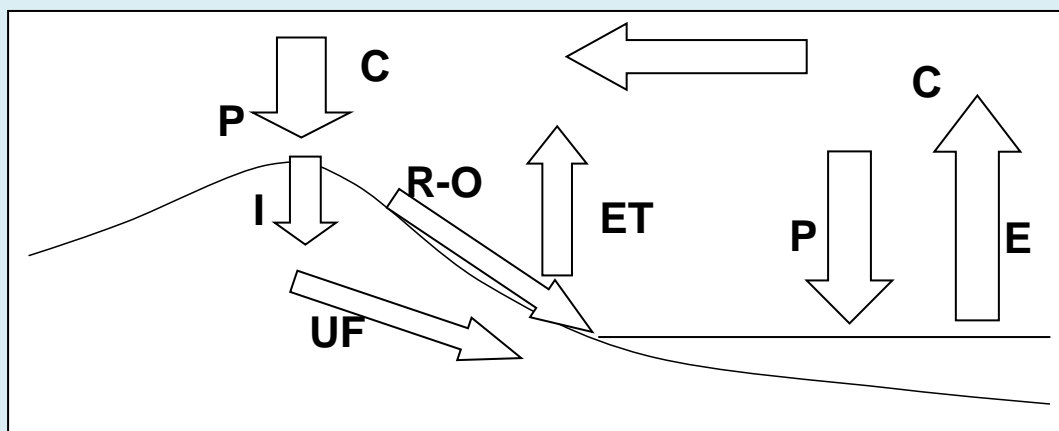
Now allow learners to complete activity 1.2a in their workbooks:



Type of activity	Resources
1.2a Drawing diagrams	Learner guide and own ideas
Instructions to give to the learners	
Activity 1.2a: In the top box on page 5, draw a simple diagram of the water cycle, showing evaporation, condensation, precipitation, transfer of vapour, infiltration, surface run-off and underground flow. In the bottom box, draw a diagram to show what the water cycle would look like during a glacial period of the last Ice Age, when temperatures were much colder and precipitation fell down as snow. Add labels to your diagrams.	

**Activity 1.2a**

The two diagrams:



Now allow learners to complete activity 1.2b:

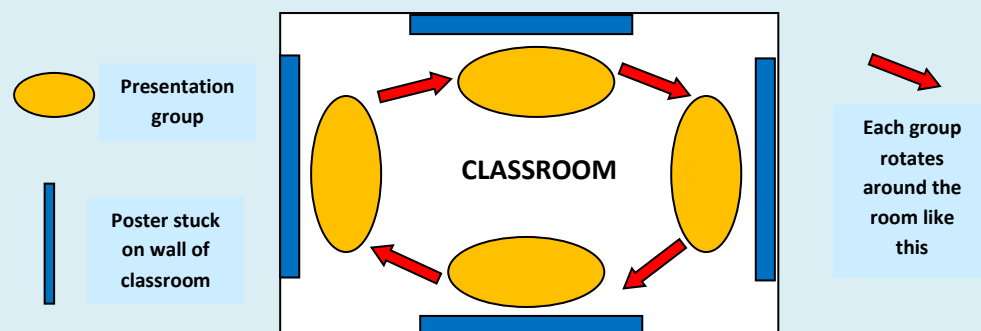


Type of activity	Resources
1.2b Carousel activity on the Earth's changing climate	Learner guide, own ideas
Instructions to give to the learners	
Activity 1.2b: The class should divide into four groups with four learners in each group. Each group selects one of the four topics given, then prepares a large poster with pictures and information about the topic. The posters are pinned on the wall, and new groups are formed. The carousel activity is then carried out, following the instructions given on page 6 of the Learner Workbook.	



Activity 1.2b

You should go through the instructions for this activity with the learners, carefully reading the details on page 6 of the Learner Workbook. Because there are four topics, there should be exactly four learners in the first group that is formed for preparing the poster. Then when the new groups are formed for the presentation, there will be four persons in each, one who is an “expert” on each poster. One group will contain all the number 1s from the first groups, another will contain all the number 2s, and so on. Each of the new groups stands in front of one of the posters, and the person who knows about the poster will make his/her presentation. After about 5 minutes, you give a signal, and all the groups move to the next poster. This process continues until all groups have visited all posters. They circulate like this:



If you have more than 16 learners in the class, then you can put more than four in each of the first groups, and then when they give themselves a number, two of them can have the same number and so share in the presentation of the topic. If you have 20 learners in the class, you can add an extra topic, so that you have five groups of four learners. One possible topic you could choose might be “Glacial and interglacial periods during the Ice Age”. If you have less than 16 learners, you can reduce the number of topics, and have three instead of four.

This is a very good method of helping your learners to speak about a topic. Everyone has to speak about his/her poster, but only to a small group.

To help you and your students understand the Earth’s geological history, diagrams showing the Earth’s geological time scale are shown on the next page. Read the diagrams from the bottom upwards.

My notes:

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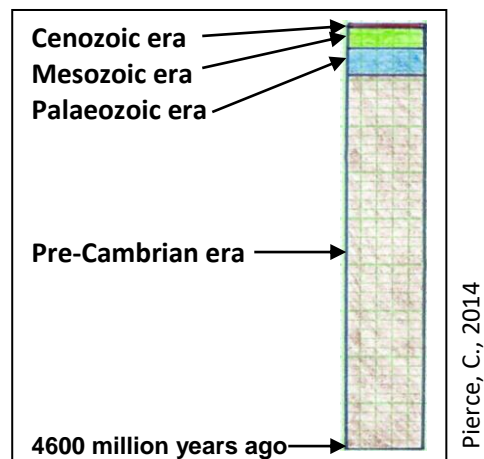
The Geological Time Scale

ERA	PERIOD	EPOCH	AGE*	MAJOR EVENTS
CENOZOIC	Quaternary	Holocene	0.01	Earliest <i>Homo sapiens</i>
		Pleistocene	1.8	
	Tertiary	Pliocene	5.3	Earliest hominids
		Miocene	23.8	
		Oligocene	33.7	Dominance of mammals
		Eocene	55	
		Paleocene	65	
MESOZOIC	Cretaceous		145	Widespread extinctions
	Jurassic		200	First flowering plants
	Triassic		251	Dinosaurs dominant
				Widespread extinctions
PALEOZOIC	Permian		299	First reptiles
	Carboniferous		359	
	Devonian		417	
	Silurian		443	Fishes dominant
	Ordovician		490	
	Cambrian		542	First fishes
				Appearance of fossils
PRECAMBRIAN				Soft-bodied animals
			3000	First one-celled organisms
			4600	Origin of the earth

*Age in millions of years (Ma)

McSaveney, E., & Nathan, S., *Te Ara*, 2013

This diagram shows the main eras of geological time, but has been drawn to scale. You can see that the Precambrian era lasted for very much longer than the other eras.



Section 2 State some natural causes of climate change

Learner

Guide:

Page 20

After completing this section, the learner should be able to:

2.1 Identify reasons for natural changes in climate.

Concepts 2.1	Time frame	Activities related to the concepts
Natural forcings of climate change - volcanic eruptions, changes in solar radiation, variations in the earth's orbit, meteorites and asteroids, changes in the composition of the atmosphere, etc.	4 hours	Activities 2.1a and 2.1b

Please allow learners to complete activities 2.1a and 2.1b in their workbooks:



Type of activity	Resources
2.1a Analysis of a diagram	Learner guide
Instructions to give to the learners	
Activity 2.1a: Complete the key to the diagram, which shows some of the natural forcings of climate change.	
2.1b Pair work - natural forcings of climate change	Learner guide and own ideas
Instructions to give to the learners	
Activity 2.1b: 1. In pairs, complete the table below to explain how and why Earth's climate has changed because of natural forcings or factors. 2. Do you think that natural forcings are playing a part in climate change today and will continue to play a part in the future?	

**Activity 2.1a**

Changes in composition of the atmosphere	C	Changes in the Earth's orbit	D
Meteorites and asteroids	F	Changes in Earth's albedo	E
Changes in energy emitted by the Sun	A	Volcanic eruptions	B

**Activity 2.1b**

1.

Natural forcing	Does it make the climate warmer or cooler?	Why does it make the climate warmer or cooler?
Dust clouds emitted by volcanic eruptions	Cooler	Dust clouds block incoming solar energy
CO ₂ and H ₂ O emitted by volcanic eruptions	Warmer	They are greenhouse gases that can absorb outgoing heat from the Earth
Increased solar radiation (more energy emitted by the Sun in solar flares, etc.)	Warmer	More energy emitted by the Sun
Earth's orbit becomes more elliptical	Warmer and cooler	Warmer twice a year when the Earth is closer to the Sun. Cooler twice a year when the Earth is further from the Sun
More forest covers the earth	Warmer	Lower albedo – forests are dark in colour.
More ice covers the earth	Cooler	Higher albedo – ice reflects incoming solar radiation
More carbon dioxide and methane in the atmosphere	Warmer	They are greenhouse gases that absorb outgoing heat from the Earth
Large meteorite hits the Earth	Cooler	Dust clouds block incoming solar energy

2. Yes. There will continue to be meteorites, volcanic eruptions, changes in energy emitted by the Sun, changes in the Earth's orbit, and changes in the Earth's albedo.

My notes:

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Section

3

Demonstrate knowledge of the natural greenhouse effect and its importance for life

Learner

Guide:

Page 23

After completing this section, the learner should be able to:

- 3.1: identify processes in the natural greenhouse effect;
3.2: identify the major greenhouse gases that contribute to global warming

Concepts 3.1 and 3.2	Time frame	Activities related to the concepts
The natural greenhouse effect, incoming energy from the Sun and outgoing energy from the Earth. Greenhouse gases (GHGs) that contribute to atmospheric warming.	6 hours	Activities 3.1a, 3.1b and 3.2

Please allow learners to complete activity 3.1a in their workbooks:



Type of activity	Resources
3.1a Pair work - answering questions on a diagram	Learner guide
Instructions to give to the learners	
Activity 3.1a: In pairs, study the diagram, then answer the following questions.	



Activity 3.1a

- 342 watts/m²
- 102 watts/m²
- 162 watts/m²
- It is radiated back into the atmosphere and into space.
- 162 watts/m² (i.e. the same amount that was absorbed by the Earth's surface.
- Infrared or heat energy
- Some is trapped by greenhouse gases, warms the atmosphere and returns to Earth.
- (On the diagram, to be written on top of the red wavy arrows in the atmosphere that look like this:)



Now please allow learners to complete activity 3.1b in their workbooks:



Type of activity	Resources
3.1b Giving a talk	Learner guide, own ideas
Instructions to give to the learners	
Activity 3.1b: <ol style="list-style-type: none"> You are going to give a talk to explain the natural greenhouse effect step by step. This box contains the different steps in the explanation, but they have not been shown in the correct order. Your first task is to sort them out and put them in the correct order in the spaces A to H below the box. Now copy this diagram on to a large piece of paper and add the labels. You can use the diagram to help you with your talk. Practice your talk. Now form pairs. Each should present to the other a step-by-step explanation of the natural greenhouse effect. 	



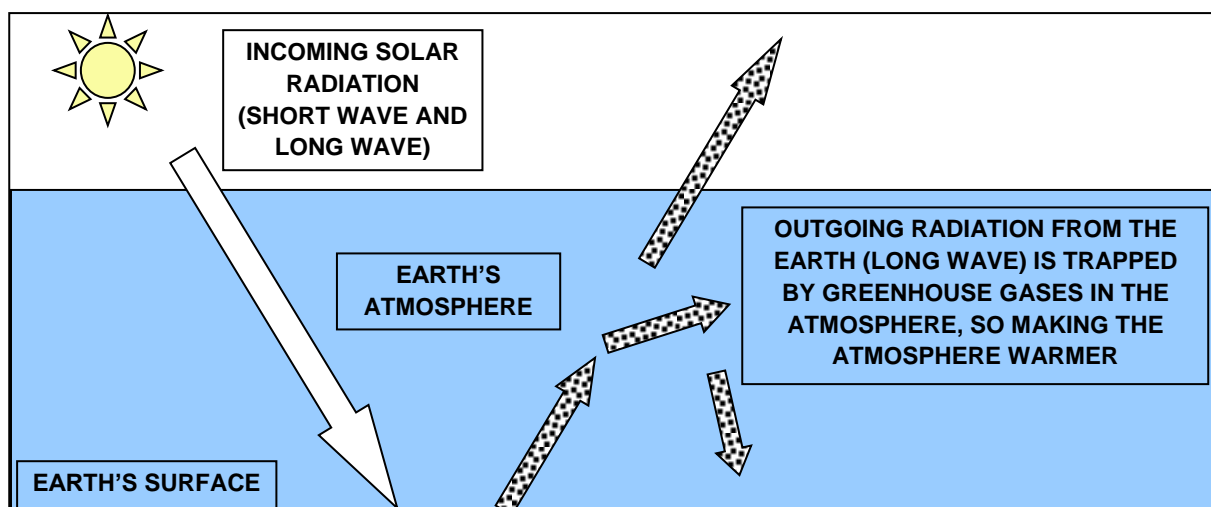
Activity 3.1b

1.

A	Incoming solar radiation, consisting of both short and long waves, enters the Earth's atmosphere.
B	Some of the incoming energy is reflected straight back into space by the Earth's atmosphere, clouds and the Earth's surface.
C	About half of the incoming solar radiation reaches the Earth's surface.
D	At the Earth's surface, solar energy is absorbed by land and sea and is converted into heat.
E	Heat from the surface of the Earth goes back into the atmosphere as outgoing long-wave (infrared) radiation.
F	Some of the outgoing infrared radiation is absorbed and re-emitted by greenhouse gases like CO ₂ and CH ₄ . This warms the atmosphere and the Earth's surface.
G	The Earth's surface gains more heat, and infrared radiation is emitted again. So the Earth's surface and the lower atmosphere get warmer.
H	Some of the infrared radiation passes through the atmosphere and is sent back into space.

2. See completed diagram below.

3. Encourage learners to practice their talks before they present to their partners. Ensure that each has completed his/her own diagram, and that they describe each step while pointing to the correct place and label on the diagram.



Now please allow learners to complete activity 3.2 in their workbooks:



Type of activity	Resources
3.2 Individual exercise – True or False?	Learner guide
Instructions to give to the learners	
Activity 3.2: Say whether each of the following statements is True or False.	



Activity 3.2

1. True
2. False
3. True
4. True
5. True

My notes:

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Section

4

Illustrate how human activities in the last 200 years are contributing to the enhanced greenhouse effect

Learner

Guide:

Page 27

After completing this section, the learner should be able to:

- 4.1:** demonstrate ways in which humans are contributing to increased emissions of greenhouse gases;
- 4.2:** carry out a field investigation in the local area to find out how human activities are contributing to the enhanced greenhouse effect;

Concepts 4.1 and 4.2	Time frame	Activities related to the concepts
Ways in which humans are contributing to increased emissions of greenhouse gases.	11 hours	Activities 4.1a, 4.1b, 4.1c and 4.2
Local examples of increased emissions of greenhouse gases.		

Firstly, please allow learners to complete activity 4.1a in their workbooks:

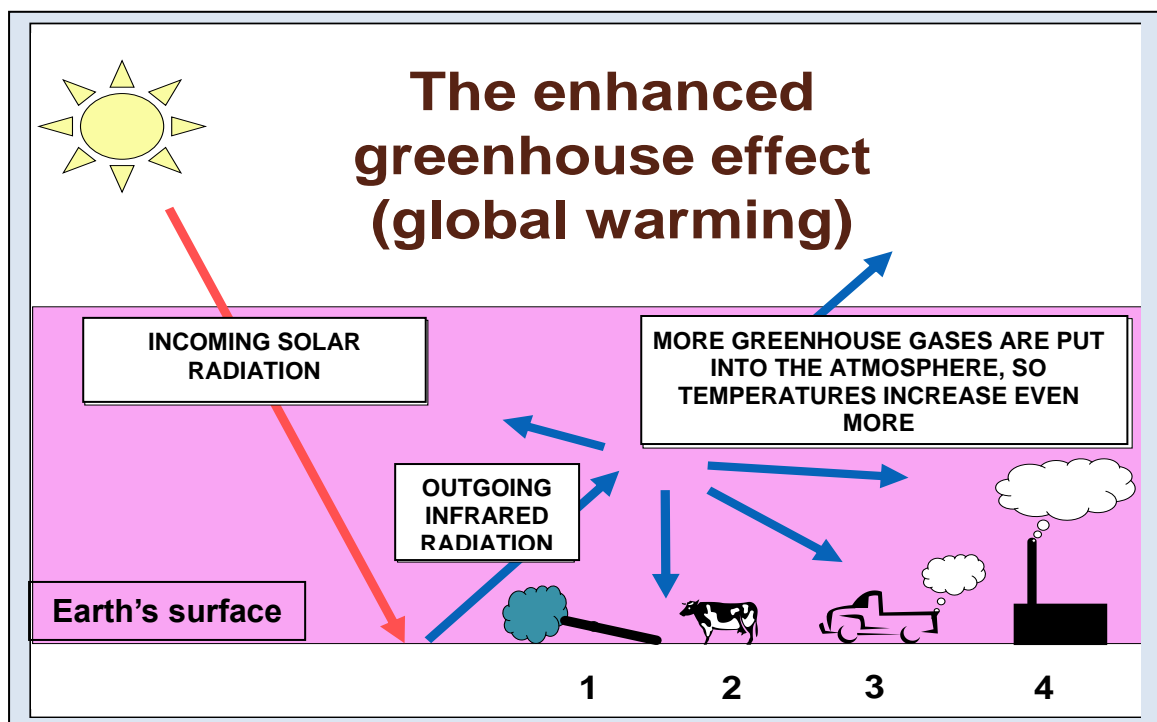


Type of activity	Resources
4.1a Completion of a diagram	Learner guide
Instructions to give to the learners	
Activity 4.1a: Complete the diagram to show how human activities are leading to the enhanced greenhouse effect. Firstly add the labels in the correct places. Secondly, state the human activities numbered 1, 2, 3 and 4 that are contributing towards the enhanced greenhouse effect.	



Activity 4.1a

- See completed diagram on the next page.
- Explanation of numbers 1, 2, 3 and 4:
 - 1** Deforestation: Fewer trees to absorb CO₂, so atmospheric CO₂ builds up.
 - 2** Rearing of cattle, goats and other ruminants: Emit CH₄ into the atmosphere.
 - 3** Industries and power stations: Emit CO₂ and N₂O into the atmosphere.
 - 4** Vehicles, ships and aircraft: If powered by petrol or diesel, emit CO₂ and carbon into the atmosphere.



Now please allow learners to complete activity 4.1b in their workbooks:

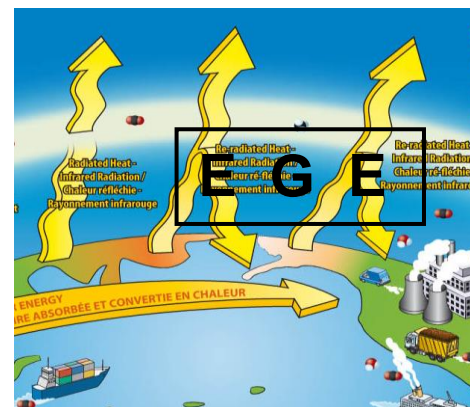


Type of activity	Resources
4.1b Pair work - analysis of a picture	Learner guide, own observations
Instructions to give to the learners	
Activity 4.1b: Study the picture. It shows how natural factors and human activities are putting greenhouse gases into the atmosphere, so leading to the enhanced greenhouse effect and climate change. Work with a friend to answer the questions below the picture.	



Activity 4.1b

- (See part of picture shown on the right.)
- Two natural causes: volcanic eruptions and natural fires.
- Six human activities: aircraft, power stations, industries, ships, vehicles, deforestation, wet rice fields, cattle ranching/cattle plantations.
- Industrialised, richer countries.



SPC & GIZ, 2014: A visual guide

Now please allow learners to complete activity 4.1c in their workbooks



Type of activity	Resources
4.1c Discussion questions for whole class or in small groups	Learner guide, own ideas
Instructions to give to the learners	
Activity 4.1c: <ol style="list-style-type: none"> 1. This graph shows measurements of the carbon dioxide content of the atmosphere that were taken from the meteorological observatory on top of Mauna Loa in Hawaii. Why do you think the amount of carbon dioxide fluctuates each year? What is the general trend shown? Why is this happening? 2. Which parts of the world do you think are suffering the most from the effects of the enhanced greenhouse effect (global warming)? Why do you say this? 3. Study the picture and suggest ways in which people in this village could be making small contributions to the enhanced greenhouse effect. 4. Complete the table to show the main sources of energy for cooking, lighting and transport in your local community. 	



Activity 4.1c

1. It fluctuates because many trees in the northern hemisphere lose their leaves in the cool season (autumn and winter), so cannot absorb so much carbon dioxide; therefore, the atmospheric CO₂ content increases. When temperatures get warmer (spring and summer), the new growth of leaves absorb more CO₂, and so the atmospheric CO₂ content decreases.
2. Many answers are possible, e.g.
 - small islands in the Pacific and Indian oceans, because of sea level rise ;
 - Australia because of more forest fires;
 - areas near the north and south poles because ice is melting very quickly;
 - Africa and the Middle East, because of more droughts;
 - the Sahel zone in Africa, and densely populated parts of Asia (e.g. Bangladesh) because of high population densities, high levels of poverty and disease, constant extreme events such as droughts and floods, shortages of fresh water, etc. - already leading to violent conflicts; poverty leads to greater vulnerability;
 - everywhere in the world, because warmer temperatures can spoil food crops, flooding can damage farms and houses, etc.
3. Ways in which people are contributing to the enhanced greenhouse effect:
 - clearing of bush for gardens (less vegetation to absorb CO₂)
 - burning of bush (more carbon and CO₂ emitted)
 - piles of rubbish (more CH₄ emitted)
 - rearing of ruminants such as goats and cattle (more CH₄ emitted)
 - burning of plastic and tyres (CO₂, N₂O, CFCs, aerosols emitted)
4. The sources of energy are likely to be firewood, bottled gas, generators using petrol or diesel, vehicles using petrol or diesel, refrigerators using paraffin, electricity from UNELCO, etc. All of these emit CO₂. If the power comes from solar panels, wind or water (hydro), then there are no emissions of CO₂.

My notes:

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Now please allow learners to carry out activity 4.2:



Type of activity	Resources
4.2 Field investigation in small groups	Own observations
Instructions to give to the learners	
Activity 4.2: Divide into small groups. Each group should undertake fieldwork in a different local community, or in different parts of the same local community. Your task is to observe all the ways in which people may be contributing to the enhanced greenhouse effect (global warming), and therefore to climate change. You should complete the questionnaire below, and also draw a sketch map of your area to show where the different activities are taking place. For example, you could record all the open piles of rubbish that you see. Don't forget to visit people's food gardens.	



Activity 4.2

Ask the learners to choose a different local community and to spend at least 2 hours there. They must observe houses, gardens and other spaces, and record their findings about ways in which people are contributing to the enhanced greenhouse effect. Each group must also draw a sketch map or maps on which they record features such as buildings, roads and food gardens. On this sketch map they should show examples of activities that contribute to global warming, including the location of all piles of rubbish.

When they have completed this activity, you can ask each group to report on its findings. Each member of the group should also make a copy of the sketch map in the box in the Learner Workbook.

Allow plenty of time for this activity - at least 4 hours.

My notes:

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Section 5

Differentiate between the natural and enhanced greenhouse effects

Learner

Guide:

Page 32

After completing this section, the learner should be able to:

5.1: clarify two ways in which the natural greenhouse effect is different to the enhanced greenhouse effect.

Concepts 5.1	Time frame	Activities related to the concepts
Differences between the natural greenhouse effect and the enhanced greenhouse effect.	5 hours	Activities 5.1a and 5.1b

Please allow learners to complete activities 5.1a and 5.1b in their workbooks:



Type of activity	Resources
5.1a Paragraph writing	Learner guide, own ideas
Instructions to give to the learners	
Activity 5.1a: After discussing the differences between the natural greenhouse effect and the enhanced greenhouse effect with your fellow learners, please write two paragraphs to explain two of these differences.	

Type of activity	Resources
5.1b Talk on the causes of climate change	Learner guide and own ideas
Instructions to give to the learners	
Activity 5.1b: Now, each learner should prepare a short talk (5-10 minutes long) on the causes of climate change, both natural and human. You can make use of the picture on page 13 of the Learner Workbook, or else draw your own pictures. Discuss with me (your facilitator) whether you will give your talk to a group of people from your training institution or to a group of people in the local community.	



Answers to questions at the bottom of the Learner Guide, page 33

Human activities shown – cattle rearing, deforestation, factory / industry, petrol station. The temperature is hot - much warmer than in the model of the natural greenhouse effect.

Activity 5.1a

Any two of the following differences could be described:

1. The natural greenhouse effect is produced by natural factors, while the enhanced greenhouse effect is due to human activities.
2. The natural greenhouse effect benefits the human race, because it keeps the atmosphere warm and makes life possible. The enhanced greenhouse effect has negative effects on humanity because it is causing hazards such as high temperatures, flooding, drought, sea level rise, ocean acidification, etc.
3. The natural greenhouse effect has been in existence for billions of years, while the enhanced greenhouse effect is very recent in the Earth's history and has really only been operating for the last 200-250 years.

Activity 5.1b

Encourage the learners to make use of the picture on page 13 of the Learner Workbook, and to draw some other pictures as well. Where possible, learners should be encouraged to visit a local community and give their talks in different households.

My notes:

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Section

6

Demonstrate the links between greenhouse gases, global warming and climate change

Learner

Guide:

Page 35

After completing this section, the learner should be able to:

- 6.1:** demonstrate, through statistical evidence, that increased levels of GHGs in the atmosphere are leading to global warming;
- 6.2:** demonstrate how rising global air and sea surface temperatures impact on other aspects of climate - changing rainfall patterns, more frequent extreme events, humidity, atmospheric and oceanic circulation, etc.

Concepts 6.1 and 6.2	Time frame	Activities related to the concepts
Evidence of increased levels of GHGs and of global warming	9 hours	Activities 6.1a, 6.1b, 6.2a, 6.2b and 6.2c
Impact of rising temperatures on other aspects of climate		

Firstly, allow learners to complete activity 6.1a in their workbooks:



Type of activity	Resources
6.1a Short answer questions	Learner guide and own ideas
Instructions to give to the learners	
Activity 6.1a: Answer the three questions on page 19 of the Learner Workbook.	



Activity 6.1a

1. You would show them the graph of observations of rising atmospheric CO₂ recorded at Mauna Loa observatory, pointing out that this is in a very remote place, far from industries and vehicles.
2. 1960: approximately 315 ppmv; 2014: approximately 399 (or 400) ppmv.
3. They fluctuate because of seasonal changes in vegetation. When trees in the northern hemisphere lose their leaves, less CO₂ can be absorbed from the atmosphere, so atmospheric CO₂ rises. When trees grow their leaves again as temperatures get warmer, more CO₂ can be absorbed from the atmosphere, so atmospheric CO₂ drops.

My notes:

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Now allow learners to complete activity 6.1b in their workbooks

Type of activity	Resources
6.1b Small group work - analysis of graphs	Learner guide and own ideas
Instructions to give to the learners	
Activity 6.1b: 1. In pairs or groups of three, study the graph, then answer the questions below. 2. Still in pairs or groups of three, study the graph of global surface temperature change and answer the questions below.	

**Activity 6.1b**

1.
 - a) 0.2°C
 - b) Just over 0.4 °C
 - c) Average temperature between 1850 and 2010 has risen. The most rapid increase in each decade was from 2000 to 2010.
2.
 - a) 0.4°C
 - b) They dropped slightly because of the huge dust cloud emitted by Pinatubo.
 - c) Higher.
 - d) Lower.
 - e) They increased.
 - f) Yes.
 - g) They increased.
 - h) They rose.
 - i) It decreased.

Now allow learners to complete activity 6.2a and 6.2b in their workbooks:



Type of activity	Resources
6.2a Map work	Learner guide and own ideas
Instructions to give to the learners	
Activity 6.2a: Study the map of changes in total rainfall in the world between 1951 and 2010. Then answer questions 1 to 7 below the map.	

Type of activity	Resources
6.2b True or False?	Learner guide and own ideas
Instructions to give to the learners	
Activity 6.2b: Use the graph provided and your own knowledge to say whether the statements 1 to 10 are TRUE (T) or FALSE (F)	

**Activity 6.2a**

1. Drier
2. Wetter
3. Wetter
4. Northern part is wetter and southern part is drier
5. Eastern Asia (China, Japan, etc.)
6. Yes and no. Some parts of the world are getting more rainfall, while other parts are getting less.



Activity 6.2b

1. False
2. True
3. True
4. False
5. False
6. True
7. True
8. True
9. False
10. True

Finally in this section, allow learners to complete activity 6.2c in their workbooks:

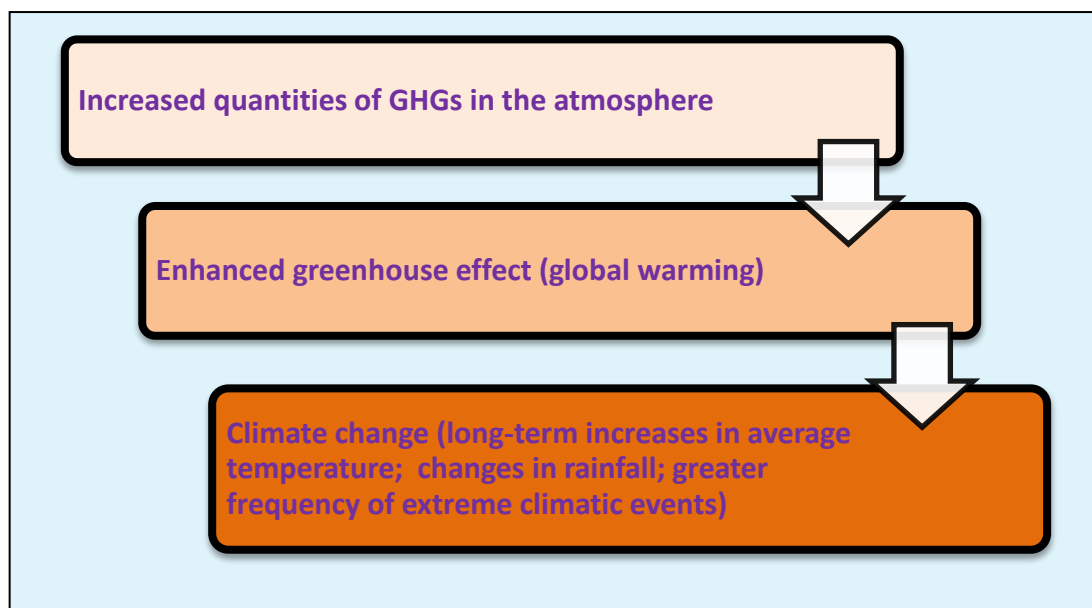


Type of activity	Resources
6.2c Diagram completion	Learner guide and own ideas
Instructions to give to the learners	
Activity 6.2c: Look again at page 40 of your Learner Guide. Then complete this flow chart to show how increased emissions of greenhouse gases are leading to climate change.	



Activity 6.2c:

See completed flow chart below:



My notes

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Section

7

Provide reasons for rising sea levels and oceanic acidification

Learner

Guide:

Page 41

After completing this section, the learner should be able to:

- 7.1:** demonstrate the effect of increasing levels of greenhouse gases on rising sea levels through the thermal expansion of oceans and the melting of polar ice;
- 7.2:** demonstrate the links between increased greenhouse gases, warmer sea-surface temperatures, oceanic acidification and the degradation of coral reefs.

Concepts 7.1 and 7.2	Time frame	Activities related to the concepts
Impact of increasing levels of GHGs on sea levels.	8 hours	Activities 7.1a, 7.1b, 7.2a and 7.2b
Connection between increased GHGs, warmer sea-surface temperatures, oceanic acidification and the degradation of coral reefs.		

Please allow learners to complete activity 7.1a in their workbooks:



Type of activity	Resources
7.1a Paragraph writing	Learner guide and own ideas
Instructions to give to the learners	
Activity 7.1a: Write a few sentences to explain what is happening in the picture.	



Activity 7.1a

You may wish to tell the learners that the picture is really a cartoon. Their task is to explain its meaning. Some of the key ideas shown by the cartoon are as follows:

- Human activities such as cattle rearing, deforestation and the burning of fossil fuels are putting additional greenhouse gases such as methane and carbon dioxide into the atmosphere.
- Greenhouse gases such as carbon dioxide and methane let solar radiation pass through the atmosphere but trap the outgoing heat radiation, so making the atmosphere and the earth warmer. Human activities are increasing this process and creating the enhanced greenhouse effect.
- Because of the enhanced greenhouse effect (the additional warming of Earth's atmosphere), the ocean is heating up, expanding and rising up. In addition, ice sheets covering the land are melting. These two factors (thermal expansion and melting of land-based ice) are causing sea level rise.
- Sea level rise is affecting coastal settlements and will mean that low-lying land will drown or disappear. People living on the coast will have to move their settlements, infrastructures and agricultural activities to higher ground. Or else they will need to migrate to other places.

My notes:

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Now please allow learners to complete activity 7.1b in their workbooks:



Type of activity	Resources
7.1b Discussion in pairs	Learner guide and own ideas
Instructions to give to the learners	
Activity 7.1b: Use the map of the tropical Pacific and your own knowledge to answer questions 1 to 5.	

**Activity 7.1b**

1. Solomon Islands and the Federated States of Micronesia.
2. TORBA
3. Some islands are experiencing tectonic uplift, with the land slowly rising. Examples - Efate, NW Malakula. Also, the map shows that sea level rise has been greatest in the north of Vanuatu and decreases as you go southwards, so that sea levels near Aneityum are rising less than those near the Torres islands.
4. Because the enhanced greenhouse effect is leading to rising temperatures in the oceans. This is causing the thermal expansion of water. Also, warmer temperatures of the atmosphere and oceans in polar and mountainous regions are causing the ice sheets there to melt, e.g. the West Antarctic ice sheet.

My notes:

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Now please allow learners to complete activity 7.2a in their workbooks:



Type of activity	Resources
7.2a Pair work - questions and discussion on pictures	Learner guide, own ideas, own observations
Instructions to give to the learners	
Activity 7.2a: <ol style="list-style-type: none"> 1. Study the picture, which shows how increased levels of greenhouse gases are having an effect on a small Pacific island. Then answer questions a) to c) below. 2. What does this picture show? It was taken near Saratamata, East Ambae. 3. On your island, can you observe any signs of rising sea levels, the degradation of coral reefs, coastal erosion and changing fish populations? Give some details. If possible do some field observations for yourselves. 4. Thinking of your answers to questions 1, 2 and 3, write a few sentences to describe the kinds of problems that people in Vanuatu are going to face in the future because of rising sea levels, ocean warming and ocean acidification. 	

**Activity 7.2a**

- a) Deforestation; burning rubbish; keeping cattle; applying chemical fertilizers.
- b) It is making the fresh water become more salty; it is reducing the supply of fresh water.
- c) The coral reef is becoming bleached and degraded. Two reasons - warmer ocean temperatures and increasing ocean acidity.

**Activity 7.2a (continued)**

2. The picture shows the effects of coastal erosion, caused by rising sea levels. Coconuts that were planted on land are now covered by the sea at high tide.
3. If you live near the coast, or can arrange transport for your learners to get there, you should ask the learners to go and do some field observations of the coastline. They should look for evidence of coastal erosion and rising sea levels, the degradation of coral reefs and changing fish populations. Encourage them to talk to older people who live on the coast to find out about the changes that have occurred during their lives. Another possibility is for you to invite an older, knowledgeable person from a coastal village to come and give a talk to the learners. You can allow 2-3 hours for this activity.
4. Encourage the learners to think about their answers to the three previous questions. They must reflect on the kinds of problems that people in Vanuatu are going to face in the future. Some examples are coastal erosion, loss of coral reefs, loss of income from tourism, loss of fish, land disputes over coastal land, rural-urban migration, and the need to relocate villages.

My notes:

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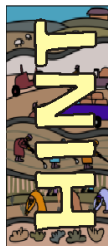
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Now please allow learners to complete activity 7.2b in their workbooks:



Type of activity	Resources
7.2b Pair work - three experiments	Learner guide, own ideas, own observations
Instructions to give to the learners	
Activity 7.2b: You may wish to conduct the following three experiments, which are suggested in the Teacher Guide for <i>“Learning about climate change the Pacific way”</i> (SPC & GIZ 2014). They will help you to better understand the impacts of climate change on the oceans. Experiment I: Investigating what happens to water when it is heated. Experiment II: Investigating what happens when floating ice melts. Experiment III: Investigating the effects of ocean acidification.	

**Activity 7.2b**

These three experiments will give the learners some practical experience of the effects of climate change on the oceans. You must give time for the learners to leave the classroom and collect the materials they need. They can conduct the experiments in pairs in their own time, then come together to discuss their findings. You should allow at least two hours for this practical/field work. Experiment I was also provided in the learner workbook for CGCK0216/CGCV0316, so you may decide not to repeat this again. When conducting Experiment II, encourage the learners to do both parts - the first part in which they put the ice into the water, and the second part in which they place the ice on a rock and allow it to melt into the water below. Experiment III will help learners to appreciate the meaning of ocean acidification, and they won't forget it!

My notes:

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Section

8

Provide an overview of future climate change projections

Learner

Guide:

Page 46

After completing this section, the learner should be able to:

- 8.1: outline future projections of climate change in Vanuatu'
- 8.2: clarify the likely effects of climate change on islands and seas.

Concepts 8.1	Time frame	Activities related to the concepts
Future projections of climate change in Vanuatu	6 hours	Activities 8.1a, 8.1b, 8.1c, 8.1d and 8.1e
The effects of climate change on islands and seas.		

Please allow learners to complete activity 8.1a in their workbooks:



Type of activity	Resources
8.1a Individual exercise - short answer questions	Learner guide and own ideas
Instructions to give to the learners	
Activity 8.1a: Answer questions 1 to 4 on page 29 of your Learner Workbook.	



Activity 8.1a

1. It is an estimation of future climate that is derived from models. Scientists use computers to calculate complicated mathematical equations that are based on the physics, chemistry and biology of the atmosphere and oceans. Through these calculations, they can predict what is going to happen to temperature, rainfall, etc.
2. A scenario is something that might happen in the future, or a possible sequence of events that might occur.
3. Low - if GHG emissions are reduced from their present levels.
Average or medium - if GHG emissions remain at their current levels.
High - if GHG emissions continue to increase from their current levels.
4. Yes, because humans can control GHG emissions - through international agreements, reduction of deforestation, use of renewable sources of energy, etc.

My notes:

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Now please allow learners to complete activity 8.1b in their workbooks:



Type of activity	Resources
8.1b Pair work - discussion of a graph	Learner guide, own ideas
Instructions to give to the learners	
Activity 8.1b: In pairs, study and discuss the graph, then answer questions 1 to 4.	



Activity 8.1b

1. 15°C
2. By 1°C
3. By between 4°C and 5°C
4. Any **three** of the following:
 - Greater frequency of extreme weather events
 - Greater frequency of hydro-meteorological hazards - flooding, droughts, landslides
 - Rise in sea levels
 - Melting of ice sheets
 - Degradation of coral reefs
 - Acidification of coral reefs
 - Failure of food crops / problems of food security
 - Decline in fisheries
 - More rural-urban migration throughout the world
 - Loss of revenue from tourism and other economic activities

(Other answers are possible)

My notes:

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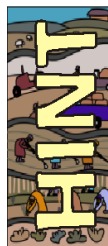
Now please allow learners to complete activities 8.1c and 8.d in their workbooks:



Type of activity	Resources
8.1c True or False?	Learner guide
Instructions to give to the learners	
Activity 8.1c: Read the climate projections for Vanuatu on page 48 of your Learner Guide, then say whether each of these statements is TRUE (T) or FALSE (F).	



Type of activity	Resources
8.1d Cartoon interpretation	Own ideas
Instructions to give to the learners	
Activity 8.1d: Discuss the meaning of this cartoon with a friend.	



Activity 8.1c

1. True
2. False
3. False
4. True
5. False
6. False
7. False
8. True
9. True
10. True



Activity 8.1d

The cartoon shows sea level rise, due to the enhanced greenhouse effect (global warming). Because global sea levels are rising, small low islands like the one in the cartoon will gradually disappear, and the man will have to swim. This means that it will be easy for the two sharks to eat him. Note that the rate of sea level rise shown in the cartoon is too quick. It will take much longer than 5 years for the seas to rise to the level of the palm tree on the island - more like 200 years!

My notes:

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Finally, please allow learners to complete activity 8.1e in their workbooks:



Type of activity	Resources
8.1e Personal reflections	Learner guide, own ideas
Instructions to give to the learners	
<p>Activity 8.1e: In the box provided, write down some of your reflections after your class discussion on how the islands and seas of Vanuatu are going to be affected by future climate change. If you prefer, you could show your ideas in the form of a picture or pictures, or even as a map.</p>	



Activity 8.1e

It is important to do the class discussion first. The questions on page 50 of the Learner Guide will help you to keep the discussion focused.

After this, you can invite the learners to do their own personal reflections. They can either write them or show them in the form of a picture or pictures. The box provided in the Learner Guide may not be large enough for pictures, so have some large sheets of butcher paper ready for the learners to use if they prefer.

It is very important that trainees think about these issues for themselves before they proceed to discuss them in future units of this course.

You, too, as a facilitator, should be reflecting on these issues. In the space below and on the next page, write down some of your own ideas.

My notes:

[illegible]

My notes (continued):

This image shows a full page of dot grid paper. It features approximately 20 horizontal rows of small, evenly spaced black dots on a white background. The dots are arranged in straight lines across the width of the page, providing a guide for writing or drawing without solid lines.

(space for illustrations)

Illustrations

Illustration and page number	Source
Cover	Andreas / Wikimedia Commons, 2014, <i>Coal-burning factory in China</i> , accessed on 15 January 2015 at http://www.esg-search.com/wp-content/uploads/2014/11/Chinese_factory_pollution_WikimediaCommons_Andreas.jpg
Completed diagrams (p. 12)	Pierce, C., 2014, <i>Completed diagrams of the water cycle today and during the last glacial period</i> .
Geological Time Scale (p. 14)	McSaveney, E. & Nathan, S., 9 July 2013, 'Geology – overview - Rocky foundations', in <i>Te Ara - the Encyclopedia of New Zealand</i> , accessed on 8 December 2014 at http://www.TeAra.govt.nz/en/diagram/8294/geological-time-scale . © Crown Copyright 2005-2013 Manatū Taonga, The Ministry for Culture and Heritage, New Zealand.
Scale diagram of Eras (p. 14)	Pierce, C., 2014, based on information in the diagram of the Geological Time Scale.
Completed diagram (p. 18)	Pierce, C., 2014, <i>Completed diagram of the natural greenhouse effect</i> .
Completed diagram (p. 21)	Pierce, C., 2014, <i>Completed diagram of the enhanced greenhouse effect</i> .
Extract from Visual Guide picture 6 (p. 21)	Secretariat of the Pacific Community (SPC) and Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH (GIZ), 2014, <i>Learning about Climate Change the Pacific Way: A Visual Guide – Vanuatu</i> . Accessed on 12 December 2014 at http://www.spc.int/images/climate-change/cc-project/Vanuatu-complete.pdf
Completed flow chart (p. 29)	Pierce, C., 2014, <i>Completed flow chart</i> .

What will I do differently next time?

Take some time to **reflect** on your own activities as facilitator of these two Units.

Then write down five of the most important lessons you have learned:

What will I do differently next time?
1.
2.
3.
4.
5.

As a facilitator, you have gained hands-on experience in the application of the two Unit standards. You may have experienced difficulties that the developers did not anticipate.

So it will be very helpful if you could give your comments below. They will contribute towards the future revision of these Units, and should be brought to the attention of the Training Manager of your institution.

Difficulties I had with these Units	Recommended changes to address the difficulties
1.	
2.	
3.	
4.	
5.	
6.	
7.	
8.	