



OzonAction Education Pack

A guide for primary school teachers



Acknowledgements

This Education Pack was developed by UNEP Division of Technology, Industry and Economics (UNEP DTIE) OzonAction Branch under the Multilateral Fund for the Implementation of the Montreal Protocol.

The Ozzy Ozone character is a registered trademark of the Government of Barbados. UNEP would like to thank the Government of Barbados for its permission to use this character.

Head of OzonAction Programme: **Rajendra Shende**

Project Manager: **Anne-Maria Fenner**, Information Officer, UNEP DTIE

Jérôme Malavelle, chargé de projet, PNUE DGEF/DTIE

Project Assistant: **Mugure Kibe Ursulet**, Technical Data & Documentation, UNEP DTIE

Writer: **Fabienne Pierre**, UNEP DTIE Consultant

Designer / Illustrator: **Fabrice Belaire**, UNEP DTIE Consultant

Illustrations for the Ozzy Ozone character : **Nikos Koutsis**, www.koutsis.com

We want to express our thanks to UNESCO and WHO for their contribution to this educational tool. Their leading expertise in education and health has given great support for this initiative to fully address the interconnected issues of ozone layer depletion.

OUR THANKS GO TO THE REVIEW PANEL FOR ITS CONSTRUCTIVE COMMENTS.

Gustavo Arnizaut, HEAT International • **James Brodie**, UNESCO • **Bernard Combes**, UNESCO • **Pierre Césarini**, Collaborating Centre of WHO • **Jim Curlin**, UNEP
Artie Dubrie, UNEP • **Eric Falt**, UNEP • **R. Gopichandran**, Centre for Environment Education, India • **Barbara Huber**, PNUE • **Isabella Marras**, UNEP • **Gerda Mercks**,
PNUE • **Sigrid Niedermayer**, UNESCO • **Theodore Oben**, UNEP • **Akpezi Ogbuigwe**, UNEP • **Justine Osborne**, Cancer Council Victoria, Australia • **Janet Sackman**,
WTA Education Services Ltd • **Craig Sinclair**, Cancer Council Victoria, Australia • **Livia Saldari**, UNESCO • **Sarianna Salmi**, Consultant • **Wayne Talbot**, WTA Education
Services Ltd • **David Wilgenbus**, Association 'La Main à la Pâte', France • **Hajo Zeeb**, World Health Organization

Copyright © 2006 United Nations Environment Programme

This publication may be reproduced in whole or in part and in any form for educational or non-profit purposes without special permission from the copyright holder, provided acknowledgment of the source is made.

UNEP would appreciate receiving a copy of any publication that uses this publication as a source. No use of this publication may be made for resale or for any other commercial whatsoever without prior permission in writing from the United Nations Environment Programme.

Disclaimer

The designations employed and the presentation of the material in this publication do not imply the expression of any opinion whatsoever on the part of the United Nations Environment Programme concerning the legal status of any country, territory, city or area or of its authorities, or concerning delimitation of its frontiers or boundaries. Moreover, the views expressed do not necessarily represent the decision or the stated policy of the United Nations Environment Programme, nor does citing of trade names or commercial processes constitute endorsement.

Preface

In the 1970's, when scientific evidence was published showing that man-made emissions of commonly used chemicals, originally thought to be harmless, were destroying the ozone layer - the natural shield that protects life on Earth from the dangerous UV radiation of the sun - a fundamental concern was raised: human activities have environmental consequences that are not always predictable but that can affect everyone's life on the planet. These increased levels of UV radiation due to the depletion of the ozone layer threaten human health. This striking reality should influence all of our actions: when we harm the environment, we harm ourselves.

The discovery in 1985 of a large ozone "hole" over Antarctica during springtime, growing larger and deeper each year, has revealed the scale of the problem. Since then, action has been taken by the international community through the adoption of the Montreal Protocol on Substances that Deplete the Ozone Layer (1987), an agreement aimed at severely restricting the use of ozone depleting chemicals. Thanks to these efforts, the first signs of the ozone layer's recovery are now becoming noticeable at mid-latitudes.

This action must be continued and sustained through informational and educational efforts to involve individuals and communities. Indeed, the damaging consequences of ozone layer depletion on human health will certainly last until the end of the 21st century, considering the time it will take for most ozone depletion to be reversed and for UV radiation levels to decrease accordingly.

Each year, between 2 to 3 million skin cancers are detected worldwide. Between 12 to 15 million people become blind from eye cataracts. According to the World Health Organization⁽¹⁾, up to 20% of these may be caused or enhanced by sun exposure. In 2003, the World Health Organization took an important initiative to address this issue and published an educational package to promote sun protection in schools. This package contains three publications to help schools and teachers develop sun protection policies and programmes with young students.

This has been the most inspiring scientific and didactic resource for the development of the OzonAction Education Pack that stands for a complementary tool aimed at highlighting the link between ozone layer depletion and increased levels of UV radiation. Indeed, the rate of health problems and diseases due to UV radiation will increase over the next decades as the ozone layer is depleted, unless people are encouraged to protect their natural environment while informed about the simple solutions they can adopt to protect themselves from the sun. The teaching programme and materials contained in the Education Pack aim at providing young students with the means to understand that they can both help prevent ozone layer depletion and adapt themselves to its potential for adverse health effects by being sun-safe.

When it comes to the consequences of ozone layer depletion on human health, children are particularly at risk. We must give them the means to protect their own future. Thanks to the assistance provided by the Protocol's Multilateral Fund, we are able to do so. The OzonAction Education Pack is part of the awareness-raising project for young children that UNEP has been developing around a very successful character: Ozzy Ozone, the ozone molecule. This project has led to the development of several multi-media materials: a video, TV and radio spots, a cartoon book and the Ozzy Ozone website. In this very important education challenge, teachers can also rely on Ozzy Ozone as a messenger to tell their students about the ozone layer in a simple and exciting way.

This Education Pack was also developed with the pedagogical advice of UNESCO, the lead agency for the promotion of the United Nations Decade of Education for Sustainable Development (2005 – 2014). Aimed at encouraging people with the knowledge and skills needed for a sustainable future, this UN initiative supports educational projects, based on interconnected issues such as environmental degradation and human health, that help children understand the complexity of the world they live in and empower them to adopt responsible behaviours.

The Education Pack offers primary school teachers a useful educational tool that meets their expectations in terms of background information, teaching ideas and materials. It is in their primary schools that children of the world get the chance to develop the social behaviour that will protect them from the harmful effects of UV radiation. Both environmentally responsible and healthy behaviour adopted at a young age stay over a lifetime. Educating children at primary school level to participate actively in the protection of the ozone layer and to know how to protect themselves from the sun must therefore be a priority.

National Ozone Units and education ministries play a crucial role in this process. Together with primary schools they can take actions to inspire both collective and individual involvement. The International Ozone Day (16 September) stands for a great occasion to do so and to start organizing classroom activities from the OzonAction Education Pack.

(1) World Health Organization, Sun Protection and Schools: How to Make a Difference, 2003, p. 1

Table of contents

THE EDUCATION PACK	5
HOW TO USE THE EDUCATION PACK	6
LESSON PLANNING : OBJECTIVES AND ACTIVITIES IN THE PROGRAMME TEACHING PROGRAMME	8
INTRODUCTION	
“THE EARTH AND THE SUN”	
> Unit A: The Earth and the sun: how do they work together?	13
> Unit B: The good effects of the sun	17
THEME 1	
“THE OZONE LAYER: A SHIELD BETWEEN THE EARTH AND THE SUN TO PROTECT US”	
> Unit A: What is the ozone layer?	20
> Unit B: UV radiation: an invisible harm	23
> Unit C: Where, when and why is UV radiation dangerous?	26
THEME 2	
“OZONE LAYER DEPLETION: LET’S NOT TAKE A RISK”	
> Unit A: Ozone layer depletion: what happens?	30
> Unit B: The ozone hole	32
> Unit C: What are the risks?	35
THEME 3	
“SOLUTIONS FOR A GLOBAL PROBLEM: WHAT CAN WE DO?”	
> Unit A: Prevention: how to protect the ozone layer	40
> Unit B: Adaptation: it’s natural to protect oneself	44
> Unit C: Many simple ways of being sun-safe	50
PREVENTIVE AND PROTECTION MEASURES IN SIMPLE WORDS: WHAT WE CAN ALL DO	55
YOUR ACTION AT SCHOOL	56
GLOSSARY	58
MORE RESOURCES	60
PARTNERSHIPS	61

The education pack

The Education Pack has been developed to provide primary school teachers with a comprehensive and “ready-to-use” educational tool. It is aimed at helping them bring into their classroom the major environmental and human issues related to ozone layer depletion in a way that arouses children’s curiosity and interest.

The materials contained in this Education Pack work together to offer the opportunity of a whole teaching and learning project, based on basic knowledge, practical skills and participation, for young children to be educated about:

- 1/ the natural role of the ozone layer;
- 2/ the causes and consequences of its depletion in terms of increased harmful solar radiation, how to prevent health threats by protecting the ozone layer;
- 3/ concrete solutions concerning how to be protected from the sun and adapt oneself to increased levels of UV radiation.

GUIDE FOR PRIMARY SCHOOL TEACHERS MATERIALS IN THE PACK

The educational Guide contained in this Education Pack is addressed to teachers to help them bring the programme into their classroom. The content of the teachers’ Guide is as follows:

- **Pedagogical advice:** the Teacher’s Guide begins with a “How to use” section that offers an overview of the teaching programme and advice to implement it.

- **Teaching programme:** afterwards, the teaching programme is presented in details. It covers four major themes: *the Earth and the Sun, the role of the ozone layer, causes and consequences of ozone layer depletion, solutions to protect the ozone layer and prevent increased levels of UV radiation, as well as solutions for more sun protection.* Each theme is divided into several educational units.

Within this programme, teachers will also find a short story, “The Story of Ozzy’s Journey”, which can be read to or by the students. It tells the story of Ozzy Ozone travelling around the world and finding about various natural sun protection strategies. This story aims to introduce sun protection measures students should consider.

- **Prevention and protection measures:** following the teaching programme, teachers will find a review of the practical solutions that should be adopted to prevent ozone layer depletion as well as to protect oneself from high level of UV radiation. This review can be used to go over the main points of the programme.

- **School initiatives:** this Guide also proposes suggestions for setting an Ozone and Health Action Plan at school, aimed at children’s direct participation in a school project for collective and individual responsibility toward the ozone layer and health protection. There is also an opportunity for your school to enter their Ozone and Health Action Plan in the UNEP Volvo Adventure Award, which rewards practical action taken by young people to solve environmental problems locally.

- **Meanings and resources:** the Guide contains a glossary and mentions additional resources for teachers. The words to be found in the glossary are marked in the text as ‘*’.

- **Ozzy Ozone Video (CD):** this video can be shown to students as an introduction to the teaching programme. It is 9 minutes long and shows Ozzy Ozone taking a voyage of discovery to find out exactly who and what is attacking the ozone layer and how children can play an important role in making a difference. This video has been shown in 62 countries and has been translated to 22 languages.

- **Ozzy Ozone cartoon book:** “Ozzy Ozone, Defender of Our Planet” is included in this Education Pack for students.

- **Ozzy Calendar:** this calendar is aimed at providing the classroom with visual illustrations of the informational content and knowledge introduced by the teachers all along the educational programme. This calendar shows Ozzy Ozone presenting 12 illustrations and can be displayed to support the teaching of the different concepts. Teachers will also find these illustrations in their educational guide along with background information.

- **World map:** the world map poster is designed to visually represent the regions of the world affected by high levels of UV radiation and ozone depletion. It mentions the hottest months for each region, highlights the hot climate areas and shows the levels of ozone concentration in the upper atmosphere.

- **“Who Knows?” Cards:** these cards contains a game of 8 sets of questions and answers aimed at organizing “Who Knows?” challenges to evaluate students’ understanding of the main points of the activities and themes. There are three levels of questions for each card: three level 1 questions (easy level), two level 2 questions (intermediate) and two level 3 questions (more able students).

There are 8 “Who Knows?” cards on:

- > The Earth and the Sun
- > The ozone layer
- > UV radiation
- > UV radiation factors
- > Ozone layer depletion
- > The risks of increased UV radiation
- > Measures to protect the ozone layer
- > sun protection rules

- **UV paper:** this card’s colour changes in contact with UV radiation. It is a tool that will help students to observe different levels of UV radiation.

How to use the education pack

OBJECTIVES

- Explain in simple terms the environmental and health issues related to ozone layer depletion.
- Encourage children to become actors in the protection of the ozone layer and develop a sense of ownership towards their environment.
- Encourage children to protect themselves from the dangerous effects of the sun.
- Bring into the classroom the understanding of:
 - > The vital role of the ozone layer
 - > The causes and consequences of ozone layer depletion
 - > The dangers of sun exposure
 - > The prevention measures: how to prevent in practice ozone layer depletion
 - > The sun protective measures: how to adapt oneself in practice to increased UV radiation

To meet these objectives, teachers are provided with information and practical resources that form a comprehensive teaching programme (background information, activities and materials), including ideas and suggestions to set up an Ozone and Health Action Plan at School.



IMPLEMENTATION OF THE TEACHING PROGRAMME

CONTENT:

- The teaching programme starts with an introductory session (two units), followed by three major themes of three units each:
 - > Introductory lesson: *The Earth and the Sun*
 - > Theme 1: *The ozone layer: a shield between the Earth and the Sun to protect us*
 - > Theme 2: *Ozone layer depletion: let's not take a risk!*
 - > Theme 3: *What can we do?*
- Each unit contains all the background information needed to implement the corresponding lesson as well as various teaching ideas/activities. Therefore, each unit contains:
 - > A short presentation of the objectives to be met during the lesson.
 - > Background information and visuals providing the content of the lesson so that teachers get a clear and complete comprehension of the issue; simple and concrete messages adapted to young children's level of understanding.
 - > A set of various activities, presented in details (main subject areas, timing, objectives, location, equipment, procedures) among which teachers can choose to illustrate the lesson.

HOW TO PLAN THE LESSONS:

- The approximate timing for primary school lessons is one hour. In this framework, teachers will have the opportunity to choose, within each unit, one or several activities to illustrate the lesson, according to their teaching priority or interest. They have at least two different options to implement each unit.
 - > First, start with the lesson, then set up one or more activities to illustrate some specific points.
 - > First start with setting up one or more activities to stimulate children's interest, then introduce and sum up the lesson.

HOW TO CHOOSE ACTIVITIES:

- Teachers can choose the activities amongst those suggested according to their **time schedule** and their **teaching environment**.
- Even though the Education Pack is targeted to primary school students in general, some activities may appear to be of a higher level than others. Activities should be chosen according to **students' grades**.
- Teachers can also choose among these activities according to the **subject areas** they wish to focus on:
 - > These activities are built on existing subjects and educational objectives specific to primary school programmes, so that children keep on acquiring and improving skills in key areas such as science, geography, health, environment, communication, language, mathematics and art.
- Finally, activities can be chosen according to the **teaching methods** they are built on:
 - > The activities are based on a wide range of educational methods from opening discussions and debates to experimentation and observation, field research, writing and reading, creativity, role-playing and games. Many activities encourage interaction and students' participation. They are intended to increase knowledge, build positive attitudes and values, enhance skills and provide support for a responsible and healthy lifestyle.
 - > **The following symbols indicate for each activity the associated teaching method:**

TOOLS TO SET UP YOUR OZONE AND HEALTH ACTION PLAN AT SCHOOL

HOW TO EVALUATE:

- The “Who Knows?” cards will help the teachers evaluate students’ understanding of the main issues addressed throughout the programme.
- At the end of the teaching programme, teachers will find a review of the preventive and protective rules everyone should follow to protect the ozone layer as well as to be protected from the sun. They can use this review to sum up the whole programme and evaluate students’ understanding of these rules.

FOLLOWING THE SEQUENCE

The teaching programme has been developed as a “step by step” programme. Units have been ordered so that the interconnected social, environmental and human dimensions of ozone layer depletion are all addressed. Each unit builds on the benefits of the previous ones; therefore it is important that teachers follow their sequence.



DISCUSSION



EXERCISE



EXPERIMENTS



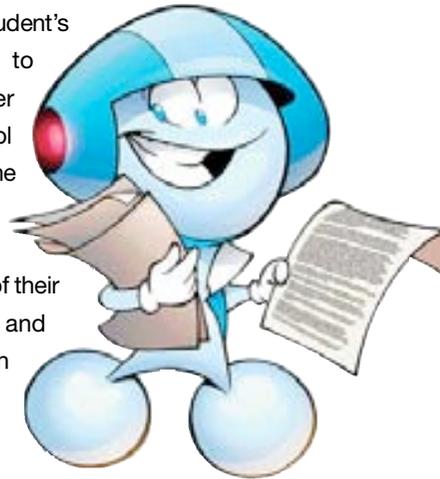
ROLE PLAY



PROBLEM

This Guide for Primary School Children also provides tools to set up Ozone and Health Action Plans at school. The corresponding section (p. 56) presents ideas and procedures for creating a local awareness and action project with students on ozone protection and sun-safe behaviours.

This Ozone and Health Action Plan at School is aimed at encouraging students to demonstrate their understanding of the issues related to ozone layer depletion. Through student’s direct participation to reach out to other members of the school and their families, ozone action planning can help students develop a sense of ownership of their own environment and reinforce sun protection behaviours.



Your school can enter its action plan in the UNEP Volvo Adventure Award. This UNEP award rewards practical action taken by young people to solve environmental problems locally.

For more information:

<http://www.volvoadventure.org>

OBJECTIVES

- > To use the content of the teaching programme to develop an Ozone and Health Action Plan for the school or community.
- > To conceive a list of practical actions – prevention measures and protection measures - to encourage and participate in ozone protection along with self-protection from the sun.
- > To implement the Ozone and Health Action Plan through school policy, individual and collective commitment and communication.

Teachers who intend to set up an Ozone and Health Action Plan for their school with the students could make the link to the project explicit while they proceed through the programme. All along the teaching programme, activities that can be used for Ozone and Health Action Planning are marked with the following symbol:



OZONE AND
HEALTH ACTION
PLAN

LESSON PLANNING objectives and activities in the programme

INTRODUCTION The sun and the Earth

CONTENTS AND ACTIVITIES	OBJECTIVES	MAJOR AREAS	METHODS	LOCATION	MATERIALS	TIMING	P
UNIT A THE EARTH AND THE SUN, HOW DO THEY WORK TOGETHER?							
Contents: what the students should know	<ul style="list-style-type: none"> The sun is an essential source of energy for life on Earth The Earth around the sun The ozone layer filter 	Science Communication Environment	Teacher's presentation	Classroom	Ozzy Calendar illustrations 2 / 3	30mins	13
Activities							
What is the sun?	<ul style="list-style-type: none"> Facts and perceptions about the sun 	Science Environment	Discussion	Classroom	Ozzy Calendar illustration 2	20mins	15
The many moods of the sun	<ul style="list-style-type: none"> Creative sentences about the sun 	Language Communication	Writing Reading	Classroom	Notebooks and pens	20mins	15
How can we see the Earth is turning?	<ul style="list-style-type: none"> Observing the Earth rotation 	Science Environment	Experimentation Observation	Schoolyard Clear ground Sunny place	Ozzy Calendar illustration 2 Chalk	15mins (3X)	15
Understanding the seasons	<ul style="list-style-type: none"> Relate the Earth and the Sun to the seasons 	Science Environment	Discussion	Classroom	Ozzy Calendar illustration 2	15mins	16
The ozone layer filter	<ul style="list-style-type: none"> Introduce the role of the ozone layer 	Science Environment	Discussion	Classroom	Ozzy Calendar illustration 3	15mins	16
UNIT B THE GOOD EFFECTS OF THE SUN							
Contents: what the students should know	<ul style="list-style-type: none"> The sun: source of all life on Earth Photosynthesis: plants make food from the sun Vitamin D: the sun helps us grow 	Science Environment Health	Teacher's presentation	Classroom	Ozzy Calendar illustrations 4	30mins	17
Activities							
Warm or Cold?	<ul style="list-style-type: none"> Observe and understand solar radiation as energy 	Science Environment	Experimentation Observation	School surroundings Sunny day		15mins	18
Building a tree for photosynthesis	<ul style="list-style-type: none"> Show how plants use the sun's energy to grow 	Science Environment Health	Role-play, collective action	Clear and clean ground	Ozzy Calendar illustration 4, 2 pieces of paper	25mins	18
The 'Who Knows?' Challenge	<ul style="list-style-type: none"> Evaluate students' understanding 	Science Environment Health	Evaluation	Classroom	"Who Knows?" card 1	15mins	19

THEME 1 The Ozone Layer: a shield between the Earth and the Sun to protect us

CONTENTS AND ACTIVITIES	OBJECTIVES	MAJOR AREAS	METHODS	LOCATION	MATERIALS	TIMING	P
UNIT A WHAT IS THE OZONE LAYER?							
Contents: what the students should know	<ul style="list-style-type: none"> The ozone layer is a protective shield Ozone molecules in the upper atmosphere “good” and “bad” ozone 	Science Environment Communication	Teacher’s presentation	Classroom	Ozzy Calendar illustrations 3, 5	30mins	20
Activities							
The ozone layer: our Earth’s umbrella	<ul style="list-style-type: none"> Understand the role of the ozone layer 	Science Environment	Discussion	Classroom	Ozzy Calendar illustration 3	15mins	21
How Ozzy was born	<ul style="list-style-type: none"> Understand how ozone molecules are formed 	Science - Environment Communication	Role-play	Clear and clean ground	Ozzy Calendar illustration 3, 5	30mins	21
The ‘Who Knows?’ Challenge	<ul style="list-style-type: none"> Evaluate students’ understanding 	Science Environment	Evaluation	Classroom	“Who Knows?” card 2	15mins	22
UNIT B UV RADIATION: AN INVISIBLE HARM							
Contents: what the students should know	<ul style="list-style-type: none"> Ultraviolet radiation: a dangerous component of sunlight The three categories of UV rays Introduction to the risks of sun exposure 	Science Environment Health Social life Communication	Teacher’s presentation	Classroom		30mins	23
Activities							
Let’s see UV radiation	<ul style="list-style-type: none"> Observe UV radiation with the UV-Meter 	Science Environment	Experimentation Observation	Schoolyard - Sunny and shaded places	UV-Meter	25mins	24
The sun’s rays burn	<ul style="list-style-type: none"> Discuss the bad effects of the sun 	Environment Health Social life	Discussion Drawing	Classroom	Paper, pens	20mins	24
The ‘Who Knows?’ Challenge	<ul style="list-style-type: none"> Evaluate students’ understanding 	Science- Health Environment	Evaluation	Classroom	‘Who Knows?’ card 3	15mins	25
UNIT C WHERE, WHEN AND WHY UV RADIATION IS DANGEROUS?							
Contents: what the students should know	<ul style="list-style-type: none"> UV radiation factors: time, season, region, and environmental context The UV Index: a tool to evaluate UV radiation levels 	Environment Geography Health Communication	Teacher’s presentation	Classroom	Ozzy Calendar illustration 6 World map	30mins	26
Activities							
Understanding UV radiation factors	<ul style="list-style-type: none"> Understand UV radiation factors and identify various situations on the map 	Environment Geography Health	Discussion Observation Problem-solving	Classroom	Ozzy Calendar illustration 6 World map	25mins	27
Our region today	<ul style="list-style-type: none"> Sum up the geographical and UV exposure situation of your region 	Environment Geography Communication	Discussion Problem-solving	Classroom	Ozzy Calendar illustration 6 World map	20mins	27
Learning about the UV Index	<ul style="list-style-type: none"> Understand the UV Index 	Geography Environment - Health	Discussion Problem-solving	Classroom	Ozzy Calendar illustration 6	25mins	28
The ‘Who Knows?’ Challenge	<ul style="list-style-type: none"> Evaluate students’ understanding 	Environment Science - Health	Evaluation	Classroom	‘Who Knows?’ card 4	15mins	29

THEME 2 Ozone Layer Depletion: Let's not take the risk!

CONTENTS AND ACTIVITIES	OBJECTIVES	MAJOR AREAS	METHODS	LOCATION	MATERIALS	TIMING	P
UNIT A OZONE LAYER DEPLETION: WHAT HAPPENS?							
Contents: what the students should know	<ul style="list-style-type: none"> The ozone layer depletion is due to human activities Identify chemicals and products responsible for ozone layer depletion How ozone molecules are destroyed 	Science Environment Social life Communication	Teacher's presentation	Classroom	Ozzy Calendar illustration 7, 8 World map	30mins	30
Activities							
The causes of ozone layer depletion	<ul style="list-style-type: none"> Identify ozone depleting substances and products 	Environment Social life	Discussion Survey	Classroom School	Ozzy Calendar illustration 7, 8	25mins	31
The ozone layer depletion process	<ul style="list-style-type: none"> Understand the reactions of ozone depleting substances 	Science - Environment Mathematics	Role-play	Classroom	Ozzy Calendar illus. 9, watch	30mins	31
Ozone is small, but it changes everything	<ul style="list-style-type: none"> Write a poem about ozone 	Language Creativity	Writing	Classroom	Notebooks, pens	15mins	31
UNIT B THE OZONE HOLE							
Contents: what the students should know	<ul style="list-style-type: none"> The ozone hole and its location Levels of ozone concentration and thinning of the ozone layer Ozone layer depletion and global warming 	Science Environment Geography Social life Communication	Teacher's presentation	Classroom	World map	30mins	32
Activities							
The Ozone Hole on the map	<ul style="list-style-type: none"> Identify regions and countries affected by ozone layer depletion 	Science Environment Geography	Observation Discussion	Classroom	World map	20mins	33
Ozone concentration: a UV radiation factor	<ul style="list-style-type: none"> Link ozone layer depletion and UV radiation 	Science Environment Geography	Observation Discussion	Classroom	World map	20mins	33
In 50 years from now	<ul style="list-style-type: none"> Write about the future 	Language Social life	Discussion Writing	Classroom	Notebooks and pens	20mins	33
The 'Who Knows?' Challenge	<ul style="list-style-type: none"> Evaluate students' understanding 	Science - Environment Social life	Evaluation	Classroom	'Who Knows?' card 5	15mins	34
UNIT C WHAT ARE THE RISKS							
Contents: what the students should know	<ul style="list-style-type: none"> Health damages due to increased UV radiations Children are the most exposed Increased UV and the environment 	Health Environment Social life Communication	Teacher's presentation	Classroom	Ozzy Calendar illustration 10, 11 World map	30mins	35
Activities							
Increased UV radiations, increased bad effects of the sun	<ul style="list-style-type: none"> The bad effects of the sun 	Health - Social life Environment	Discussion	Classroom	Ozzy Calendar illustration 10	20mins	37
How much time in the sun?	<ul style="list-style-type: none"> Evaluate the average time in the sun 	Health - Social life Mathematics	Discussion Problem-solving	Classroom	Blackboard or paper	20mins	37
Increased UV radiation and natural ecosystems	<ul style="list-style-type: none"> Effects of UV radiation on crops and marine life 	Environment Social life	Discussion Drawing	Classroom	Ozzy Calendar illus. 11, paper, pens	20mins	37
'Who Knows?' Challenge	<ul style="list-style-type: none"> Evaluate students' understanding 	Health Social life	Evaluation	Classroom	'Who Knows?' Card 6	15mins	38

THEME 3 What can we do?

CONTENTS AND ACTIVITIES	OBJECTIVES	MAJOR AREAS	METHODS	LOCATION	MATERIALS	TIMING	P
UNIT A PREVENTION: HOW TO PROTECT THE OZONE LAYER							
Contents: what the students should know	<ul style="list-style-type: none"> • Actions taken by the international community • Prevention measures students can take to protect the ozone layer 	Social life Environment	Teacher's presentation	Classroom	Ozzy Calendar illustration 7, 8	20mins	40
Activities							
Spread the message	<ul style="list-style-type: none"> • Identify what to do to protect the ozone layer 	Environment Social life Communication	Discussion	Classroom	Ozzy Calendar illustration 7, 8	15mins	41
On the stage: how would you tell your mother about the ozone layer?	<ul style="list-style-type: none"> • Learn how to communicate about ozone layer depletion and preventive measures 	Social life Communication	Role-play	Classroom	Dialogue "How would you tell your mother?"	20mins	41
Market trip	<ul style="list-style-type: none"> • Students to look for ozone-friendly products at the market 	Social life Mathematics	Survey Observation	Local market grocer's shop	Notebooks and pens	60mins	41
'Who Knows?' Challenge	<ul style="list-style-type: none"> • Evaluate students' understanding 	Social life Environment	Evaluation	Classroom	'Who Knows?' Card 7	15mins	42
UNIT B ADAPTATION: IT'S NATURAL TO PROTECT ONESELF							
Contents: what the students should know	<ul style="list-style-type: none"> • Learn about how animals naturally protect themselves from the dangerous effects of the sun • Everyone is concerned with the risks related to UV radiation 	Health Environment Geography Social life	Teacher's presentation	Classroom	World map The story of Ozzy's journey	20mins	44
Activities							
Observe and comment on animals' behaviours	<ul style="list-style-type: none"> • Talk about the way animals protect themselves from the sun 	Environment - Health Communication	Discussion Drawing	Classroom	Notebooks paper, pens	20mins	45
The story of Ozzy's journey	<ul style="list-style-type: none"> • Learn about animals from all over the world, how they protect themselves from the sun 	Environment Geography Communication	Reading Observation Discussion	Classroom	The story of Ozzy's journey World map	25mins	45
Our own Ozzy story	<ul style="list-style-type: none"> • Evaluate local behaviours in the sun 	Environment Social life	Discussion	Classroom		25mins	45
UNIT C MANY SIMPLE WAYS OF BEING SUN-SAFE							
Contents: what the students should know	<ul style="list-style-type: none"> • Sun protection rules • Practical and health skills: how to be well protected from the sun 	Health - Social life Communication Environment - Science	Teacher's presentation	Classroom	Ozzy Calendar illustration 12	30mins	50
Activities							
The protection rules	<ul style="list-style-type: none"> • Learn the essential sun protection rules 	Health Social life	Discussion	Classroom	Ozzy Calendar illustration 12	15mins	51
Our shadow indicator	<ul style="list-style-type: none"> • To use one's shadow to tell when the sun is dangerous 	Health Science	Experimentation Observation	Clear and clean ground	Ozzy Calendar ill. 12 chalk, sunny day	15mins (X3)	51
Seek shade	<ul style="list-style-type: none"> • To map shaded areas around the school 	Health - Science Environment	Observation Drawing	Schoolyard or school's surrounding	Sunny day, notebooks, pens	40mins	51
The most beautiful hat competition	<ul style="list-style-type: none"> • Students to make a sun protection hat 	Health Creativity	Practical activity	Classroom	Large pieces of paper, scissors, glue	30mins	52
Dangerous or safe situations?	<ul style="list-style-type: none"> • Evaluate students' understanding in concrete situations 	Health Social life	Problem-solving Evaluation	Classroom	Evaluation panel	15mins	52
'Who Knows?' Challenge	<ul style="list-style-type: none"> • Evaluate students' understanding 	Health Social life	Evaluation	Classroom	'Who Knows?' Card 8	15mins	54



TEACHING PROGRAMME

INTRODUCTION - THE EARTH AND THE SUN

UNIT A

The Earth and the Sun, how do they work together?

SUMMARY

This lesson highlights the relationship between the Sun and the Earth in a positive way. Talking about the Sun is a way of introducing the theme of the ozone layer through concepts that are familiar to young children (sun, light, warmth, nights, days, seasons).

LEARNING OBJECTIVES

- The Sun is an essential source of energy for life on Earth
- The Earth rotates and orbits around the Sun
- The ozone layer filters the sun's energy and protects us from its dangerous ultraviolet radiations

CONTENTS

Display Ozzy Calendar

UV Index	High UV radiation	Prevention category	UVI range
Time of the day	8 am to 4 pm	Low	<2
Time of the year	Summer or Fall seasons	Medium	3 to 5
Location	Close to the equator	High	6 to 7
Elevation	Altitude above sea level	Very high	8 to 10
Reflection	Sand, water, snow	Extrem	11+
Weather	No dark clouds in the sky		

THE SUN*: A STAR ESSENTIAL TO OUR EVERYDAY LIVES

The Sun is the star that stands at the centre of our solar system* and around which nine planets orbit (or revolve) including the Earth we live in. Because it is closer to our planet than any other star, the Sun is by far the brightest object in the sky. In addition, the Sun is so large that over one million Earths could fit in it.

Our Sun is essential to our everyday life: it sends us radiation, energy to keep us warm and light to see by. It is the Sun's energy that makes life on Earth possible: actually, the Earth is at such a perfect distance from the Sun – not too far, not too close – that it is the only planet in the solar system where life can be found.

SEE ACTIVITIES 1 AND 2

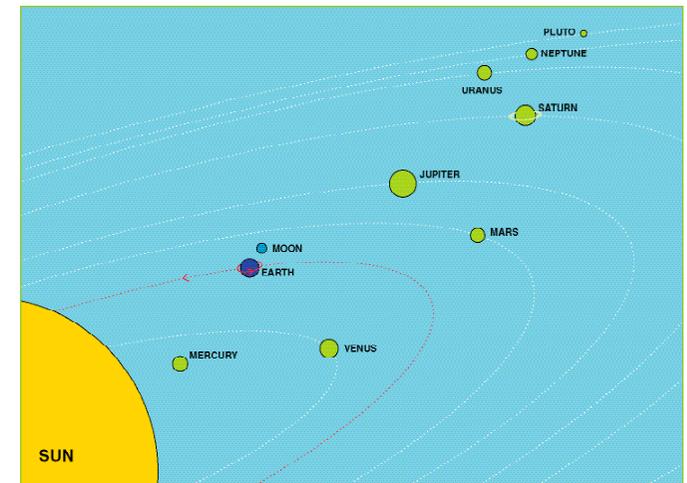


Illustration 2 : OUR SOLAR SYSTEM

NIGHTS AND DAYS, SUMMERS AND WINTERS

It is the special way which the Earth and the Sun work together that makes our nights and days, as well as our seasons.

- > It is because the Earth rotates that we have nights and days. It takes one full day (24 hours) for the Earth to rotate completely around once at 1000 miles per hour (1600 kilometres/h). This is 5 times faster than the world's fastest train! The night falls when we start rotating away from the sun.
- > There are two things which explain why we have seasons: first, while rotating the Earth orbits around the Sun at a rate of 67 000 miles per hour (108 000 kilometres/h), which is 360 times faster than the world's fastest train. It takes one year (365 days) for the Earth to go around the Sun once. Second, the Earth is slightly tipped (we say its rotational axis is tipped over about 23° from vertical). As the Earth travels around the Sun, it remains tipped in the same direction. This means that sometimes we are pointing towards the Sun, and sometimes we are pointing away. When we are tilted towards the Sun, it is summer (hot season): we receive more radiation from the Sun and therefore it is warmer. On the contrary, when we are tilted away from the Sun we receive less radiation from it, it is colder, which gives us our winters (cold seasons). The reason why the Northern half and the Southern half of the Earth have opposite seasons is that when one is pointing towards the Sun, the other is pointing away. One simple way to see that the Earth and the Sun behave differently in summer (hot season) and winter (cold season) is to look at the sky: in summer the Sun is high in the sky, while in winter it is much lower.

SEE ACTIVITIES 3 AND 4

THE OZONE LAYER* LETS THROUGH THE GOOD SOLAR ENERGY AND PROTECTS US FROM THE DANGEROUS SUN'S RAYS

The sun's energy and light are essential to life on Earth. But the sunlight also has a very harmful component called ultraviolet radiation* or UV rays. These UV rays are invisible but dangerous to all living beings on Earth, including us.

Fortunately, the sun's energy works along with molecules* of oxygen* (the living gas in the air we breathe) to continually produce an invisible layer to protect us: the ozone layer.

DEFINITION: Molecules are the simplest components of an element or compound. Everything is made of molecules: in other words, molecules are the very tiny pieces – invisible to the eyes – of anything.

The ozone layer wraps all the way around the Earth, it lets the sun's good energy through and at the same time blocks its most dangerous UV rays.

The ozone layer is high in the sky, in the upper atmosphere (called the stratosphere*), whereas we live in the lower atmosphere (called the troposphere*). The main role of the ozone layer is to protect us from the harmful rays of the sun.

SEE ACTIVITY 5

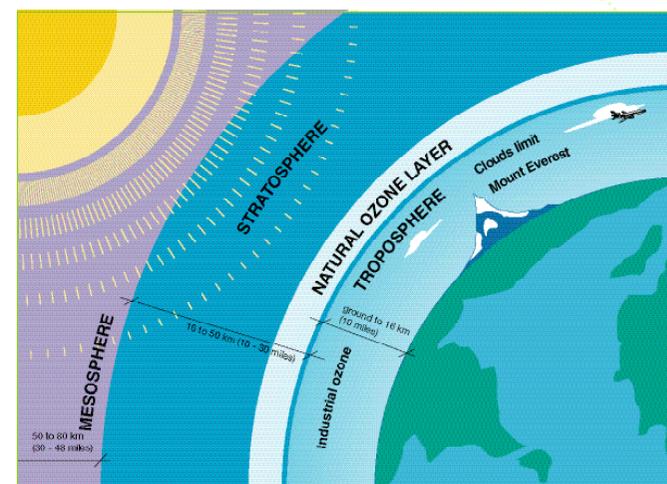


illustration 3 : THE OZONE LAYER BETWEEN THE SUN AND THE EARTH

ACTIVITIES

The Earth and the Sun, how do they work together?



1/ WHAT IS THE SUN?

MAJOR AREAS: Science, Environment

TIMING: 20mins

ACTIVITY OBJECTIVE: for students to talk about the Sun as a familiar element of their everyday life

EQUIPMENT: Ozzy Calendar – Illustration 2

PROCEDURE:

- > **Ask the students what they already know about the Sun. For example:** What is the Sun? Where is it? What is the function of the Sun? What is nice about the Sun?
- > **Explain to the class** what the Sun is, its role and how it provides life-energy on Earth.



2/ THE MANY MOODS OF THE SUN

MAJOR AREAS: Language

TIMING: 20mins

ACTIVITY OBJECTIVE: for students to write creative sentences to express their perception of the Sun

EQUIPMENT: notebooks, pens

PROCEDURE:

- > **Ask the students to write three sentences about the Sun, for example**
 - > "If the Sun was an animal, it would be..."
 - > "If the Sun was a feeling, it would be..."
- > **Ask the students to tell the class what is their favourite sentence and why**



3/ HOW CAN WE SEE THE EARTH IS TURNING?

MAJOR AREAS: Science, Environment

TIMING: 15mins (repeated 3 times in a day)

ACTIVITY OBJECTIVE: for students to draw their shadow several times in a day to observe the Earth rotation

EQUIPMENT: Ozzy Calendar – Illustration 2, chalk, clear ground. On a sunny day.

PROCEDURE:

- > **Explain to the class** the Earth's rotation, the reason for nights and days. We can observe the Earth's rotation by drawing our shadows at different times of the day.
- > **Take the students outside to clear ground and divide them into teams**
 - > Repeat this experience 3 times in the day: in the morning, around noon, late afternoon. Give each team a piece of chalk.
 - > Have one student from each team stand with the sun to their back.
 - > Have the other students draw those students' shadows on the ground with chalk.
 - > It is important that the students whose shadows have been drawn return to the same position to repeat the activity.
 - > When the experience has been repeated 3 times, ask the students what they can observe. The shadows have turned, which proves the Earth rotation.



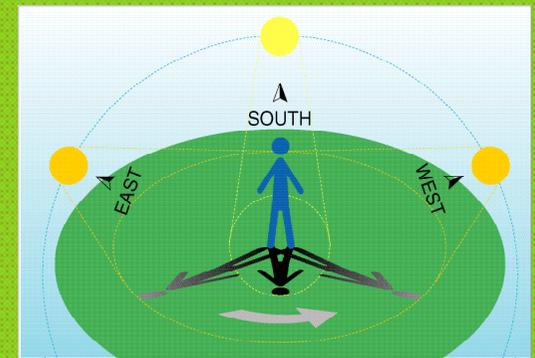
TEACHING TIPS:

You can use Ozzy Ozone Video as an introduction to this teaching programme.



TEACHING TIPS: Students could draw what people do on a sunny day.

You can keep these pictures to return to them at the end of the programme and activities, and ask the group to change them so the people are protecting themselves from harmful exposure to the sun.



TEACHING TIPS: You can ask the group to make a papier mache ball and paint it as a globe. You can suspend the globe on string attached to the top and bottom so it is at an angle. In a darkened classroom you can shine a torch to model night and day.

ACTIVITIES

The Earth and the Sun, how do they work together?

4/ UNDERSTANDING THE SEASONS

MAJOR AREAS: Science, Environment

TIMING: 15mins

ACTIVITY OBJECTIVE: for students to learn about the relation between the Earth's orbit around the Sun and seasons

EQUIPMENT: Ozzy Calendar – Illustration 2

PROCEDURE:

- > **Ask the students:** What is the current season in our country? What other seasons do we have in our country? Are the seasons the same all over the world?
- > **Explain to the class** that the position of the Sun in the sky is not the same in summer (hot season) and in winter (cold season). In summer, the Sun is high in the sky, while in winter it is lower in the sky.
 - > **For more able students,** explain the reasons for seasons and opposite seasons in the Northern and Southern hemispheres. The Earth is slightly tilted and it orbits (or revolves) around the Sun. It means sometimes we are pointing towards the Sun (sun's rays are more overhead), sometimes we are pointing away. When we are close, it is summer. When we are away, it is winter. The Northern half and the Southern half of the Earth have opposite seasons because when the North points towards the Sun, the South points away. Hence, when it is hot in the South, it is cold in the North.



5/ THE OZONE LAYER FILTER

MAJOR AREAS: Science, Environment

TIMING: 15mins

ACTIVITY OBJECTIVE: to give an introduction to the ozone layer

EQUIPMENT: Ozzy Calendar – Illustration 3

PROCEDURE:

- > **Explain to the class** sunlight has a dangerous invisible component called ultraviolet rays or UV rays. Explain how the ozone layer, high in the sky, wraps all the way around the Earth to let the good energy of the sun through and prevent its bad UV rays from reaching us.
- > **Ask the students** to compare the ozone layer to other filtering / blocking or protecting objects (strainer, umbrella, sunglasses...)
- > **Ask the students:** What would happen if there was no ozone layer?



INTRODUCTION - THE EARTH AND THE SUN

UNIT B

The good effects of the sun

SUMMARY

This lesson should highlight the good effects of the sun. It is important that students understand how they benefit from the sun before they are told about the risks of sun exposure increased by ozone layer depletion. This way they can distinguish natural benefits from unsafe features of the sun.

LEARNING OBJECTIVES

- The sun's energy is the source of all life on Earth
- The process of photosynthesis: plants make food from the sun
- Vitamin D: the sun helps us grow

CONTENTS

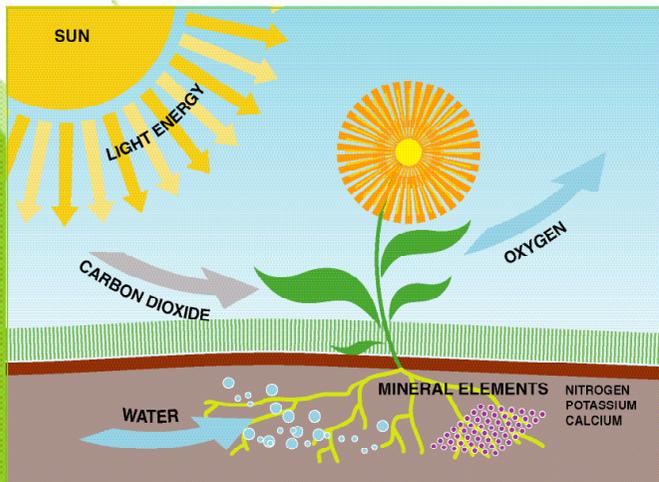
THE SUN PROVIDES US WITH ENERGY AND LIFE

The sun sends us warmth and light, in other words energy. It is this energy that makes life on Earth possible. With special equipments, the sun's energy can even be used to replace electricity.

SEE ACTIVITY 1

illustration 4 :

PHOTOSYNTHESIS: HOW DO PLANTS GROW?



PHOTOSYNTHESIS*: HOW DO PLANTS GROW?

Living beings also know how to use this energy for their own good.

First of all, plants – for example trees – get their energy directly from the sun through a process called photosynthesis. Indeed, there is no need to feed plants, because they are able to turn carbon dioxide* - a gas in the air - and water into their own nutrients (a sort of sugar) by using energy from sunlight.

- > Plants take carbon dioxide molecules* (written CO_2) from the air.
- > They also take water molecules (written H_2O) and use sunlight to split these water molecules into their basic components - hydrogen* (H) and oxygen* (O) - to keep only hydrogen.
- > From what plants take from the air (carbon dioxide) and from water (hydrogen), they create new molecules called carbohydrates* they can use to stimulate their own growth or store for later use.

Plants even create more 'food' than they need, which they store in roots, seeds, stems and fruits that animals and we can eat. Therefore, we also get our life energy indirectly from the sun by eating plants and their products such as rice, potatoes, carrots and so on.

In addition, in the process of photosynthesis plants release the oxygen left from the water they use into the air, which is a very useful action. Hence, the forests have been called the "Lungs of the Earth" because they take carbon dioxide to stimulate their own growth and release in the air their surplus oxygen that is vital to all life on Earth.

SEE ACTIVITY 2

VITAMIN D*: HOW DO WE GROW?

The sun is also good for our growth and well-being. Thanks to the sunlight our skin can make Vitamin D which helps our body to use calcium* (found in milk for example) more efficiently. This helps our bones and muscles to be strong and healthy. A very small amount of the sun's energy everyday is enough for our skin to produce the amount of Vitamin D we need to remain healthy, especially in sunny regions.

ACTIVITIES

The good effects of the sun

1/ WARM OR COLD?

MAJOR AREAS: Science, Environment

TIMING: 15mins

ACTIVITY OBJECTIVE: to observe the impact of solar radiation on the Earth's surface; to show that we can intercept the radiation and make power from it

EQUIPMENT: schoolyard or school surroundings. On a sunny day.

PROCEDURE:

- > Have the students gathered in the schoolyard or school surroundings on a sunny day and divide them into teams.
- > Ask the students to find objects (or surfaces) both on sunny and shaded places. Students should touch these objects and compare their temperature.
- > **Ask the students:** What do you observe? Are these objects (or surfaces) warm or cold? Why?
- > **Explain to the class:** solar radiation sends us warmth and energy. It is because some of these objects (or surfaces) are exposed to the sun that they get warm. It is because in shaded places the sun's light is blocked that shaded objects remain cold. sun's light can also be said to provide 'energy', and it is this energy that makes life possible on Earth. This energy can be captured and transformed into electricity. That is what solar cells, used in calculators for example, do: they transform the sun's light into power.



2/ ROLE PLAY: BUILDING A TREE FOR PHOTOSYNTHESIS (MORE ABLE STUDENTS)

MAJOR AREAS: Science, Environment, Health

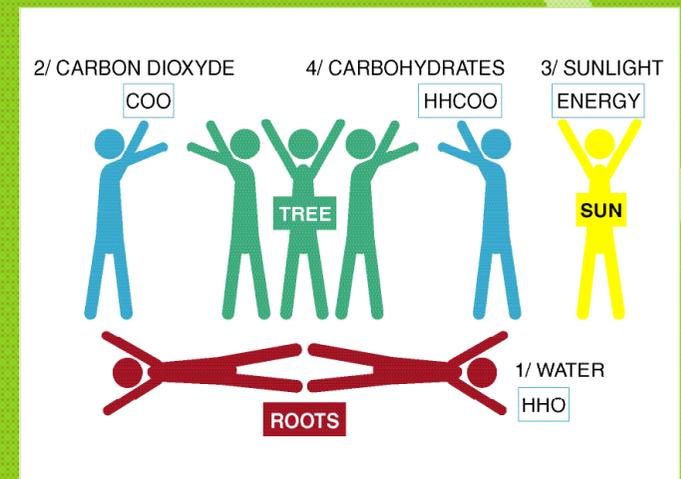
TIMING: 25mins

ACTIVITY OBJECTIVE: to show how plants and trees use the sun's energy to produce sugars and oxygen

EQUIPMENT: Ozzy Calendar – illustration 4, 2 pieces of paper, clear and clean ground

PROCEDURE:

- > **Prepare 2 pieces of paper: first one to be a water molecule ("HHO" written on it), second one to be a carbon dioxide molecule ("COO" written on it):**
 - > Get the students into a circle.
 - > Invite some students to be the trunk of a tree. They should raise their arms up and open their hands to represent branches and leaves. Then point out that the tree would fall without roots.
 - > Invite some other students to be the roots. They should lie with their feet touching the trunk.
 - > Ask the students what the roots do. Then have the students being the roots to pretend they absorb water by making sucking noises. The water enters the trunk to go up to the leaves. Get one leaf of the tree to hold the water paper (with HHO written on it).
 - > Move the carbon dioxide paper (written COO) around. As carbon dioxide enters the leaves, get another leaf of the tree to hold the carbon dioxide paper.
 - > Invite one student to be the sun and explain to the class that the sun provides the energy for the tree to rip the H from water and to add it to carbon dioxide so that sugar is formed. This sugar is the 'food' of the tree.
 - > Ask the student being the sun to erase the two "H" on the water paper and to add two "H" on the carbon dioxide paper.
 - > Explain that the "O" left on the water paper is oxygen the tree doesn't need to grow and ask the leaf holding it to release it into the air.
 - > To sum up, explain to the class that the sun has provided the energy for the tree to take hydrogen from water and to add it to the carbon dioxide taken from the air. The tree can release the oxygen left from the water into the air, which is a good thing as all living being need oxygen to live.
- > **Explain to the class:** The sun's energy is also useful for us. It helps our skin to produce Vitamin D so that our body can use calcium, which helps us grow well, keeps our bones and muscles strong and healthy. A very small amount of the sun's energy everyday is enough for our skin to produce Vitamin D.



ACTIVITIES

The good effects of the sun

3/ THE 'WHO KNOWS?' CHALLENGE: INTRODUCTORY SESSION

MAJOR AREAS: Science, Environment, Health

TIMING: 15mins

ACTIVITY OBJECTIVE: to sum up the key points of the introductory session and evaluate the students' understanding of the related concepts through the "Who Knows?" challenge

EQUIPMENT: 'Who Knows?' card on the introductory session – series 1, notebooks and pens

PROCEDURE:

- > Ask the students the questions on the 'Who Knows?' card on the introductory session. There are three levels of questions: 1 (easy), 2 (intermediate), 3 (challenging). Every correct answer to easy questions brings one point, every correct answer to intermediate questions brings 2 points, every correct answer to challenging questions brings 3 points.
- > For each question, remind the students how many points a correct answer brings.
- > Once the students have given an answer (written or oral), provide the class with the answer mentioned on the 'Who Knows?' card and ask the students to write it on their notebook.
- > Each student could count his/her own score according to the correct answers s/he has given.

> **Questions:**

1/ The Sun is:

- A star
- A planet

> **Answer:** The Sun is a star at the centre of our solar system. Nine planets orbit (or revolve) around the Sun, including the Earth we live in. This star is essential to all life on Earth.

2/ The Sun sends us (several correct answers)

- Light
- Energy
- Fire
- Warmth
- Rain

> **Answer:** the Sun sends us light, warmth and energy.

3/ Does the Sun revolve around the Earth?

- Yes
- No

> **Answer:** No. When we look at the Sun in the sky, it seems to turn around us. But in reality, it is the Earth that revolves around the Sun.

4/ The ozone layer protects us from dangerous UV radiation that comes from:

- The Sun
- Space
- The moon

> **Answer:** The ozone layer protects us from the dangerous UV radiation contained in the sun's light. UV radiation comes from the Sun.

5/ Plants make their own food out of (several correct answers)

- Water
- Vegetables
- The sun's light
- Air
- Bugs

> **Answer:** Plants grow through a process called photosynthesis. They use water, air and sun's light.

6/ To make carbohydrates, plants need (several correct answers)

- Carbon dioxide
- Hydrogen
- Oxygen

> **Answer:** To make carbohydrates (a kind of sugar), plants need carbon dioxide from the air and hydrogen from water. They release the oxygen left from water molecules in the air.

7/ Which vitamin does our skin produce thanks to the sun?

- Vitamin A
- Vitamin C
- Vitamin D

> **Answer:** thanks to the sun, our skin can produce Vitamin D, which is good for our growth as vitamin D helps make our muscles and bones strong



LEVEL 1

LEVEL 2

LEVEL 3

THEME 1 - THE OZONE LAYER: A SHIELD BETWEEN THE EARTH AND THE SUN TO PROTECT US

UNIT A

What Is The Ozone Layer?

SUMMARY

The introductory lessons have brought students to approach briefly the theme of the ozone layer through the relationship between the Sun and the Earth. This lesson aims at explaining in details the role and the nature of the ozone layer. Ozzy Ozone character is introduced to support students' understanding of ozone molecules.

LEARNING OBJECTIVES

- The ozone layer is a protective shield that blocks the harmful UV radiations of the sun
- Formation and composition of ozone molecules in the upper atmosphere
- Differences between "good" and "bad" ozone

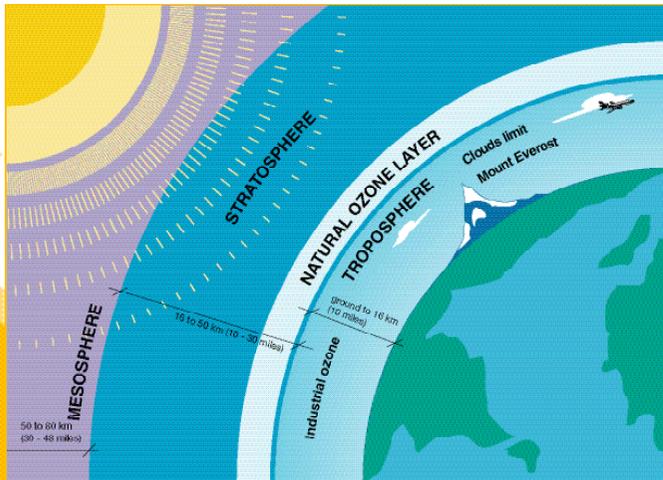
CONTENTS

THE OZONE LAYER* PROFILE

The ozone layer is a thin invisible shield that protects us from the harmful rays of the sun. It is made of ozone* gas and stands in the upper atmosphere (called the stratosphere*) at an altitude of 15 to 50 km (10 to 30 miles) above the Earth. That is the reason why it is said to be made of stratospheric ozone. 90% of all ozone gas is found in the upper atmosphere but is spread thinly and unevenly.

Altogether in the upper atmosphere the ozone molecules* form a kind of safety net that blocks most of the dangerous UV rays of the sun, just like roofs, umbrellas and hats protect us from the rains. If the ozone layer is damaged, it cannot protect us anymore from the harmful radiations of the sun and our health is endangered.

SEE ACTIVITY 1



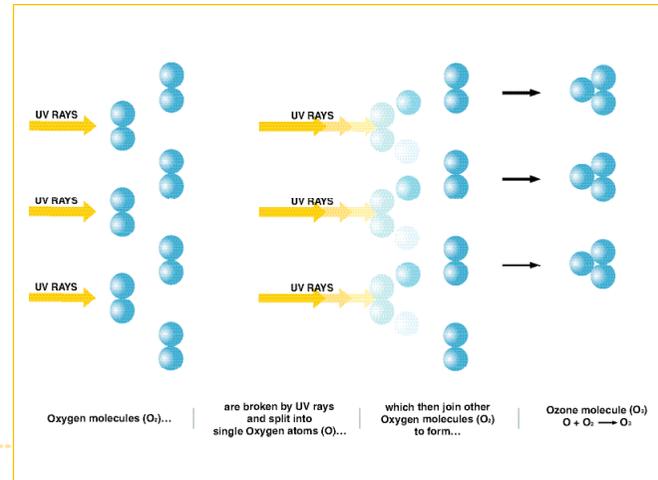
WHAT IS OZONE?

Ozone is a form of oxygen. Indeed, ozone molecules are composed of three atoms* of oxygen*. That is why ozone molecules are written O_3 .

In the upper atmosphere, ozone molecules are created through the breaking apart of oxygen molecules by the sun's energy.



INTRODUCE OZZY OZONE



When the sun's rays strike an oxygen molecule made of two bounded oxygen atoms (O_2), it splits apart into two single oxygen atoms (O).

One of these single oxygen atoms then combines with an oxygen molecule to form an ozone molecule ($O + O_2 \rightarrow O_3$).

SEE ACTIVITY 2

TEACHER'S TIPS: MISCONCEPTIONS ABOUT STRATOSPHERIC AND TROPOSPHERIC OZONE

90% of ozone molecules are found in the upper atmosphere (stratosphere) and form our protective ozone layer. But ozone is also found at ground level, in the lower atmosphere (troposphere*). Stratospheric ozone plays a positive role as it protects us from the dangerous UV rays of the sun.

But at ground level, tropospheric ozone plays a negative role, it is a very harmful pollutant as breathing ozone can cause health problems, like shortness of breath, lung diseases, asthma and eye irritation.

Even though this education pack is focusing on good ozone (stratospheric), it is important to make the difference between 'good' and 'bad' ozone (tropospheric).

ACTIVITIES

What is the ozone layer?

1/ THE OZONE LAYER: OUR EARTH'S UMBRELLA

MAJOR AREAS: Science, Environment

TIMING: 15mins

ACTIVITY OBJECTIVE: for students to understand the role of the ozone layer

EQUIPMENT: Ozzy Calendar - illustration 3

PROCEDURE:

- > **Explain to the class:** the ozone layer is an invisible shield located high in the sky and made of ozone gas. It is aimed at protecting us from the harmful rays of the sun. Explain the difference between 'good' and 'bad' ozone: ozone is bad at ground level because we breathe it and it causes health problems. Explain to the students that the lessons are all about the ozone layer made of good ozone.
- > **Ask the students:** How do you think ozone is formed?
- > Then play the ozone game below



TEACHING TIPS: More able students could check the Ozzy Ozone website to search information about the ozone layer:
<http://www.ozzyozone.org>

2/ PLAY ROLE: HOW OZZY WAS BORN

MAJOR AREAS: Science, Environment, Communication

TIMING: 30mins

ACTIVITY OBJECTIVE: for students to play and understand how ozone molecules are formed in the upper atmosphere

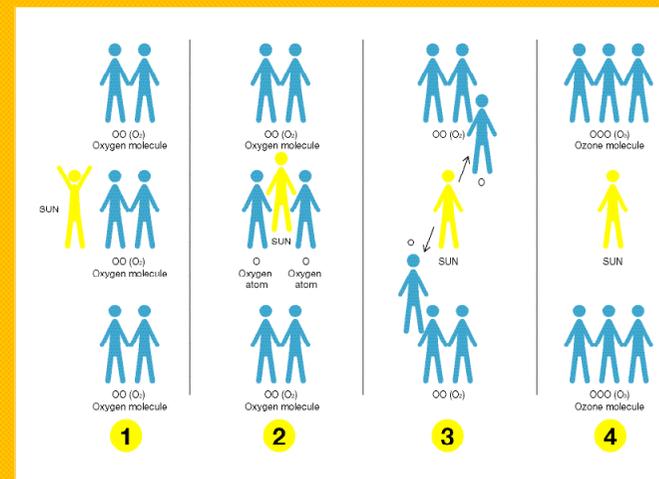
EQUIPMENT: Ozzy Calendar illustrations 3 and 5

PROCEDURE:

Introduce Ozzy the Ozone molecule to the classroom: Explain that the ozone layer is made of ozone molecules like Ozzy. Using Ozzy's character design, explain that ozone molecules are composed of three atoms of oxygen bound together ($O-O-O \rightarrow O_3$). Ozone molecules are created through the breaking apart of oxygen molecules by the sun's energy.

Organize a role-play:

- > Ask all the students to be oxygen atoms, except one or two who will be sun rays.
- > Ask the students who are oxygen atoms to form groups of two by holding hands. These groups are oxygen molecules (O_2).
- > Ask the student(s) being the sun's ray(s) to touch only one oxygen molecule (group of two) to split it.
- > When split, ask the two students of the oxygen molecule to join another group of two by holding hands to form a group of three. They should choose a different one. The groups of three students become ozone molecules (O_3).
- > When completed, count the number of oxygen atoms (1 student), oxygen molecules (2 students) and ozone molecules (3 students). There should be only a few ozone molecules. In the upper atmosphere, there are far less ozone molecules than oxygen molecules.



ACTIVITIES

What is the ozone layer?

3/ THE 'WHO KNOWS?' CHALLENGE: ABOUT THE OZONE LAYER

MAJOR AREAS: Science, Environment

TIMING: 15mins

ACTIVITY OBJECTIVE: to sum up the key points of the lesson through the "Who Knows?" challenge

EQUIPMENT: 'Who Knows?' card on the ozone layer – series 2, notebooks and pens

PROCEDURE:

- > Ask the students the questions on the 'Who Knows?' card on the ozone layer. There are three levels of questions: 1 (easy), 2 (intermediate), 3 (challenging). Every correct answer to easy questions brings one point, every correct answer to intermediate questions brings 2 points, every correct answer to challenging questions brings 3 points.
- > For each question, remind the students how many points a correct answer brings.
- > Once the students have given an answer (written or oral), provide the class with the answer mentioned on the 'Who Knows?' card and ask the students to write it in their notebooks.
- > Each student could count his/her own score according to the correct answers s/he has given.

> **Questions:**

1/ The ozone layer is low in the sky and we can see it

- True
- False

> **Answer:** False. The ozone layer is high in the sky, located in the stratosphere. We cannot see it, ozone is an invisible gas.

2/ In the upper atmosphere, ozone is called:

- Stratospheric ozone
- Tropospheric ozone

> **Answer:** in the upper atmosphere ozone is called 'stratospheric ozone' because it is located in the stratosphere (15 to 50 km / 10 to 30 miles above the Earth).

3/ What does the ozone layer protect us from?

> **Answer:** The ozone layer protects us from the dangerous UV radiation of the sun

4/ The ozone layer is made of:

- Oxygen
- Hydrogen
- Ozone

> **Answer:** The ozone layer is made of ozone that is a kind of oxygen (three oxygen atoms bound together, written O₃).

5/ How many oxygen atoms are contained in one ozone molecule?

- One
- Two
- Three

> **Answer:** 3 oxygen atoms bound together are needed to form an ozone molecule.

6/ What do the following signs refer to?

- O
- O₂
- O₃

> **Answer:** O refers to an oxygen atom, O₂ refers to an oxygen molecule and O₃ refers to an ozone molecule.

7/ What is tropospheric ozone?

> **Answer:** Tropospheric ozone is ozone found in the lower atmosphere, at ground level. Tropospheric ozone is dangerous for our health, it is a strong pollutant that can cause shortness of breath, lung disease, asthma.



LEVEL 1

LEVEL 2

LEVEL 3

THEME 1 - THE OZONE LAYER: A SHIELD BETWEEN THE EARTH AND THE SUN TO PROTECT US

UNIT B

UV Radiation: An Invisible Harm

SUMMARY

Exposure to the sun can be dangerous. Ozone layer depletion causes increased UV radiation to reach the surface of the Earth and creates the potential for more health damage. It is important for students to understand what UV radiation is. This lesson will explain UV rays in simple terms and relies on experiences that help students understand.

LEARNING OBJECTIVES

- Ultraviolet radiations as an invisible component of sunlight
- The three categories of UV rays
- Introduction to the risks of exposure to UV radiation

CONTENTS

WHAT IS UV RADIATION?

The sunlight has a very harmful component called ultraviolet radiation* (or UV rays) that we cannot see or feel. It is not the warmth or the brightness of the sun that causes health problems but these invisible UV rays. Hence, a bad and even cold weather does not mean there are no UV rays in the sunlight and no danger. UV radiation levels (the more UV rays, the more dangerous) are independent from temperature and can still be high when the sky is cloudy.

The ozone layer* protects us from most UV rays but not 100% of them. Some UV rays can still reach us and therefore we need to be protected from them.

SEE ACTIVITY 1

THE UV RAYS CLASSIFICATION

There are three different categories of UV rays that do not have the same strength and therefore do not affect us the same way:

- > UV-A* rays are the most common rays to reach us because the ozone layer lets them through. They are the least strong UV rays, so they may be the least dangerous. However, UV-A rays are still harmful to our health, which means we need to be protected from them.
- > UV-B* rays cause the most damage to human health. Although the ozone layer prevents most of UV-B rays from reaching us, some can still go through and do serious harm. A significant increase of UV-B radiation reaching the Earth can be very dangerous for us, but also for plants and animals.
- > UV-C* rays are extremely strong and dangerous. Fortunately, they are completely blocked by the ozone layer and absorbed in the atmosphere.

WHY ARE UV RAYS DANGEROUS?

In a word, the sun's UV rays are dangerous for us as well as for plants and animals because they burn. They damage our health by penetrating deep into our skin and eyes, and by weakening our immune system* (our body's natural capacity to fight diseases). Spending some time in the sun without protection when UV radiation is high can cause immediate health problems. But the bad effects of the sun are cumulative, they stay with us for life: it means exposure to UV radiation today can also cause serious health problems in the future.

SEE ACTIVITY 2

ACTIVITIES

UV radiation: an invisible harm

1/ LET'S 'SEE' UV RADIATION⁽²⁾

MAJOR AREAS: Science, Environment

TIMING: 25mins

ACTIVITY OBJECTIVE: for students to experiment and observe the presence of invisible UV rays and their intensity

EQUIPMENT: UV-Meter, schoolyard or school's surroundings, a sunny day

PROCEDURE:

- > **Explain to the class:** sunlight contains invisible rays – called ultraviolet rays (or UV rays) that we cannot feel or see but that are very harmful to our health. There are three types of UV rays: UV-A, UV-B and UV-C rays. The most dangerous are UV-B.
- > **Have the students gathered in the schoolyard or school's surroundings on a sunny day and divide them into four teams:**
 - > Put the UV-Meter in the sun. After a few minutes, show it to the students: would you say the colour of the UV-Meter has changed? Why?
 - > Explain to the class that the UV-Meter is sensitive to UV rays: its colour changes according to levels of UV rays. Given the colour codes, does the UV-Meter indicate low, moderate or high UV radiation after exposure to the sun?
 - > Put the UV-Meter in shade and repeat the same experiment: given the colour codes, does the UV-meter indicate low, moderate or high UV radiation?
- > **Explain to the class:** UV rays are invisible but thanks to the UV-Meter we can see what is the level of UV radiation in the sunlight. The more the UV-Meter receives UV rays, the more its colour gets darker. In shade, the UV-Meter receives far less UV rays than in the sun.



2/ THE SUN'S RAYS BURN

MAJOR AREAS: Environment, Health, Social Life

TIMING: 20mins

ACTIVITY OBJECTIVE: for students to discuss and relate their own experience of the bad effects of the sun

PROCEDURE:

- > **Ask the students:** how do you feel under the sun? Does the sun have bad effects? How many of you have already been sunburnt? Have you had painful eyes after spending a long time outside on a sunny day?
- > **Explain to the class:** the sun also has bad effects. UV rays burn and penetrate our skin and our eyes, they can also weaken our body so that it is not able to fight diseases as well as it should.
- > **Ask the students** what they can do to protect themselves from the sun: from these ideas, design a sun safety checklist with the class.



 **TEACHING TIPS:** The sun safety checklist can be reviewed and completed during the lesson on sun protection measures (p. 50) when students may actually change their measures.

(2) This activity has been inspired by the 2005 sun protection programme of the associations 'La main à la pâte' and 'Sécurité Solaire' in France.

ACTIVITIES

UV radiation: an invisible harm

3/ 'WHO KNOWS?' CHALLENGE: ABOUT UV RAYS

MAJOR AREAS: Science, Environment, Health

TIMING: 15mins

ACTIVITY OBJECTIVE: to sum up the key points of the lesson through the 'Who Knows?' challenge

EQUIPMENT: 'Who Knows?' card on UV rays – series 3, notebooks and pens

PROCEDURE:

- Ask the students the questions on the 'Who Knows?' card on UV rays. There are three levels of questions: 1 (easy), 2 (intermediate), 3 (challenging). Every correct answer to easy questions brings one point, every correct answer to intermediate questions brings 2 points, every correct answer to challenging questions brings 3 points.
- For each question, remind the students how many points a correct answer brings.
- Once the students have given an answer (written or oral), provide the class with the answer mentioned on the 'Who Knows?' card and ask the students to write it in their notebooks.
- Each student could count his/her own score according to the correct answers s/he has given.

➤ **Questions:**

1/ What is the meaning of 'UV' in 'UV rays'?

> **Answer:** 'UV' is a short way to say 'ultraviolet'

2/ Can we see or feel UV rays?

Yes No

> **Answer:** No. We cannot see or feel UV rays. UV radiation is a component of sun's light but it is invisible.

3/ Can UV rays reach us when there are clouds in the sky?

Yes No

> **Answer:** Yes. UV rays can reach us when there are clouds in the sky. Only dark and rainy clouds can absorb a significant amount of UV rays.

4/ Why are UV rays dangerous for us?

> **Answer:** UV rays are dangerous for our health. They can hurt and penetrate deep inside our skin and our eyes, they can also affect our immune system. Exposure to UV radiation can cause health problems today (sunburns, eye irritation) and later in life (skin cancer, cataract).

5/ Does UV radiation affect us on the long run?

Yes No

> **Answer:** Yes. Exposure to UV radiation also affects us on the long run; the bad effects of the sun are cumulative and they can cause serious health problems in the future.

6/ How many categories of UV rays exist?

4 10 3

> **Answer:** There are 3 categories of UV rays: UV-A (the least strong that are not filtered by the ozone layer), UV-B (strong and dangerous because not all filtered by the ozone layer) and UV-C (extremely strong but all filtered by the ozone layer).

7/ 'UV rays' is a synonym for sunlight

True False

> **Answer:** False. 'UV rays' is not a synonym for sunlight but UV rays are contained in the sunlight even though we cannot see them.



LEVEL 1

LEVEL 2

LEVEL 3

THEME 1 - THE OZONE LAYER: A SHIELD BETWEEN THE EARTH AND THE SUN TO PROTECT US

UNIT C

Where When and Why is UV radiation dangerous?

SUMMARY

Once students have learned about UV radiation, they need to identify the conditions for the sun to be harmful. This lesson presents the six main elements that make sun exposure particularly dangerous for human health. Knowledge of UV radiation factors is a prerequisite for self-protection.

LEARNING OBJECTIVES

- UV radiation levels vary and depend on time, season, region, and environmental contexts
- The UV Index is a tool to evaluate UV radiation levels and potential for health damages

UV RADIATION FACTORS

Although the ozone layer* is aimed at preventing dangerous UV rays* from reaching us, some can still get through it and harm us. Therefore, the longer we stay out in the sun, the more we are exposed to UV radiation.

The amount of UV rays reaching us is not always the same and it actually depends on several factors that need to be known in order to avoid dangerous situations. Most of these factors are related to the distance UV rays have to travel to reach us: the longer the distance, the more UV rays are filtered and absorbed in the atmosphere* before having a chance to reach the surface of the Earth.

- > **The time of the day:** between 10 am and 4 pm we receive a lot of UV rays. The sun is at its highest and so is the level of UV radiation. The distance UV rays have to travel to reach us is short at that time of the day because the sun is at its highest position in the sky.
- > **The time of the year:** the sun's intensity changes throughout the year. It is stronger in summer (hot season) than in winter (cold season). In summer (hot season), the sun is higher in the sky, which increases the level of UV radiation; in winter (cold season), it is on the contrary lower in the sky, which means lower UV radiation. This is because we are pointing towards the sun in summer – meaning a shorter distance for UV rays to travel to us – that there is more harmful radiation reaching the surface of the Earth. In winter on the contrary, we are pointing away from the sun and therefore we receive less UV rays.

CONTENTS

- > **The equator*:** The equator is the imaginary line drawn around the planet, halfway between the poles. Countries that are close to the equator are more at risk than others. This is due to the fact that the sun is more directly overhead at the equator, which means the distance UV rays need to travel to reach us is shorter. UV radiation is always high at the equator.
- > **Elevation:** the higher the altitude we live at, the higher the UV radiation level. Because there is less atmosphere to absorb the damaging UV rays at high altitude, the amount of UV rays reaching the Earth increases about 8% with every 1000 meters (3280 feet) above sea level. People who live in the mountains are more exposed.
- > **Reflection:** UV rays are reflected off surfaces such as sand, water and snow. These surfaces act like mirrors and increase the amount of UV rays we receive. UV radiations are very strong by the sea, on the beach and in mountains.
- > **Weather:** weather variations can also affect the levels of UV radiation but only in specific cases: only dark and heavily burdened with water clouds can absorb the UV rays significantly (about 80% of them). On the contrary, scattered clouds can increase the level of UV radiation at the surface of the Earth, due to the fact that these clouds offer UV rays a reflecting and intensifying surface.

SEE ACTIVITIES 1 AND 2

THE UV INDEX

The Global Solar UV Index, developed by the World Health Organization in collaboration with UNEP and The World Meteorological Organisation, is a tool to describe the level of UV radiation at the Earth's surface everyday. It uses a range of values from zero upward, taking into account all the factors mentioned below, to indicate the potential for adverse health effects due to UV radiation. The higher the value, the greater the amount of dangerous UV rays and the potential for damage to our health. In addition, the higher the value, the less time it takes for harm to occur. The UV Index is often used along with the weather forecast in newspapers, TV and radio.

SEE ACTIVITY 3

illustration 6 :

HIGH UV RADIATION FACTORS AND THE UV INDEX

UV factors	High UV radiation	Exposure category and risk for health	UVI range
Time of the day	From 10 am to 4 pm		
Time of the year	Summer or hot seasons	Low	<2
Location	Close to the equator	Moderate	3 to 5
Elevation	Altitude above sea level	High	6 to 7
Reflection	Sand, water, snow	Very high	8 to 10
Weather	No dark clouds in the sky	Extrem	11+

ACTIVITIES

Where When and Why is UV radiation dangerous?

1/ UNDERSTANDING UV RADIATION FACTORS

MAJOR AREAS: Environment, Geography, Health

TIMING: 25 mins

ACTIVITY OBJECTIVE: for students to understand UV radiation factors and to use the world map to identify most exposed places in the world as well as the situation of their own country

EQUIPMENT: Ozzy Calendar - illustration 6, world map

PROCEDURE:

- > **Display the world map**, which indicates high UV radiation months for each region of the world and hot climate areas.
- > **Ask the students** to locate their country/region on the map: is it located in a hot climate area?
- > **Comment** on most exposed countries/regions on the map: where are they located? What do they have in common?
- > **Explain to the class** that UV radiation levels depend on several factors: time of the day, time of the year, location, elevation, reflection, weather.
- > **Give them the table with the factors listed in the explanation.**



2/ OUR REGION TODAY (MORE ABLE STUDENTS)

MAJOR AREAS: Environment, Geography

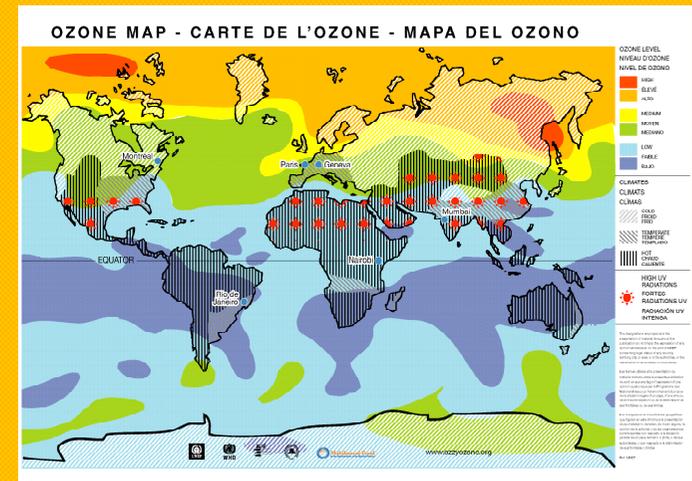
TIMING: 20 mins

ACTIVITY OBJECTIVE: to sum up the geographical and UV exposure situation of your region taking into account today's weather

PROCEDURE:

Ask the students to answer as many of the following questions as possible:

- > What time is it? So, is UV radiation increased at that time? Yes or No
 - > What is the date? So, is UV radiation increased during this month? Yes or No
 - > Are we close to the equator? So, is UV radiation increased where we live? Yes or No
 - > At what altitude do we live? So, is UV radiation increased at this altitude? Yes or No
 - > Do we live by the sea? Is there sand or snow? So, is UV radiation increased where we live? Yes or No
 - > What is the weather today? So, is UV radiation higher today? Yes or No
- > **Count the Yes and No** answers and ask the students to evaluate the level of UV radiation and potential for adverse health effects out of this result. Would they say the potential for adverse health effects is low, moderate or high?



UV FACTORS	HIGH UV RADIATION
Time of the day	From 10 am to 4 pm
Time of the year	Summer or hot seasons
Location	Close to the equator
Elevation	Altitude above sea level
Reflection	Sand, water, snow
Weather	No dark clouds in the sky



TEACHING TIPS: This activity can be repeated with other countries or capital cities to be ranked according to their potential for exposure to high UV radiation.

ACTIVITIES

Where When and Why is UV radiation dangerous?

3/ LEARNING ABOUT THE UV INDEX (MORE ABLE STUDENTS)

MAJOR AREAS: Geography, Environment, Health

TIMING: 25mins

ACTIVITY OBJECTIVE: for students to learn about the UV Index as an informational tool based on the evaluation factors they have used in previous activities

EQUIPMENT: Ozzy Calendar illustration 6, world map

PROCEDURE:

- > The following table shows weather predictions, daily UV Index and risk levels over 3 days for 6 cities in the world.
- > First, draw this table on the blackboard or on paper without showing UV Index values nor risk levels.
- > Choose 2 cities on the table and locate them on the map. According to the UV radiation factors mentioned in the previous activities, ask the students whether they would say the potential adverse health effects is low, moderate or high for the two selected cities.
- > **Explain to the class:** to evaluate the potential adverse health effects of the sun, there is a tool. It is called the UV Index. It is a tool that describes every day the level of UV radiation in order to tell us how dangerous it is to stay in the sun. It measures and combines all the UV radiation factors mentioned below (time of the year, location, elevation), associated with weather conditions, to describe specific daily levels of UV radiation. The UV Index uses a range of values from zero. Zero means that UV radiation is very low and the sun is not dangerous for our health in these conditions.
- > **On the table:**
 - > Add the UV Index values for each city on the table.
 - > Checking the values used by the UV Index on Ozzy Calendar illustration no. 6, ask the students to determine for each city and each day the risk levels (low, moderate, high, very high, extreme).
- > **Ask the students:** for each city, are the UV Index values the same over the 3 days? How does it relate to the weather? How far are these countries from the equator? Which cities are in the northern part of the Earth? Which are in the southern part? Some cities have the same weather (Paris and Nairobi have showers on Friday for example) and still their UV Index is not the same (2 for Paris and 10+ for Nairobi), why? Repeat this exercise with other examples.



TEACHING TIPS: You could check in the newspapers: Is UV Index mentioned along with the weather forecast? If so, what is the UV index today? How is it related to the UV radiation factors (time of the year and weather)

	FRIDAY 21/10/05			SATURDAY 22/10/05			SUNDAY 23/10/05		
	Weather	UV Index Values	Risk level	Weather	UV Index Values	Risk level	Weather	UV Index Values	Risk level
Paris France	Showers	2	Low	Showers	2	Low	Showers	1	Low
Nairobi Kenya	No sun Showers	10+	Extreme	Scattered Thunderstorms	10+	Extreme	Partly cloudy	10+	Extreme
Bombay India	Sunny	10	Very High	Sunny	10	Very High	Sunny	10	Very High
Montreal Canada	Sunny	3	Moderate	Partly cloudy	3	Moderate	Rain	2	Low
Rio de Janeiro Brazil	Scattered Thunderstorms	10	Very High	Isolated Thunderstorms	10	Very High	Scattered Thunderstorms	8	Very High
Geneva Switzerland	Showers	3	Moderate	Few showers	3	Moderate	Rain	1	Low

ACTIVITIES

Where When and Why is UV radiation dangerous?

4/ "WHO KNOWS?" CHALLENGE : UV RADIATION FACTORS

MAJOR AREAS: Environment, Geography, Health

TIMING: 15mins

ACTIVITY OBJECTIVE: to sum up the key points of the lesson through the 'Who Knows?' challenge

EQUIPMENT: 'Who Knows?' card on UV radiation factors – series 3, notebooks and pens

PROCEDURE:

- > Ask the students the questions on the 'Who Knows?' card on UV radiation factors. There are three levels of questions: 1 (easy), 2 (intermediate), 3 (challenging). Every correct answer to easy questions brings one point, every correct answer to intermediate questions brings 2 points, every correct answer to challenging questions brings 3 points.
- > For each question, remind the students how many points a correct answer brings.
- > Once the students have given an answer (written or oral), provide the class with the answer mentioned on the 'Who Knows?' card and ask the students to write it in their notebooks.
- > Each student could count his/her own score according to the correct answers s/he has given.

> **Questions:**

1/ At what time of the day is UV radiation at its highest?

> **Answer:** UV radiation is at its highest between 10am and 4pm.

2/ Why is UV radiation higher in summer?

- The sun is high in the sky and UV rays have a shorter distance to travel to reach us
- There is less ozone in the atmosphere
- The sun is particularly busy in summer

> **Answer:** The sun is high in the sky and UV rays have shorter distance to travel to reach us in summer or hot seasons. In Summer, the sun is more dangerous

3/ What are the surfaces that reflect and increase UV radiation? (several correct answers)

- Sand
- Wood
- Water
- Stone
- Snow

> **Answer:** The surfaces that reflect and increase UV radiation are sand, water, snow

4/ When is UV radiation at its highest in our region? Which months?

> **Answer:** depends on your region.

5/ Where is the equator?

- In the northern part of the Earth
- In the southern part of the Earth
- Between the northern part and the southern part of the Earth

> **Answer:** The equator is the imaginary line drawn around the planet halfway between the North and South poles. It is therefore between the northern part and the southern part of the Earth.

6/ In October, why is the UV Index very high in Rio de Janeiro and very low in Paris?

- Because it rains in Paris
- Because Rio de Janeiro is in the southern part of the Earth and Paris is in the northern part of the Earth.
- Because Rio de Janeiro is in South America and Paris is in Europe.

> **Answer:** Rio de Janeiro and Paris have opposite seasons. This is because Rio de Janeiro is in the southern part of the Earth and Paris in the northern part of the Earth. October is a cold season, almost winter, in Paris while it is hot season in Rio de Janeiro. As UV radiation is higher in summer than winter, it is higher in Rio de Janeiro than in Paris in October.

7/ Is the UV Index about the weather?

- Yes
- No

> **Answer:** No. The UV Index describes the level of UV radiation in order to tell us how dangerous it is to stay in the sun. It uses all the UV radiation factors that are the time of the day, the time of the year, location and even elevation. It also takes into account the weather, given that in some very specific weather conditions UV radiation can be partly absorbed by dark and rainy clouds.



LEVEL 1

LEVEL 2

LEVEL 3

THEME 2 - OZONE LAYER DEPLETION: LET'S NOT TAKE THE RISK!

Ozone Layer Depletion: What Happens?

UNIT A



SUMMARY

Ozone layer depletion increases the amount of UV rays that reach the surface of the Earth and that are dangerous for human health. This lesson should teach students about the causes and the process of ozone layer depletion. The students can build on what they have learned about UV radiation to understand the crucial importance of the thin ozone layer.

LEARNING OBJECTIVES

- Human activities use chemicals that are released in the air and deplete the ozone layer
- Products that contain ozone-depleting substances
- How ozone molecules are destroyed

CONTENTS

WE ENDANGER THE OZONE LAYER*

A delicate balance is naturally maintained in the amount of stratospheric ozone (in the upper atmosphere) for the ozone layer to allow and protect us efficiently against the harmful UV rays* of the sun.

Unfortunately, since the 1950s, a number of human activities have been seriously disturbing this balance, threatening and harming our natural protective ozone layer. These activities developed by human societies are dangerous because they release in the air some chemicals that destroy ozone molecules* in the upper atmosphere: this causes what we call ozone layer depletion*. The consequence for us is an increased amount of damaging UV rays reaching the surface of the Earth.

The chemicals that are responsible for ozone layer depletion are called Ozone Depleting Substances* or ODS. These substances are mainly chemicals called chlorofluorocarbons* (CFCs), and halons *. CFCs and halons are not found in nature; they are man-made.

Indeed, although we may never have heard about them, CFCs and halons have many uses in everyday life. CFCs are used in refrigerators, air conditioners and sprays. Halons are used in fire extinguishers. Another ozone depleting substance, called methyl bromide*, is also used as an agricultural pesticide*.

This does not mean that these products are dangerous for us. CFCs or other ODS can only become harmful to the ozone layer when they escape into the air. This can happen during manufacturing but also when people decide to repair or throw away appliances that contain ODS without precautions.

SEE ACTIVITY 1

illustration 7 : OZONE DEPLETING SUBSTANCES

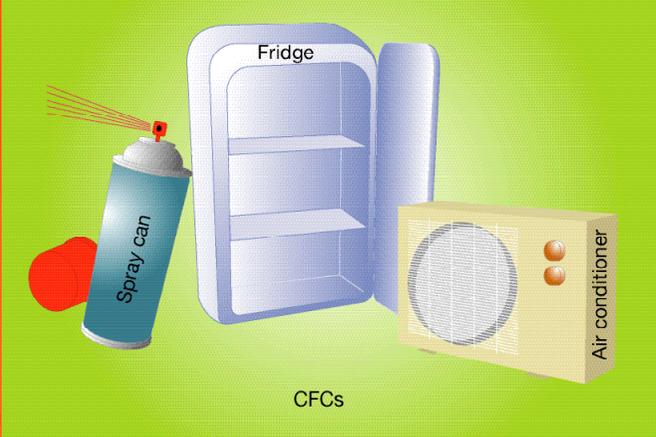
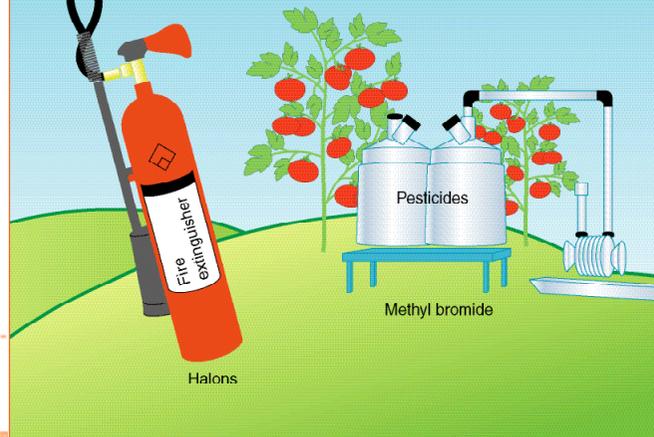


illustration 8 : OZONE DEPLETING SUBSTANCES



THE PROCESS OF OZONE DEPLETION

What happens exactly when CFCs or other ozone depleting substances are released into the air? How do they destroy ozone molecules?

- > First, CFCs (or other ODS) can migrate into the upper atmosphere thanks to the air currents that carry them.
- > Once CFCs have reached the upper atmosphere, they are hit and broken by UV rays.
- > During this process, some substances that are particularly harmful to the ozone layer are released, that is to say chlorine and bromine atoms*.
- > Once released in the upper atmosphere, chlorine and bromine atoms react with ozone molecules and break them, which leads to the thinning of the ozone layer. Each chlorine atom can spend almost a hundred years breaking ozone molecules and can break apart as many as 100 000 of them during this period. It means that the chlorine atoms that are released today through CFCs travelling in the upper atmosphere could still be doing harm in a hundred years.

By releasing these chemicals in the atmosphere, we harm the ozone layer and ourselves. As the ozone layer is being depleted, less UV rays are absorbed and, consequently, more can reach and harm us. It was shown that for every 1% decrease in the stratospheric ozone, the UV radiation reaching us will increase by 2%.

SEE ACTIVITY 2

THE OZONE LAYER: A RARE AND PRECIOUS COMMON GOOD

Atmospheric air is made of different kinds of molecules, including ozone molecules. But the total amount of ozone molecules is very small: out of about 1 million air molecules, less than 10 are of ozone. It shows how little and precious the stratospheric ozone is: these few molecules are vital to us.

SEE ACTIVITY 3

ACTIVITIES

ozone Layer Depletion: what happens?

1/ THE CAUSES OF OZONE LAYER DEPLETION

MAJOR AREAS: Environment, Social Life

TIMING: 25mins

ACTIVITY OBJECTIVE: for students to learn about the human activities and common products that can be harmful to the ozone layer

EQUIPMENT: Ozzy Calendar - illustrations 7, 8

PROCEDURE:

- > Ask the students to look at illustration no.7, 8 in the Ozzy Calendar and ask them: Which of these objects do you know? What are they used for? What happens when they are broken?
- > Explain to the class: These products can contain some chemicals (CFCs, halons, methyl bromide) that cause ozone layer depletion. They are called ozone depleting substances (or ODS).
- > Make a list of products containing ODS. Using the list of products containing ODS, devise a survey sheet and use it to find out which products your school uses.

2/ ROLE PLAY: THE OZONE LAYER DEPLETION PROCESS⁽³⁾ (MORE ABLE STUDENTS)

MAJOR AREAS: Science, Environment, Mathematics

TIMING: 30mins

ACTIVITY OBJECTIVE: for students to see what happens when chlorine/bromine atoms break ozone molecules and how the number of chlorine/bromine atoms increases the rate of ozone layer depletion.

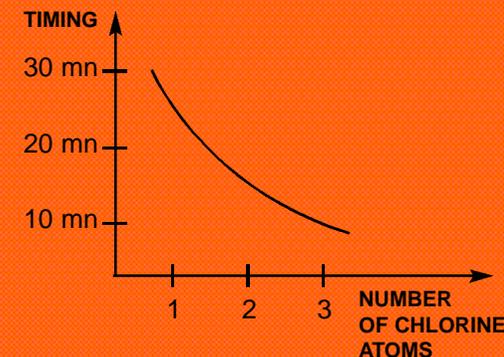
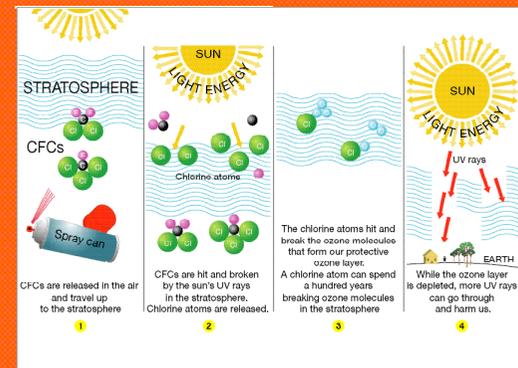
EQUIPMENT: Ozzy Calendar illustration - no.8, blackboard/paper, watch

PROCEDURE:

- > Explain to the class: If ODS are released in the air, they migrate up to the stratosphere where they are broken apart by the sun's rays. This process releases chemicals - chlorine or bromine atoms - that react with and destroy the ozone molecules that form our ozone layer. Each of these atoms can spend almost a hundred years breaking ozone molecules.

Run the role-play:

- > Designate one student to be a chlorine atom that has been released after CFCs have been broken by UV rays in the upper atmosphere. This student could use a piece of coloured ribbon as an armband.
- > Ask the other students to be oxygen atoms: some of them will stand alone to be free oxygen atoms (O), others will form groups of two by holding hands to be oxygen molecules (O₂), and others will form groups of three by holding hands to be ozone molecules (O₃).
- > At the signal begin timing. The student being a chlorine atom should pursue the groups of three - ozone molecules - and try to catch them. The ozone molecules may try to avoid the chlorine atom but must stay linked.
- > The chlorine atom is free to attack another group of three - ozone molecule.
- > The process should continue until all ozone molecules have been broken down to oxygen molecules and atoms.
- > Record the amount of time required for one chlorine atom to break all of the ozone molecules.
- > The game should be repeated twice, with two and then three chlorine atom pursuers.
- > The time needed to break down all the ozone molecules should be recorded each time.
- > Graph the result of each game round (timing and number of chlorine atoms). This graph should illustrate that increased chlorine levels in the upper atmosphere increase the rate of ozone destruction.



3/ OZONE IS SMALL, BUT IT CHANGES EVERYTHING⁽⁴⁾

MAJOR AREAS: Language, Creativity

TIMING: 15mins

ACTIVITY OBJECTIVE: for students to write a short poem about something that is very little but very important to them

EQUIPMENT: notebooks and pens

PROCEDURE:

- > Ask the students to write two or three sentences: it should be a poem about something they use or see in their everyday life that is hardly noticeable but very important to them.
 - > As an example: just a pinch of salt in a dish can make all the difference to the taste
- > Explain to the class: there are very few ozone molecules to form the ozone layer. Ozone molecules are rare and precious; they play a vital role for all living beings on Earth.

(3) Inspired from the Environmental Health Centre, Division of the National Safety Council (USA), Sun Safety Activity Guide

(4) Inspired from the Centre for Environment Education, India, The Educator's Kit on Ozone Layer Protection

THEME 2 - OZONE LAYER DEPLETION: LET'S NOT TAKE THE RISK!

UNIT B

The Ozone Hole

SUMMARY

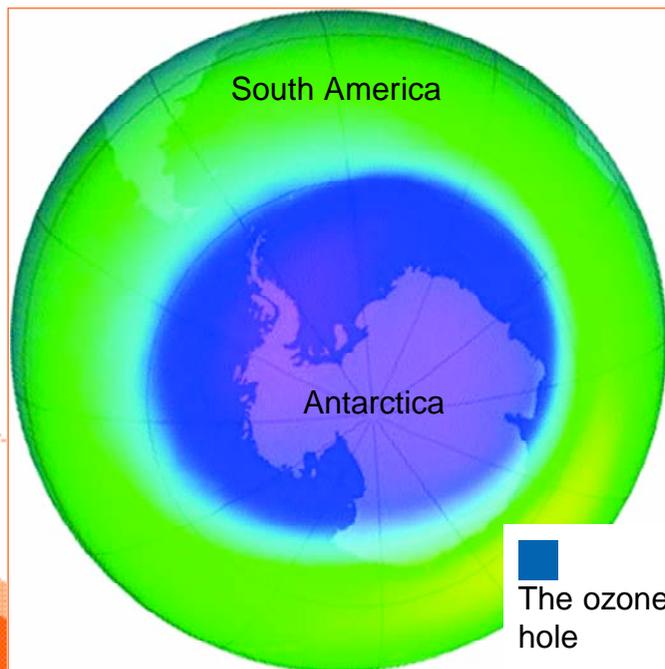
The consequences of ozone layer depletion are profound and will last. During this lesson, students will be taught about the thinning of the ozone layer and the 'ozone hole' that results from the activities and process described in the previous lessons.

LEARNING OBJECTIVES

- What is the ozone hole and where is it located?
- Levels of ozone concentration and thinning of the ozone layer
- Ozone layer depletion and global warming

CONTENTS

Illustration 9 : THE OZONE HOLE LOCATION



AN ALARMING DISCOVERY

Everybody on Earth is concerned and affected by the consequences of ozone layer depletion*. However, some regions of the world are already more severely affected. During the 1980s, scientists discovered an extremely alarming thinning of the ozone layer* over the region of Antarctica (Southern pole of the globe). Since then, they have proved that every year in spring, when ozone layer depletion process is at its highest, at least 50% of the ozone layer is destroyed over Antarctica: this is called the 'ozone hole'. Unfortunately, since then evidence has been made that the ozone layer was also being severely depleted over the Northern pole of the globe, which means we have to talk about the 'ozone holes' now. In summertime 2005, the Northern ozone hole was all over Europe.

The ozone layer is thinning severely over many regions and countries where people live: parts of South America, Australia, New Zealand and South Africa are particularly affected. Over North America, Europe and Asia the ozone layer is also getting thinner.

The consequences of this phenomenon can be dreadful: the more the ozone layer is depleted, the more the people who live in these regions and countries are exposed to increased amounts of damaging UV rays*.

SEE ACTIVITY 1, 2 AND 3

TEACHERS' TIPS: OZONE HOLE AND GLOBAL WARMING

CFCs are also harmful at ground level, in the lower atmosphere. They contribute to some extent to break the 'greenhouse effect'. The 'greenhouse effect' is a vital phenomenon without which it would be much colder on Earth. The problem is that some gases, such as CFCs, trap the heat that should naturally escape and reinforce the 'greenhouse effect'. This makes the Earth become warmer and may result in climate change, with consequences for sea level and weather extremes. Scientists call this phenomenon 'global warming'. In addition, 'global warming' may delay the ozone layer recovery.*



ACTIVITIES

The ozone hole

1/ THE OZONE HOLE ON THE MAP

MAJOR AREAS: Science, Environment, Geography

TIMING: 20mins

ACTIVITY OBJECTIVE: for students to see the regions and countries that are most affected by the thinning of the ozone layer and the ozone hole

EQUIPMENT: world map

PROCEDURE:

- > **Explain to the class:** more than 20 years ago, scientists found a hole in the ozone layer resulting from the process of its continuous depletion. The 'ozone hole' is located over a region called Antarctica and forms in spring on a yearly basis.
- > **Display the world map and invite the students to identify the location of the ozone hole** (giving them the corresponding colour code). Then ask them: do people live there? Is our country far from the ozone hole? What happens to the people living close to the ozone hole?



2/ OZONE CONCENTRATION: A UV RADIATION FACTOR

MAJOR AREAS: Science, Environment, Geography

TIMING: 20mins

ACTIVITY OBJECTIVE: for students to identify levels of ozone concentration in the upper atmosphere as UV radiation factors

EQUIPMENT: world map

PROCEDURE:

Explain to the class: The ozone layer is also thinning over many regions and countries of the world. This leads to increased dangerous UV radiation reaching and harming people all over the world. Levels of ozone concentration in the upper atmosphere must be considered as a factor of UV radiation and associated with the other factors (time of the day, time of the year, location, elevation, reflection, weather).

Ask the students to identify the regions and countries that are affected by a significant thinning of the ozone layer (giving them the corresponding colour codes). Then ask them: Do people live there? Is our country affected? How depleted is the ozone layer above our country?



3/ IN 50 YEARS FROM NOW

MAJOR AREAS: Language, Creativity, Social Life

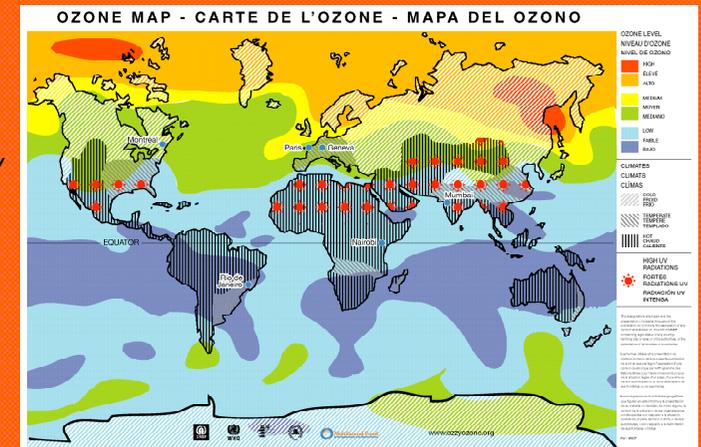
TIMING: 20mins

ACTIVITY OBJECTIVE: for students to write a short text to describe their town/village 50 years from now

EQUIPMENT: notebooks, pens

PROCEDURE:

- > Ask the students to write a short text to describe their town/village and the conditions of life of their inhabitants 50 years from now if the ozone layer has kept on depleting.
- > Ask them to write a piece about what can be done to stop the ozone layer depletion.



ACTIVITIES

The ozone Hole

4/ WHO KNOWS? CHALLENGE : OZONE LAYER DEPLETION

MAJOR AREAS: Science, Social Life

TIMING: 15mins

ACTIVITY OBJECTIVE: to sum up the key points of the lesson through the 'Who Knows?' challenge

EQUIPMENT: 'Who Knows?' card on ozone layer depletion – series 5

PROCEDURE:

- > Ask the students the questions on the 'Who Knows?' card on ozone layer depletion. There are three levels of questions: 1 (easy), 2 (intermediate), 3 (challenging). Every correct answer to easy questions brings one point, every correct answer to intermediate questions brings 2 points, every correct answer to challenging questions brings 3 points.
- > For each question, remind the students how many points a correct answer brings.
- > Once the students have given an answer (written or oral), provide the class with the answer mentioned on the 'Who Knows?' card and ask the students to write it in their notebooks.
- > Each student could count his/her own score according to the correct answers s/he has given.

> **Questions:**

1/ Why is the ozone layer depleted?

> **Answer:** The ozone layer is depleted because chemicals such as CFCs, halons and methyl bromide that are dangerous to ozone molecules are released in the atmosphere.

2/ Which products contain ozone depleting substances? (several correct answers)

■ Refrigerators ■ Motorbikes ■ Cars ■ Sprays ■ Ovens ■ Fire extinguishers ■ Pesticides

> **Answer:** Refrigerators, sprays, fire extinguishers, pesticides and cars with air conditioning systems can contain ozone depleting substances.

3/ What do we call the main ozone depleting chemicals?

■ FFCs ■ CCFs ■ CFCs

> **Answer:** The main ozone depleting chemicals are CFCs.

4/ What other ozone depleting substances do you know? (several correct answers)

> **Answer:** The other main ozone depleting substances are halons and methyl bromide.

5/ When was the first ozone hole discovered?

■ 1985 ■ 1998 ■ 2005

> **Answer:** A first ozone hole was discovered in 1985 over Antarctica. Since then, it has been forming each year during spring time when ozone layer depletion is at its highest. Another ozone hole, over the Northern pole, has also formed recently.

6/ Where are the ozone holes located?

> **Answer:** The Southern ozone hole is located over Antarctica. It forms each year during springtime. There is also an ozone hole forming over the Northern pole. In addition, the ozone layer is getting thinner and thinner over many other regions of the world.

7/ What do ozone layer depletion and global warming have in common?

- Ozone layer depletion causes global warming
- Global warming causes ozone layer depletion
- Global warming may delay the ozone layer recovery

> **Answer:** Global warming may delay the ozone layer recovery.



LEVEL 1

LEVEL 2

LEVEL 3

THEME 2 - OZONE LAYER DEPLETION: LET'S NOT TAKE THE RISK!

UNIT C

What are the risks ?

SUMMARY

Students have learned about dangerous UV radiation and ozone layer depletion causing increased levels of UV radiation. This lesson will help students understand the concrete consequences of increased UV radiation on human health and especially on theirs.

LEARNING OBJECTIVES

- Health damages due to increased UV radiations: skin, eye, immune system
- Children are the most exposed to health damages due to UV exposure
- Bad consequences of increased UV radiation for plants and animals

CONTENTS

THE RISKS FOR HUMAN HEALTH

UV rays* can harm our skin and eyes; they can also weaken our immune system*. That is the reason why increased UV radiation due to ozone layer depletion* is a threat to our health.

SEE ACTIVITY 1

illustration 10 : SUN EXPOSURE AND HEALTH EFFECTS



SKIN DAMAGE

When we are outside in the sun, we are exposed to UV rays (especially UV-B*) that penetrate and damage our skin deep down, leading to various health problems. The skin has its own system to try to prevent the damages caused by UV rays: it produces a kind of shield from a dark-coloured pigment, called melanin*, aimed at blocking UV rays. This is the reason why some people get suntanned. While producing melanin, their skin gets darker. But the skin system of self-defence is far from being strong enough to protect us efficiently from UV radiation, especially when it is getting higher. Actually **suntan***, as any kind of change of the colour of the skin, means the skin has been exposed to excessive UV radiation. suntan shows that the skin has been damaged and that it will be even more difficult to offer protection for the future.

The most common and immediately visible damaging effect of excessive exposure to UV rays is **sunburn*** (itchy, warm and red skin). If the level of UV radiation is high, sunburn can occur very quickly, the first noticeable sign of sunburn being that the skin becomes red. This sign should be taken as a warning: when sunburn occurs one should avoid the sun. In general, burns and other skin damages occur by the time we see them, and they stay with us – in the memory of our skin – for life.

In the long run, excessive exposure to UV rays can cause **premature ageing*** (wrinkling of the skin) and severe skin diseases such as **skin cancer***. Skin cancer starts when the skin cells, getting confused because of the damaging effects of UV rays, begin growing and multiplying. Skin cancer does not appear overnight but it is a serious disease that must be treated at early stage. Above all, avoiding sun exposure when UV radiation is high can prevent skin cancer.

EYE DAMAGE

Just like our skin, our eyes can be sunburnt and damaged by UV rays. Our eyes have a natural protective reaction to bright light (they close instantly), but they must be protected from the harmful and invisible UV rays of the sun. Indeed, UV radiation increases the rate of eye problems, such as **eye irritation or inflammation**.

In the long run, UV rays can cause severe damage to the transparent part of the eye that regulates the amount of light we need to see clearly. This part of the eye is called the 'lens*'. When damaged by UV rays, the lens loses its transparency, which is a disease called cataract*. According to the World Health Organization, **eye cataracts** are the world's leading cause of blindness.

IMMUNE SYSTEM

Excessive exposure to UV rays has also been proved to weaken our immune system, that is to say the natural ability of our body to fight diseases and to recover from them.



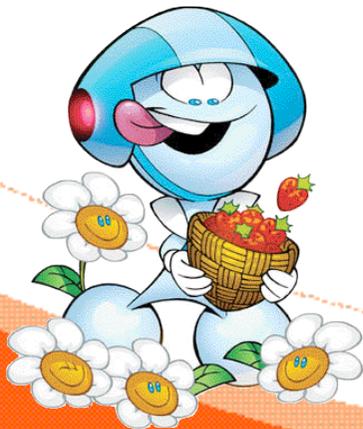
THEME 2 - OZONE LAYER DEPLETION: LET'S NOT TAKE THE RISK!

THE SAME RISKS FOR ALL?

The skin's sensitivity to UV radiation depends on the amount of melanin* – the pigment that colours our skin – it contains. Everybody's skin contains melanin, but not the same amount. This means that light skins, that only have a small amount of this pigment, are more easily harmed when exposed to the sun's UV rays than darker skins that have a greater amount of melanin. That is the reason why it is very common to think that only light-skinned people are affected by skin damages due to UV radiation. But this is wrong: if darker skins are less sensitive to the sun, it does not mean dark-skinned people are protected and cannot be harmed. Actually, because dark-skinned people may assume they are not concerned, they may also detect skin diseases (such as skin cancer*) at a later, more dangerous stage.

Everybody, no matter what skin type, must be conscious of the risks related to high UV radiation exposure. In addition, eye damage and suppression of the immune system* are totally independent of skin types or colours. They affect everyone.

Health damages due to high UV radiation is not related to lifestyles either. No matter where we live, in urban or rural areas, and whatever our environment is: when we expose ourselves to the sun and to high levels of UV radiation, we all take the same risk.



WHY CHILDREN ARE PARTICULARLY AT RISK?

The bad effects of sun exposure, no matter skin type, lifestyle or environment, concern everyone. However, children are particularly at risk.

First, children are in a process of growth, their skin is thinner and can be damaged very easily.

In addition, the harmful effects of the sun are cumulative over a lifetime, which means that sun exposure during childhood increases the risk of skin diseases later in life. Every day of exposure to UV rays at a young age counts, adding up to the risk of having health problems later.

Finally, a significant part of a person's lifetime UV exposure occurs before the age of 18⁽⁵⁾. Children spend a lot of time outdoors and therefore it is important to protect them from the sun.

SEE ACTIVITY 2

WE CAN PROTECT OURSELVES

Health and environmental problems due to increased levels of UV radiation are serious and scary. But it is important to understand that there are solutions to help protect the ozone layer* so that UV radiation levels decrease, and solutions to help us stay healthy by protecting ourselves from the bad effects of the sun.

(5) According to the World Health Organization

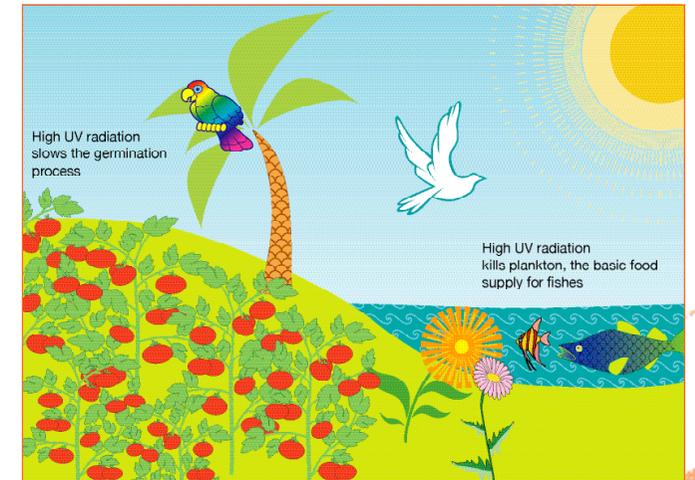
THE RISK FOR THE ENVIRONMENT

Increased UV radiation also affects the essential ecological processes of our environment. UV rays can damage plants and slow their germination process, which is detrimental to crop yield and agricultural production.

UV rays are also very harmful to marine life: they affect the smallest creatures found in the waters, such as plankton, which are the base of the food chain for marine life. Indeed, if plankton dies, fishes lose their food supply, which is also detrimental to fishery.

SEE ACTIVITY 3

Illustration 11 : HIGH UV RADIATION AND THE ENVIRONMENT



ACTIVITIES

What are the risks ?

1/ INCREASED UV RADIATION, INCREASED BAD EFFECTS OF THE SUN

MAJOR AREAS: Health, Environment, Social Life

TIMING: 20mins

ACTIVITY OBJECTIVE: for students to relate their own experience of the bad effects of the sun and learn about health damages due to UV exposure

EQUIPMENT: Ozzy Calendar illustration 10, paper

PROCEDURE:

- > **Explain to the class:** UV rays cause damage to the skin: sunburn, premature ageing and severe skin diseases in the long run. UV rays also have harmful effects on the eyes that can lead to eye inflammation and to serious damage to the lens of the eye, to blindness in the long run (cataracts). UV radiation also affects our immune system.
- > **Ask the students:**
 - > How many of you have already been sunburnt? How did it feel? What did you observe? How many of you have already had painful eyes after a long time in the sun?
 - > Which parts of your body can sunburn easily and why? Face? Eyes? Neck? Shoulders? Arms? Hand? Chest? Stomach? Back? Legs? Feet?



2/ HOW MUCH TIME IN THE SUN?

MAJOR AREAS: Health, Social Life, Mathematics

TIMING: 20mins

ACTIVITY OBJECTIVE: for students to evaluate the average time they spend in the sun per day

EQUIPMENT: blackboard or paper

PROCEDURE:

Ask the students to describe all their activities during a usual weekday from the moment they wake up to the moment they go to bed.

- > From this information, draw a table on the blackboard/paper that indicates the time of the day and the time that each activity takes.
- > For each activity, ask the students whether it is an outdoors (in the sun) activity or an indoors activity. Report their answer in the table.
- > Ask the students to add the duration of outdoors activities, then to add the duration of indoors activities. Have the students compare the time they spend in the sun to the time they spend out of the sun during an average weekday.

Explain to the class: children usually spend more time in the sun than adults. In addition to the fact that their skin is thinner and fragile, this is one of the reasons why they are particularly at risk: being exposed to UV radiation at young age may cause health problems later in life.



3/ INCREASED UV RADIATION AND NATURAL ECOSYSTEMS

MAJOR AREAS: Environment, Social Life

TIMING: 20mins

ACTIVITY OBJECTIVE: for students to understand and communicate the effects of increased UV radiation on the environment

EQUIPMENT: Ozzy Calendar illustration 11, paper, pens

PROCEDURE:

- > **Explain to the class:** Increased UV rays are harmful to plants and animals, particularly to crops and marine life. UV rays slow down plants' germination process and they can also kill plankton (the smallest creatures in the waters) that is the basic food supply for marine life. It is detrimental to human beings as it can damage agricultural production and fishery.
- > **Ask the students:** why are crops and fish important to us? What would happen to fish if they were lacking food?
- > **Have the students produce a poster advertising effects of ozone thinning to fish, crops, and plants:** the poster should show the process of increased UV radiation due to ozone layer depletion harming crops and marine life.



ACTIVITIES

What are the risks ?

4/ WHO KNOWS? CHALLENGE: THE RISKS

MAJOR AREAS: Health, Social Life

TIMING: 15mins

ACTIVITY OBJECTIVE: to sum up the key points of the lesson through the 'Who Knows?' challenge

EQUIPMENT: 'Who Knows?' card on the risks of increased UV radiation – series 6

PROCEDURE:

- > Ask the students the questions on the 'Who Knows?' card on risks due to UV radiation. There are three levels of questions: 1 (easy), 2 (intermediate), 3 (challenging). Every correct answer to easy questions brings one point, every correct answer to intermediate questions brings 2 points, every correct answer to challenging questions brings 3 points.
- > For each question, remind the students how many points a correct answer brings.
- > Once the students have given an answer (written or oral), provide the class with the answer mentioned on the 'Who Knows?' card and ask the students to write it in their notebooks.
- > Each student could count his/her own score according to the correct answers s/he has given.

> **Questions:**

1/ What happens to our skin when it is exposed to UV rays?

> **Answer:** When exposed to UV rays, our skin reacts. It produces melanin as a self-defence mechanism and consequently gets suntanned. When over-exposed to UV radiation, our skin is harmed and gets sunburnt. Later in life, exposure to UV radiation can lead to serious diseases such as skin cancer.

LEVEL 1

2/ What happens to our eyes when they are exposed to UV rays?

> **Answer:** When exposed to UV rays, our eyes get hurt. They can be inflamed and later in life over-exposure to UV radiation can lead to a serious disease called 'cataract', which is the world's leading cause of blindness.

3/ What is the function of the immune system?

- To fight UV rays
- To fight diseases (virus, infections)
- To fight warmth

> **Answer:** The function of the immune system is to fight diseases (virus and infections) and help us recover from them. Exposure to UV radiation can affect our immune system.

4/ What are the reasons for children being particularly at risk? (several correct answers)

- They are smaller than adults
- Their skin is thinner
- Their skin is not prepared for the sun yet
- They spend more time in the sun than adults

LEVEL 2

> **Answer:** Children are particularly at risk when exposed to UV radiation because they are in a process of growth and their skin is thinner. They are also more at risk because they spend more time in the sun than adults: 80% of a lifetime exposure to UV radiation occurs before the age of 18.

5/ Why is increased UV radiation dangerous for marine life?

- Because fish gets skin diseases
- Because it kills plankton that fish eats
- Because it makes the oceans warmer

> **Answer:** Increased UV radiation is dangerous for marine life because it kills planktons, which are the basic food supply for all marine life.

6/ What is 'melanin'?

- A vitamin
- A muscle
- A coloured pigment

LEVEL 3

> **Answer:** Melanin is the coloured pigment our skin contains. When exposed to the sun, our skin naturally produces melanin to protect itself from its dangerous rays. Everybody's skin contains melanin but not the same amount: dark-skin contains more melanin than light skin. However, melanin does not protect efficiently against UV rays and everybody, regardless of skin types, needs additional protection.

7/ Which part of the eye is affected by cataract?

- Pupil
- Lens
- Iris

> **Answer:** Cataract is a disease that affects the lens of the eye: the lens that lets the light in the eye loses its transparency, which can lead to blindness.



Solutions to the global problem

THEME 3 - WHAT CAN WE DO?

UNIT A

Prevention: how to protect the ozone Layer

SUMMARY

The consequences of ozone layer depletion on health and environment via increased UV radiations are very worrying. Students must be taught about the solutions and actions that can be taken. This lesson is aimed at bringing the students into a participatory and responsible attitude towards the protection of the ozone layer. It also aims at encouraging the students to communicate about what they have learned from the previous lessons and activities.

LEARNING OBJECTIVES

- Actions taken by the international community
- Actions students can take individually and collectively to protect the ozone layer

CONTENTS

THERE ARE SOLUTIONS TO PROTECT THE OZONE LAYER*

To protect all life on Earth from increased dangerous UV radiations*, it is crucial to protect our ozone layer and prevent it from being depleted by the chemicals we manufacture and use. This means putting a stop to production and consumption of CFCs* and other Ozone Depleting Substances so that none are ever released into the atmosphere* anymore.

There has been considerable progress since the signing of the Montreal Protocol on Substances that Deplete the Ozone Layer in 1987, an international agreement to reduce and eliminate CFCs and other ODS. As of July 2006, 189 countries have ratified the Montreal Protocol. So far, production and consumption of CFCs have been phased out in industrialized countries and schedules are in place to eliminate the use of other ODS. Developing countries and countries with economy in transition operate under specific phase-out schedules and have set the objective of the full elimination of CFCs by January 2010. Thanks to these efforts, the first signs of recovery of the ozone layer are even becoming noticeable at mid-latitudes.

If we all do the right things, the ozone hole will disappear. Everyone at all levels can contribute to the protection of the ozone layer and children have a great role to play in this effort. At the individual level, there are simple solutions to prevent ozone layer depletion and increased UV radiation:

INFORM:

First, everyone can spread the message to his or her friends, family and community. It is important to explain what can be done to protect the ozone layer, our natural shield against UV rays. Children can tell what they have learned about ozone layer depletion* and its consequences on people's health, on plants and animals.



BUY OZONE-FRIENDLY PRODUCTS:

Children should encourage their parents and family to be careful about what they buy and tell them to choose products that do not contain CFCs or other ODS. Whenever it is possible, it is much better to purchase ozone-friendly products that do not contain ODS (refrigerator, air conditioning, sprays, fire extinguishers). Ozone-friendly products always have a specific label that makes them easily recognizable.

BE CAREFUL WITH APPLIANCES:

Children can also encourage their parents and family to be careful about what they throw away or have repaired. Refrigerators and air conditioners (in cars for example) can contain CFCs that are likely to be released into the atmosphere if not properly handled. If refrigerators or air conditioners are to be repaired or thrown away, it is important to remove carefully the CFCs. CFCs need to be stored or recycled, so that they are not released into the atmosphere and they cannot harm the ozone layer. Mechanics who repair this kind of appliances should be specifically certified to work with CFCs.

DO NOT USE PESTICIDES* WITH METHYL-BROMIDE*:

Everyone should also encourage people they know who work in agricultural production to use pesticides that do not contain methyl bromide, another ozone depleting substance. Pesticide application is generally a rather dangerous activity. If used anyway, pesticides should not contain methyl bromide.

SEE ACTIVITY 1, 2 AND 3

ACTIVITIES

Prevention: how to protect the ozone layer

1/ SPREAD THE MESSAGE

MAJOR AREAS: Environment, Social Life, Communication

TIMING: 15mins

ACTIVITY OBJECTIVE: for students to identify the actions they can take to protect the ozone layer

EQUIPMENT: Ozzy Calendar illustrations 7, 8

PROCEDURE:

- > **Sum up the key points on the causes of ozone layer depletion and ask the students:** What are the products we should pay particular attention to for the ozone layer? What could we do to protect the ozone layer?
- > **Explain to the class** the simple and concrete solutions to help preserve the ozone layer. If we all do the right things, the ozone hole will disappear.
- > **Children** can tell their friends, parents, family what they have learned about ozone layer depletion and its consequences on people's health. They can encourage them to buy ozone-friendly products and be careful when they throw away or have repaired appliances that contain CFCs (refrigerators, air conditioners, sprays).



2/ ON THE STAGE: HOW WOULD YOU TELL YOUR MOTHER ABOUT THE OZONE LAYER?

MAJOR AREAS: Social Life, Communication

TIMING: 20mins

ACTIVITY OBJECTIVE: for students to learn how to communicate in a familiar environment on ozone layer depletion and preventive measures. Students to demonstrate their understanding of the causes and consequences of ozone layer depletion, to show their ability to tell others about it.

EQUIPMENT: dialogue "How to tell your mother about the ozone layer" (p. 43)

PROCEDURE:

- > Prepare two copies of the dialogue "How to tell your mother about the ozone layer"
- > Designate one student to be a child wanting to tell his/her mother why it is important to be aware of ozone layer depletion and what can be done to prevent it. Ask this student to choose another student to be his/her mother.
- > Ask the two students to play the dialogue "How to tell your mother about the ozone layer" for the other students.
 - > The first student should pretend s/he is back home from school. S/he meets his or her mother and start telling her about what s/he has just learned about the ozone layer (its role) and what causes its depletion. The two students should read and play the whole dialogue.
- > When completed, ask the other students what they think about what they have heard and seen. Would they add other information? Would they tell their parents differently and why?



3/ MARKET TRIP: WHERE ARE THE OZONE-FRIENDLY PRODUCTS?

MAJOR AREAS: Social Life, Mathematics

TIMING: about 1 hour

ACTIVITY OBJECTIVE: for students to look for ozone-friendly products at the local market or at the grocers' shop and compare the proportion of ozone-friendly products with the proportion of products containing ODS.

EQUIPMENT: notebooks, pens

PROCEDURE:

- > Take the students to visit the local market or grocers' shop and divide them into teams.
- > Ask the students to look for products likely to contain ODS and among them for ozone-friendly products. Students should take notes during the visit and count all the products with ODS as well as ozone-friendly products they find.
- > Take the students back to school. In the classroom, ask the students to make statistics about the proportion of ozone-friendly products they have found at the market. What do they observe?



REMINDER: WHERE CAN WE FIND OZONE DEPLETING CHEMICALS?

- > Refrigerators
- > Air conditioning systems (e.g. in cars)
- > Spray cans
- > Fire extinguishers
- > Pesticides

WHAT CAN WE DO?

- > Buy and use ozone-friendly products without Ozone Depleting Substances: no CFCs, no halons, no methyl bromide
- > Ask certified mechanics to repair or take care of used appliances that contain ODS
- > Spread the message!



TEACHING TIPS: Students can also improvise the dialogue!

ACTIVITIES

Prevention: how to protect the ozone layer

4/ WHO KNOWS? CHALLENGE : SOLUTIONS FOR THE OZONE LAYER

MAJOR AREAS: Health, Social Life

TIMING: 15mins

ACTIVITY OBJECTIVE: to sum up the key points of the lesson through the 'Who Knows?' challenge

EQUIPMENT: 'Who Knows?' card on the solutions for the ozone layer – series 7

PROCEDURE:

- > Ask the students the questions on the 'Who Knows?' card on solutions for the ozone layer. There are three levels of questions: 1 (easy), 2 (intermediate), 3 (challenging). Every correct answer to easy questions brings one point, every correct answer to intermediate questions brings 2 points, every correct answer to challenging questions brings 3 points.
- > For each question, remind the students how many points a correct answer brings.
- > Once the students have given an answer (written or oral), provide the class with the answer mentioned on the 'Who Knows?' card and ask the students to write it in their notebooks.
- > Each student could count his/her own score according to the correct answers s/he has given.

> **Questions:**

1/ What can you do for the ozone layer when you are back home?

- Play football
- Tell my parents about the ozone layer, why it is important to protect it and how they can do so.

> **Answer:** When you are back home, you can tell your parents about the ozone layer, why it is important to protect it and how they can do so. They can buy ozone-friendly products and handle used appliances likely to contain ODS with care.

2/ What are the common products likely to contain ODS? (several correct answers)

- Refrigerators
- Ovens
- Air conditioning
- Motorbikes
- Spray cans
- Fire extinguishers
- Pesticides

> **Answer:** The most common products likely to contain ODS are: refrigerators, cars with air conditioning, spray cans, fire extinguishers, pesticides.

3/ Why is it important to handle products with ODS with care?

- Because they are fragile
- Because if not handled with care, ODS can be released into the air and damage the ozone layer

> **Answer:** It is important to handle products with ODS with care so that ODS cannot be released into the air and will not damage the ozone layer. Only mechanics certified to work with ODS should repair or recycle these products.

4/ Products containing ODS are dangerous only when they are used

- True
- False

> **Answer:** This is false. Products that contain ODS are always dangerous for the ozone layer, be they new or old.

5/ Who can participate in the protection of the ozone layer?

- The countries
- The companies
- Everyone

> **Answer:** Everyone can participate in the protection of the ozone layer. That includes countries and companies, but also ourselves.

6/ Which agricultural products can be dangerous for the ozone layer?

- Fertilizer
- Pesticides

> **Answer:** Pesticides can be dangerous for the ozone layer when they contain methyl bromide. Methyl bromide is an Ozone Depleting Substance (ODS).

7/ What is the objective of the Montreal Protocol on Substances that Deplete the Ozone Layer?

> **Answer:** The objective of the Montreal Protocol is to gradually eliminate the consumption and production of ODS in all countries.



LEVEL 1

LEVEL 2

LEVEL 3

A DIALOGUE TO PLAY: "HOW WOULD YOU TELL YOUR MOTHER ABOUT THE OZONE LAYER?"

Child: Mother, I have to tell you about what the teacher told us today! I never knew we had an ozone layer overhead!

Mother: What is this? An "ozone layer" overhead? I've never heard about such a thing!

Child: Well, actually we cannot see it. It's invisible and very very high in the sky. But you know, it's our shield!

Mother: Our shield? I don't understand a word. What is this ozone layer? I only know about chocolate layers in the cakes I make.

Child: Mother, your chocolate layer cakes are the most delicious in the world. But "Mother Earth" has made another kind of layer made of a natural gas called "ozone". That is why it is called the "ozone layer". It is incredible, although it stands very high in the sky and we cannot see it, this ozone layer is what makes life possible down here on Earth! And it is very thin because ozone is rare, just like gold.

Mother: I cannot believe that such a rare thing would make such a difference to life on Earth...

Child: But it does. Imagine making a pot of soup. Just a very small amount of herbs or spices make that soup tasty. It's the same in the case of ozone molecules. And Mother Nature always keeps the ozone layer in balance so that the vital shield can protect us. Just as you always keep your tasty soup in delicious balance with the right amount of herbs and spices.

Mother: OK, so that tasty layer makes life possible on Earth? But what does it protect us from?

Child: It lets the good energy of the sun through but blocks its dangerous rays. These dangerous rays are called UV rays. The teacher said it means ultraviolet rays. If too many of these UV rays reach us, they harm our skin and eyes or make us feel very tired. Many people in the world get very sick because of UV rays.

Mother: Well, good that we have this ozone layer!

Child: Yes mother. But there is a problem. The teacher also told us that some of the products people often use, like sprays or refrigerators, contain chemicals that are extremely dangerous for the ozone layer. These chemicals are called "CFCs". When released into the air, these chemicals travel up to the sky and damage the ozone layer so badly that now, there is a hole in it.

Mother: But how could a spray used down here affect ozone layer way up there enough to make a hole in it?

Child: Look, when you cook my favourite meal down in the kitchen, the smell drifting upstairs makes me feel so hungry! It's the same process!

Mother: But if there is a hole in this ozone layer, does it still protect us from these horrible UV rays?

Child: The truth is that the ozone layer doesn't protect us as well as it should. Now that it is depleted, it lets more UV rays through.

Mother: Oh my dear! What are we going to do? Never go in the sun because the UV rays would strike us?

Child: Mother, the good news is that we have solutions!

Mother: We can repair the ozone hole?

Child: It will take time. But the teacher told us we can protect the ozone layer so that it will recover. It is quite simple; we need to prevent ozone layer depletion. We can buy 'ozone-friendly' products that do not contain CFCs. It is easy because there is a label on ozone-friendly products. When we want to throw away used appliances that contain CFCs or have them repaired, we can ask a mechanic who will not let those CFCs into the air. We can also tell our neighbours to do the same.

Mother: Well, I'm glad to see we can help the ozone layer recover. But what about the UV rays?

Child: Because the ozone layer is depleted, more dangerous UV rays can reach us. It means that until the ozone layer is repaired, the sun is particularly dangerous. But we can protect ourselves from the sun in many ways. First, the teacher said the amount of UV rays we are likely to receive depends on the time of the day and on the time of the year. We need to be particularly careful between 10am and 4 pm, when the sun is high in the sky, and even more in summer. At this time of the day, it's better to seek shade not to be exposed to UV rays. Otherwise, always protecting our skin with clothes and shoes, our eyes and our head with a hat... all these simple solutions will make us safe in the sun!

Mother: I feel better now. and I'm glad to see you are a good student. I have to tell your father about all this, it is very important!

Child: I will play football with my friends today, I will tell them too !

Mother: Good, but not before you have put on your hat!

THEME 3 - WHAT CAN WE DO?

UNIT B

Adaptation: it's natural to protect oneself

SUMMARY

Students can participate in the protection of the ozone layer but they need to be protected from the long-lasting consequences of its depletion. This lesson aims at showing students that protecting oneself from the dangerous effects of the sun is wise behaviour. The lesson is particularly focused on animals to introduce the theme of health protection in a way that arouses students' curiosity and interest.

LEARNING OBJECTIVES

- Animals naturally protect themselves from the dangerous effects of the sun
- No matter where or how we live, we are all concerned with the risks related to UV radiation

CONTENTS

HOW DO ANIMALS PROTECT THEMSELVES FROM THE UV RAYS?

When a dangerous situation is recognized as such, it is natural to adopt protective behaviours and take specific actions to remain safe. That is what animals do when the sun is dangerous. Nature itself has provided means and instincts to the animals that live in very sunny and hot environments to protect themselves from the dangerous UV rays* of the sun. These animals are said to be adapted to their natural environment, which can be sometimes a very tough one.

In very sunny and hot regions, particularly in the deserts or the savannahs, many animals sleep during the day when the sun's rays are the strongest. They are awake in the evening and at night when it is cooler and when no UV rays can reach them. These animals are said to be nocturnal. During the hottest part of the day, some of them stay deep underground in burrows or seek shade besides the trees and beneath the bushes.

There are also many animals living in sunny and hot environments that are active during the day (they are said to be diurnal) and have to find solutions to be protected from the sun. First, they spend most of the day in whatever shade they find. They also naturally develop safe behaviours and strategies: they avoid the peak hours of the sun, being active only in the early morning and late afternoon; they can also use natural sun block such as mud. Finally, animals' hairs, shells and feathers are often made sun protective.

Wild animals tend to seek shade when the sun is too strong and dangerous. However, it is our responsibility to protect from the sun the animals we take care of: pets and farm animals should not be left out in the sun in the middle of the day.

WE HAVE OUR OWN STRATEGIES

Human societies and cultures have also developed their own strategies for individuals to be protected from the negative effects of the sun. Lifestyles, habitats, clothes and other customs often take into account the necessity to avoid the sun's dangerous rays. This is particularly true in regions where the sun is the strongest. It is also the case when people have to spend a lot of time outside in the sun to work (in the fields or on boats for example).

Increased UV radiation has made the sun even more dangerous for us now. This means the good protective habits and means that already exist should be even more developed and inspire everyone.

SEE ACTIVITY 3

SEE ACTIVITIES 1 AND 2

ACTIVITIES

Adaptation: it's natural to protect oneself



1/ OBSERVE AND COMMENT ON ANIMALS' BEHAVIOURS

MAJOR AREAS: Environment, Health, Creativity

TIMING: 20mins

ACTIVITY OBJECTIVE: for students to relate their own knowledge of and experience with animals and sun protection

EQUIPMENT: notebooks or paper, pens

PROCEDURE:

- > **Ask the students:** How do animals behave in the heat of the day? How do they avoid the sun's rays? How do they protect themselves from the sun? Do they have natural protective means (like shells, feathers...)? How do they use their natural surroundings?
- > **Explain to the class:** animals have their own means to protect themselves from the sun. They avoid staying in the sun during the peak hours, they seek shade and some of them are only active during the night. Many animals have hairs, shells or feathers that protect them from UV radiation.
- > **Ask the students to design an animal** that protects itself from ozone depletion and harmful UV radiation using either shade or special features such as hairs, shells or feathers.



2/ THE STORY OF OZZY'S JOURNEY AROUND THE WORLD⁽⁶⁾

MAJOR AREAS: Environment, Geography, Communication

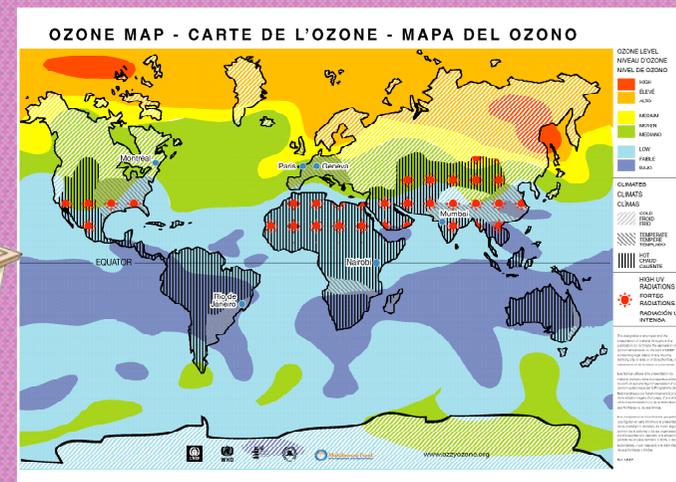
TIMING: 25mins

ACTIVITY OBJECTIVE: for students to read and comment on the story of Ozzy's journey, referring to the world map

EQUIPMENT: 'The Story of Ozzy's Journey' (see p. 46 of this teacher's guide), world map

PROCEDURE:

- > Give 'The Story of Ozzy's Journey' to one student and ask him/her to read loudly the title and the first sentence of the story. Then every student will read one sentence of the story and give the book to another student until the whole story has been read. For younger students, you could read the story.
- > Whenever the story mentions and illustrates animals, ask the student who is reading to show the illustration to the classroom.
- > Whenever the animals refer to specific regions, identify the regions with the students on the world map.
- > When the story has been fully read, ask the students whether there are some strategies that could be adopted. Does it raise ideas or remind them of some strategies they know?



3/ OUR OWN OZZY STORY

MAJOR AREAS: Environment, Social Life, Creativity

TIMING: 15mins

ACTIVITY OBJECTIVE: for students to tell the story of Ozzy coming to their region/town/village

EQUIPMENT: notebooks, pens

PROCEDURE:

- > **Ask the students:** what would Ozzy say about our region/town/village if he came to visit? What would he say about the sun here? What about people habits and behaviours in the sun? Would he say people are well protected from the sun's rays?
- > **Ask the students:** What do we do to protect ourselves from the sun? What do we use? How do we use our surroundings?



(6) Inspired by the San Diego State University Foundation. For related activities, you can check the sunwise Stampede website: <http://www.foundation.sdsu.edu/sunwisestampede/index.html>

High in the sky, some ozone molecules were having a rest from their hard day spent filtering UV rays. As the night was falling, they were looking down from above at the Earth, daydreaming. How they wish they could see the Earth closer ...it was such a beautiful planet from the sky! One of them, Ozzy Ozone, was listening to his friends trying to imagine what they would find there. He knew they would find his story amazing.

“Well, you’d be surprised to hear that I’ve been there once”, Ozzy declared.

They all stop talking in shock.

“You must be joking! How did you manage to make your way through the atmosphere?” asked one of the ozone molecules, dazzled.

“I must admit that wasn’t easy: I had to dodge chlorine and bromine atoms surrounding me, running after me while I was flying downwards as fast as I could”, replied Ozzy proudly.

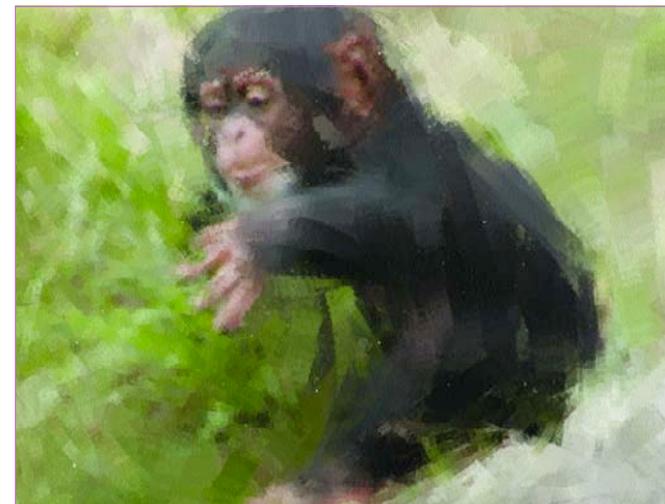
The other ozone molecules couldn’t believe their ears and they were longing to know more. “That sounds crazy, but ... please go on and tell us more!” begged Ozzy’s friends.

“I had just realised that I wasn’t being chased by the chlorine atoms anymore, when I suddenly hit something which stopped my fall. When I had recovered from my dizziness, I realized I was lying on a tree branch. Unfortunately it seemed the thud I had made by falling down had woken up my new neighbour.”

Ozzy’s audience was thrilled. They had all stopped breathing until one of them asked: “And what did it look like?!” Ozzy decided not to make them wait any longer.

“Well, almost its entire body was covered with black hair and it had very long arms and large ears. He introduced himself in a friendly way as a **CHIMPANZEE** and told me that he was from Congo in Africa. He was very surprised to hear that I was an ozone molecule and that my role was to protect the Earth from the dangerous radiation of the sun. But I was amazed when he taught me how **CHIMPANZEES** protect themselves from the harm caused by the sun. They simply live in the forests where the trees filter the sunbeams and they construct their nests in the trees out of leaves to sleep in at night or hide from the sun in the daytime. In fact, just like their cousins the **GORILLAS**, they avoid the peak hours of the sun and most of their activity is in the morning and late afternoon hours. Bright, isn’t it?

“I wanted to know more, so I visited many other African countries.



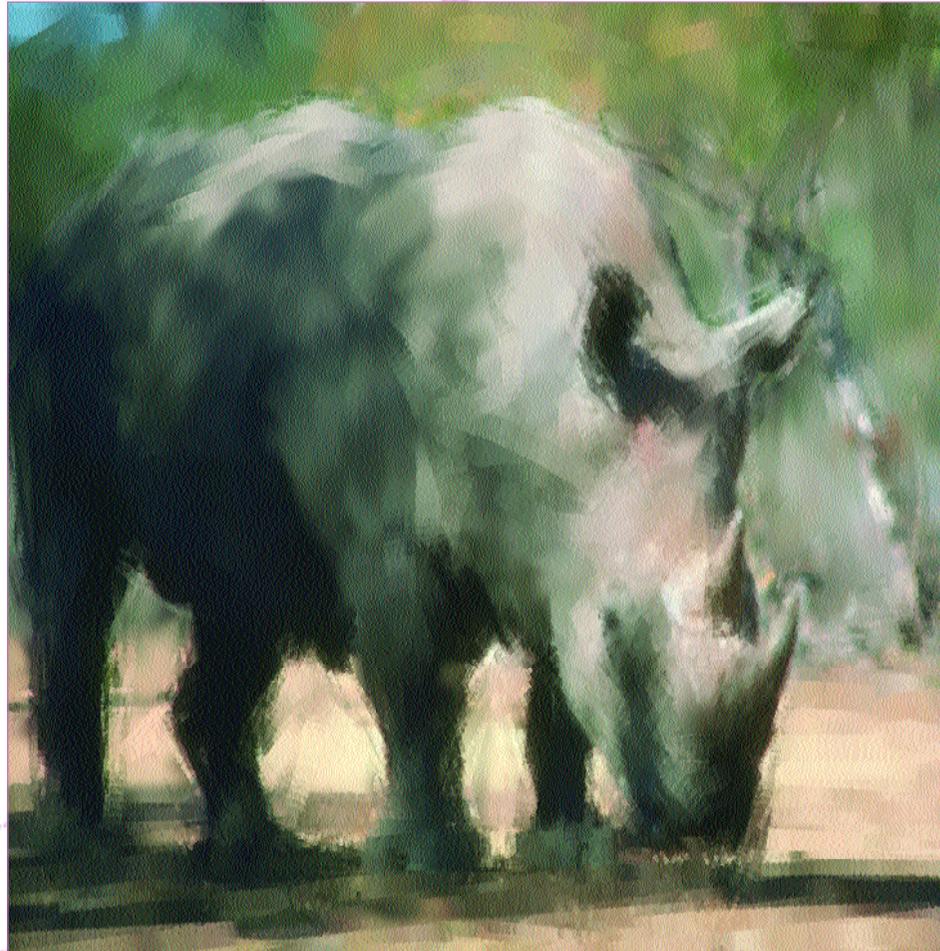
OF OZZY'S JOURNEY



In Kenya I met huge and heavy animals with tiny eyes and ears called **HIPPOS**: they spend most of the daytime in rivers, hiding under the water to feel lighter. When they don't hide under the water, they secrete oil that helps them keep their skin moist in the heat of the sun and protects it from sunburn. This acts like sunscreen to prevent their skin being sunburnt. How smart! Not so far from there, I saw **RHINOS** with their distinctive horn-shaped noses; they roll over in the mud to create a thick coating on their skin and it acts like a shield against the sun.

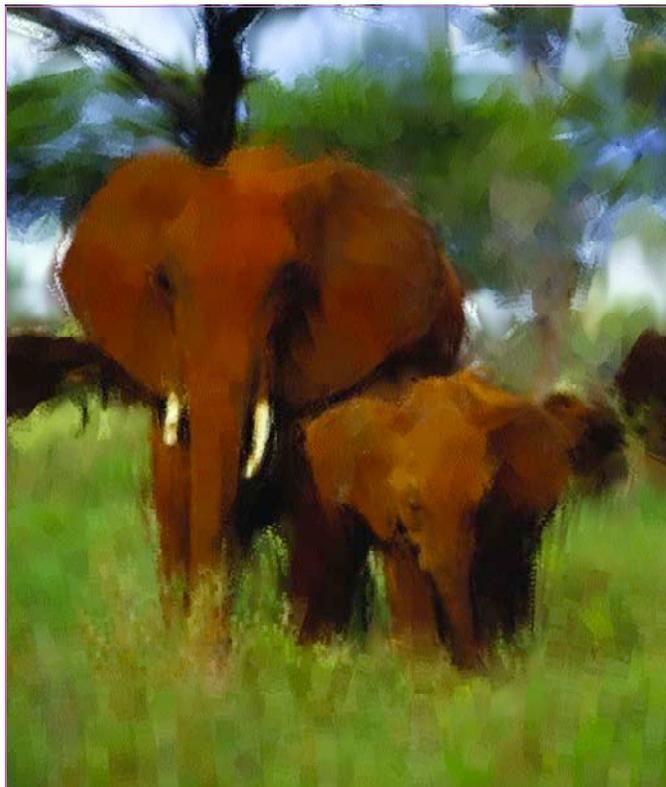
Well, I had already made many friends but my journey was not over..."

"So where did you go then?" asked Ozzy's friend, eyes wide open.



"I made my way south to the Kalahari Desert, South Africa, where the land is dry and full of stones and sand. I met there a strange type of **MONGOOSE** called a meerkat. Meerkats have greyish or brown fur and black rings around their eyes that look like natural sunglasses.

THE STORY



“After seeing these funny tiny animals, I crossed the Indian Ocean to reach India where I encountered **ELEPHANTS** with their big ears, tusks and trunks. They use dirt and hay as a natural sun block – they spread it on their backs to cover their skin. In the heat of the day, **ELEPHANTS** keep cool by snuffing up trunks full of water and spraying themselves. That’s why they usually live in forests with rivers nearby. I was extremely lucky to meet them.



“Then I headed south for Australia where I saw **KOALAS**, which look like little bears with big ears and strong claws so that they might clutch at trees. As nocturnal animals, they spend most of the day sleeping in eucalyptus trees, the leaves of which they use both as food and shelter from the sun.”

“That’s incredible! Have you travelled all around the Earth? Where did you go then?” asked Ozzy’s friends.

“I went north east to the Galapagos Islands on the west coast of South America, where I saw **TORTOISES** whose big shells protect them from the sun’s rays. They can even hide entirely within their



“By the time I got to Death Valley, California, North America, I had to spend the night there and that was perfect timing because in the daytime you can hardly see animals in that desert land which is dry, filled with sand, stones and scorched vegetation. I only met a very friendly bird called a **ROADRUNNER** that runs and hides in shady bushes, but reduces its activity by 50% during the heat of midday. Late afternoon as soon as we met, the **ROADRUNNER** challenged me for a race: he was the fastest bird I had ever seen! I had to lie down for a couple of hours after this...



OF OZZY'S JOURNEY



But at night, it was almost overcrowded! I met **RABBITS** that avoid staying under the sunlight too long by hiding in holes during the day.

“Then I crossed the Atlantic Ocean to reach France in Europe where I met **DUCKS** and **GEESE** living in a huge green park; though the temperature is not as high there as it is in the desert, the sunbeams may be harmful, especially between 10 am. and 4 pm in summer. And when they are, the **DUCKS** and **GEESE** dive in the ponds or lakes and when they get out of the water, they lay under shady trees.



“My last destination was the Arctic Pole where the climate and landscape are totally different: ice and snow as far as the eye can see, white everywhere. Nothing at first sight except **POLAR BEARS**. Their white fur absorbs sunlight and that’s how they get warm but their special eyelids look like some sunglasses that protect their eyes from the sun’s reflection on the white snow.”

“Wow! All the things you saw are really beautiful, aren’t they? And all these animals in the world have something in common: they have instincts of self-preservation, they adapt themselves to nature; they use the good effects of the sun and protect themselves from the bad ones, whether they’re gifted with their own special natural features or not. Everybody on Earth should also know about us and our work!”

Ozzy’s mind was filled with the most beautiful images of the world and he was happy that he had a chance to share these memories with his friends. He was so proud also that his mission was to protect life on Earth. Therefore he concluded:

“Well, I really like my job!”

Written by Fabienne Pierre

THEME 3 - WHAT CAN WE DO?

UNIT C

Many simple ways of being sun-safe

SUMMARY

This last lesson aims at providing students with concrete and practical solutions to protect themselves from the sun. The objective is to show students they can adapt themselves to increased UV radiation by being well protected. sun protection is simple and fun.

LEARNING OBJECTIVES

- sun protection rules
- Practical and health skills: how to use our shadow to know when the sun is dangerous, seek shade, how to make a hat...

SOLUTIONS TO BE WELL PROTECTED FROM UV RAYS

Health damage due to increased UV radiation* must be taken seriously. Fortunately, there are many simple ways of being efficiently protected from the harmful rays of the sun. The following rules are for everyone to remain healthy and safely enjoy the sun.

SEE ACTIVITY 1

Illustration 12: SUN PROTECTION RULES



CONTENTS

FIRST RULE:

Avoid the sun from 10am to 4pm, during the hours of the day with maximum UV rays. It is important not to stay with the sun overhead and to seek shade as often as possible so that we do not take the risk that our skin and eyes get burnt by the UV rays. Shade sources such as trees or umbrellas provide year-round protection and they can block up to 60% of the UV radiation. The size of our shadow tells us when it is dangerous to stay in the sun without protection and gives us a very easy rule to remember: no/short shadow, no sun. When the sun rises our shadow starts off taller than we are, then by the middle of the day it gets shorter than us and again taller than us at the end of the day. It means that the shorter our shadow is, the better it is to avoid the sun.

SEE ACTIVITY 2 AND 3

SECOND RULE:

Cover our skin as much as possible, so that UV rays simply do not reach our skin. This always means wearing protective clothes with long sleeved shirts, long pants, trousers or skirts and shoes every time we are in the sun and UV radiation is high.

THIRD RULE:

Wear a hat as much as possible. It is also important to pay special attention to the parts of our body that are particularly exposed to the sun's rays: that is to say our face, our eyes, our ears and the back of our neck. A hat with a wide brim offers good protection from UV rays.

SEE ACTIVITY 4

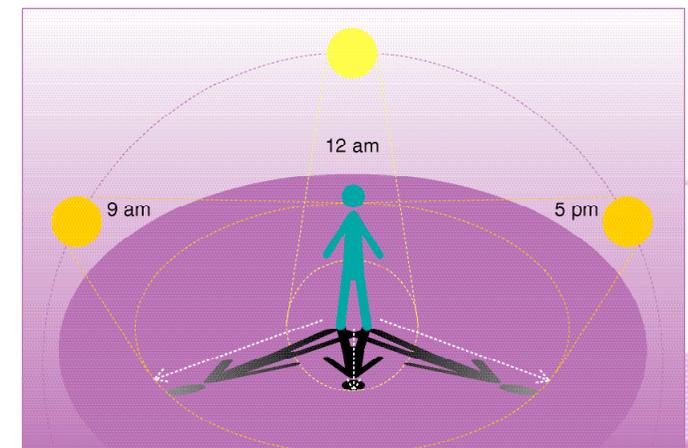
SUNGLASSES:

Sunglasses are also very efficient to protect the eyes from being damaged by UV rays and reduce the risk of eye cataracts*. Whenever it is possible, it is good to wear sunglasses in the sun.

SUNSCREEN:

Sunscreen can also be very efficient to protect the skin from UV rays (providing that the sun protection factor is high). sunscreen can be applied on all parts of the body that are not covered (face, hands, ankles, neck). Whenever it is possible, it is also good to use sunscreen in addition to other sun protection measures.

SHADOW INDICATOR



ACTIVITIES

Many simple ways of being sun-safe



1/ THE PROTECTION RULES

MAJOR AREAS: Health, Social Life

TIMING: 25mins

ACTIVITY OBJECTIVE: for students to talk about what can protect them from UV rays and learn about the sun protection rules

EQUIPMENT: Ozzy Calendar illustration 12

PROCEDURE:

- > **Ask the students:** what parts of your body are the most exposed to the sun? Why? What can you use to protect your face, your eyes, your arms, and your legs...?
- > **Explain to the class the sun protection rules:** seek shade, wear hats and protective clothes, whenever possible wear sunglasses and put some sunscreen on unprotected parts of your body.

2/ OUR SHADOW INDICATOR

MAJOR AREAS: Health, Science

TIMING: 15mins (X3)

ACTIVITY OBJECTIVE: for students to see that the size of their shadows changes throughout the day and tells them whether it is dangerous to stay in the sun. This activity is based on the same principle than activity 3 in introduction unit A.

EQUIPMENT: Ozzy Calendar illustration 12, chalk, sunny day

PROCEDURE:

- > **Explain to the class:** UV radiation is at its highest between 10 am and 4 pm. We can use our own shadow as an indicator of high UV radiation levels.
- > Take the students to the schoolyard or school's surroundings in the morning and divide them into teams.
- > Give each team some chalk.
- > Have one student from each team stand with the sun to their back.
- > Have the other students draw these students' shadows on the ground with chalk.
- > When tracing is complete for each team, ask the students: are the shadows shorter or taller than their owners?
- > Repeat the exercise around noon and then late afternoon to illustrate the rule: the shorter your shadow is, the more dangerous UV radiation.



3/ SEEK SHADE

MAJOR AREAS: Health, Science, Environment

TIMING: 40 mins

ACTIVITY OBJECTIVE: for students to identify the shaded areas around their school

EQUIPMENT: notebooks, pens, sunny day

PROCEDURE:

- > Take the students for a walk around the school and ask them to identify the sources of shade (trees, buildings).
- > Ask the students to map their school, the schoolyard or surroundings including the shaded sources and surfaces.

THE SUN PROTECTION RULES

- > Avoid staying in the sun without good protection during the peak hours from 10am to 4pm
- > Seek shade
- > Wear a hat and protective clothes
- > Wear sunglasses / put some sunscreen when possible

TEACHING TIPS: The students could also plant seeds of trees in the schoolyard to create a new source of shade for the future

ACTIVITIES

Many simple ways of being sun-safe

4/ THE MOST BEAUTIFUL HAT COMPETITION

MAJOR AREAS: Health, Creativity

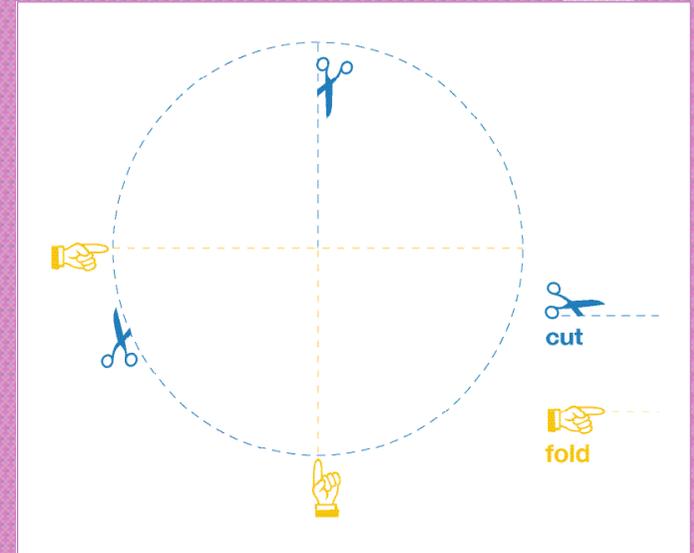
TIMING: 30mins

ACTIVITY OBJECTIVE: for students to make their protective hat and decorate it for a competition

EQUIPMENT: model for making a hat, large pieces of paper (A3 format), scissors, glue

PROCEDURE:

- > One day before, explain to the students that they are going to make a hat in class and there will be a competition for the most creative one. Ask them to bring some materials (flowers, straw, feathers, leaves, pearls, coloured pens...) to decorate their hat with.
- > Ask the students: what could be the requirements for a hat to be efficiently sun protective? To protect their face and their neck?
- > **To make a hat:**
 - > Give one large piece of paper per student.
 - > Ask the students to draw the biggest possible circle on their piece of paper showing them the model.
 - > Ask them to cut the circle out and then to fold it into four.
 - > Ask them to unfold it and to cut along one fold.
 - > Ask the students to decorate the circle with the materials they have brought, and to leave some blank space around the cut fold borders. Encourage them to be creative.
 - > Ask the students to overlap the cut edges to form a cone and glue into place.
- > When all the hats are ready, ask the students to show theirs to the classroom and to vote for the most creative one.



5/ ACTIVITY SHEET: DANGEROUS OR SAFE SITUATIONS?

MAJOR AREAS: Health, Social Life

TIMING: 20mins

ACTIVITY OBJECTIVE: to evaluate the students' understanding of UV radiation in concrete situations

EQUIPMENT: Evaluation panel p.53

PROCEDURE:

- > **Prepare copies of the evaluation panel (p.53) for the class and give them out to the students.**
- > For each situation represented on the evaluation panel, ask the students whether they think it is a safe or an unsafe situation. Ask the students to vote for "safe" then for "unsafe" by raising hands.
- > For each situation ask one student who gave the correct answer to explain to the others why the situation is safe or unsafe, then complete if necessary.



12:10 am



3:00 pm



11:00 am



4:00 pm



5:00 pm



9:00 am



ACTIVITIES

Many simple ways of being sun-safe

6/ 'WHO KNOWS?' CHALLENGE: SUN PROTECTION RULES

MAJOR AREAS: Health, Social Life

TIMING: 15mins

ACTIVITY OBJECTIVE: to sum up the key points of the lesson through the 'Who Knows?' Challenge

EQUIPMENT: 'Who Knows?' card on the sun protection rules – series 8

PROCEDURE:

- > Ask the students the questions on the 'Who Knows?' card on sun protection rules. There are three levels of questions: 1 (easy), 2 (intermediate), 3 (challenging). Every correct answer to easy questions brings one point, every correct answer to intermediate questions brings 2 points, every correct answer to challenging questions brings 3 points.
- > For each question, remind the students how many points a correct answer brings.
- > Once the students have given an answer (written or oral), provide the class with the answer mentioned on the 'Who Knows?' card and ask the students to write it in their notebooks.
- > Each student could count his/her own score according to the correct answers s/he has given.

> **Questions:**

1/ At what time of the day is UV radiation the most dangerous?

- From 8am to 10am
- From 10am to 4pm
- From 4pm to 8pm

> **Answer:** It is between 10am and 4pm that UV radiation is at its highest and is the most dangerous. It is very important to wear protective clothes and to seek shade to safely enjoy being out.

2/ Is UV radiation high or low when your shadow is shorter than you?

- High
- Low

> **Answer:** When our shadow is shorter than us it means that UV radiation is likely to be high and particularly dangerous. The smaller our shadow is, the more protection we need.

3/ What are the sun protection rules?

> **Answer:** Avoid staying in the sun without good protection during the peak hours from 10am to 4pm. Seek shade. Wear a hat and protective clothes. Wear sunglasses / put some sunscreen when possible.

4/ What is the best to protect us from UV rays?

- Caps
- Hats with a wide brim

> **Answer:** Caps do not offer protection as well as hats with wide brim do because they provide less shade to the head and neck.

5/ Do shade trees block 100% of UV rays?

- Yes
- No

> **Answer:** No. Shade trees do not block 100% of UV rays but only 60%. It is however a very good and easy way to be protected from UV radiation.

6/ What is the safest situation?

- Under a tree with a hat and protective clothes
- In the street in the sun with a short sleeved shirt
- On the beach with sunglasses

> **Answer:** The safest situation is the first one: under a tree with a hat and protective clothes provide a very efficient protection from UV radiation for the entire body. On the contrary, short sleeved shirts are not protective enough, wherever we are. sunglasses protect our eyes but on the beach, where UV radiation –reflected by sand and water– is particularly likely to be high, we need to seek shade and be fully protected with protective clothes and a hat.

7/ Some animals are active mostly during the night. During the day they sleep in shade, under the trees or the bushes. These animals are said to be:

- Nocturnal
- Diurnal

> **Answer:** These animals are "nocturnal". The word "diurnal" refers to animals that are active mostly during the day. Animals that are active during the day protect themselves from the sun: they seek shade, avoid the peak hours, some of them have hairs, shingles or feathers that protect them from UV rays.



LEVEL 1

LEVEL 2

LEVEL 3

PREVENTIVE AND PROTECTION MEASURES IN SIMPLE WORDS

WHAT WE CAN ALL DO!

PREVENTIVE MEASURES : PROTECT THE OZONE LAYER

The best way to prevent increased levels of UV radiation in the future is to protect the ozone layer. There are simple ways to participate in the protection of the ozone layer at an individual level:

BUY OZONE-FRIENDLY PRODUCTS:

Buy products that do not contain CFCs or other ODS as often as possible (refrigerator, air conditioning, sprays, fire extinguishers). Ozone-friendly products always have a specific label that makes them easily recognizable.

BE CAREFUL WITH PRODUCTS/APPLIANCES LIKELY TO CONTAIN ODS:

CFCs and other ODS can be found in a number of products/appliances. For example, refrigerators and air conditioners (in cars) can contain CFCs that are likely to be released into the atmosphere if not properly handled. If refrigerators or air conditioners are to be repaired or thrown away, it is important to remove carefully the CFCs. CFCs need to be stored or recycled, so that they are not released into the atmosphere and they cannot harm the ozone layer. Mechanics who repair this kind of appliances should be specifically certified to work with CFCs.

DO NOT USE PESTICIDES WITH METHYL-BROMIDE:

When they have to use pesticides, people who work in agricultural production should use some that do not contain methyl bromide, another ozone depleting substance.

INFORM:

Everyone can spread the message to his or her friends, family and community. It is important to explain what can be done to protect the ozone layer, our natural shield against UV rays.

PROTECTION MEASURES: BE PROTECTED FROM THE SUN

Over-exposure to the sun is dangerous for our health. Ozone layer depletion has made the sun even more dangerous. Being depleted, the ozone layer cannot play fully its protective role against the dangerous UV rays of the sun. There are simple measures to be well protected from these increased levels of UV radiation:

FIRST MEASURE:

Avoid the sun and seek shade during the hours of the day with maximum UV rays, that is to say from 10 am to 4 pm.

SECOND MEASURE:

Look at your shadow: the shorter your shadow is, the more dangerous UV radiation is.

THIRD MEASURE:

Cover your skin as much as possible, so that UV rays simply do not reach it. This always means wearing protective clothes with long sleeved shirts, long pants, trousers or skirts and shoes every time we are in the sun and UV radiation is high.

FOURTH MEASURE:

Wear a hat as much as possible. It is also important to pay special attention to the parts of your body that are particularly exposed to the sun's rays: that is to say your face, your eyes, your ears and the back of your neck. A hat with a wide brim offers good protection from UV rays.

SUNGLASSES:

Sunglasses are also very efficient to protect the eyes from being damaged by UV rays and reduce the risk of eye cataracts. Whenever it is possible, it is good to wear sunglasses in the sun.

SUNSCREEN:

Sunscreen can also be very efficient to protect the skin from UV rays (providing that the sun protection factor is high). sunscreen can be applied on all parts of the body that are not covered (hands, ankles, neck). Whenever it is possible, it is also good to use sunscreen in addition to other sun protection measures.



YOUR ACTION AT SCHOOL



This section presents ideas and procedures for setting up a local awareness and action project with students on ozone protection and sun-safe behaviours. This Ozone and Health Action Plan is aimed at encouraging students to demonstrate their understanding of the issues related to ozone layer depletion.

PLANNING

The planning phase contains three major aspects: defining objectives, research and fact-finding to know more about your own local situation as regards ozone layer depletion and sun protection, defining the accurate actions that can be taken at school.

STEP 1: WHAT IS YOUR OBJECTIVE?

Look at the information and activities from the previous sections. Decide what you need to tell people about ozone protection and sun-safe behaviours. This is your objective.

STEP 2: RESEARCH AND FACT-FINDING

It is always useful to find out what people already know to inform them in the best possible way. The objective is that people understand what you mean and see clearly how they can be involved. Finding out more about local situations will help develop the most efficient Ozone and Health Action Plan according to what the people need to be informed about.

- > What do people think and do?
 - > Find out what other people think and do. What do people know already about ozone protection and sun protection?
 - > You can do a survey among friends, school members, and families.
 - > Students could develop their own questions that are relevant to the population's living conditions and habits (climate, life-styles, etc.)
 - > What are the results of your survey?
- > What's the situation at a collective level?
 - > Carry out research among local authorities, local companies or non-governmental organisations to find out about these issues.
 - > Speak to policy makers and find local ideas to solve the ozone issue and encourage sun protection.

STEP 3: MAKE AN ACTION PLAN

The action plan should be a list of practical actions to be taken for the ozone layer protection and for sensitisation to sun-safe habits and behaviours.

ACTIONS

The development of a school/community policy and setting up of a school/community information campaign are two examples of actions that can be taken to meet these objectives. A lot of activities described in the teaching programme can be used here. In any case, the Ozone and Health Action Plan should be meant to implement both preventive and protection measures. While students should be taught about how to prevent ozone layer depletion, they should also learn how to protect themselves from increased UV radiation.

DEVELOPMENT OF A SCHOOL POLICY

- > An ozone-friendly policy:
 - > As often as possible avoid products, such as spray cans, that contain ozone depleting substances (spray cans, extinguishers, air conditioners, refrigerators). Always check the labels and choose ozone-friendly products.
 - > Handle products that contain ozone depleting substances with care and have them removed or repaired by mechanics who are certified to work with ODS.
- > A sun-safe policy
 - > Have outdoors activities organized outside the peak hours of 10 am to 4 pm or always seek shaded areas.
 - > As much as possible, wear protective clothing, hats and sunglasses. Students could make hats for school.
 - > Have shade structures around the school, plant shade trees.

AN INFORMATION CAMPAIGN

- > Make presentations: the students prepare a short talk which they can present to students in younger classes / parents about the ozone layer, its depletion and the risks of increased UV radiation. This short talk should focus on practical actions to be taken and behaviours to participate in ozone protection and to protect one's health. Students could prepare pictures to illustrate their talk.
- > A protection poster: students design a poster about sun protection and ozone depletion, labelled with good ozone-friendly practices and sun-safe behaviours, drawings, catchy sentences and insights.
- > A song for Ozzy: students choose a local song and write new lyrics about Ozzy Ozone and what can be done to protect him.
- > A sun-safe parade: students meet other school/community/family members to explain various ways to be protected from UV rays (the shadow rule, how to make a hat, planting trees...).

The Ozone and Health Action Plan can enter in the UNEP/Volvo Adventure Award, an initiative to reward practical actions taken by young children all around the world to solve environment problems locally. For more information, you can visit the website: <http://www.volvoadventure.org>

MORE ACTIONS

Your school can also participate in other UNEP Tunza activities for children and youth such as: the annual Children's Painting Competition, the children's "Plan for the Planet Campaign" and the International Conference for Children on the Environment.

THE INTERNATIONAL CHILDREN'S PAINTING COMPETITION

The International Children's Painting Competition on the Environment is held annually for children between the ages of 6 and 14 years. It is organized by the United Nations Environment Programme (UNEP), Japan-based Foundation for Global Peace and Environment (FGPE), Bayer AG and Nikon Corporation. Each Competition focuses on the theme selected for the following World Environment Day (5 June). The main winners are invited to the city where the celebrations of World Environment Day are held. The Competition has been held since 1990 and has received over 160,000 entries from children in over 100 countries. Its goal is to increase environmental awareness and actions among children, and to inspire them to participate in community environmental activities. Winning paintings have been used for posters including those of World Environment Day, calendars, postcards for worldwide distribution and publications as well as on the UNEP website.

PLANT FOR THE PLANET CAMPAIGN

The Plant for the Planet Campaign was launched by UNEP in February of 2003. The five-year Campaign aims to promote reforestation and inspire communities to embark on major forestation projects in their communities. The Campaign also seeks to develop a culture of planting and caring for trees, among children and in schools. Plant for the Planet mainly targets schools and children of 14 years and below and solicits the participation of other members of the community and the private sector to become involved in tree planting. The Campaign was initiated in Kenya, which continues to organize major tree planting events every year in April and in November. The Campaign aims to plant over five million trees globally by 2008.

TUNZA INTERNATIONAL CHILDREN'S CONFERENCE

The Tunza International Children's Conference is the largest United Nations event for children, enabling them to discuss and learn about their rights and responsibilities regarding the environment as well as meet children from other parts of the world. The Conference targets children between the ages of 10 and 14 who are nominated by their schools and/or community organizations. The Conference provides a unique opportunity for children to present their environmental projects, inspire each other with their active environmental work, become active environmental citizens and to contribute towards the future of the planet. Each Conference culminates in an environmental petition to world leaders and the United Nations and personal commitments which the children will pursue when they return home.

The International Children's Conference is held every two years; the first was held in 1995 in Eastbourne, England. Other conferences have been held in Canada, Kenya and USA. A Tunza Junior Board works with UNEP and the local organizing committee to ensure that the Conference reflects the needs of the children. The Board, elected every two years, consists of six representatives from UNEP regions: North America, Europe, Latin America and the Caribbean, Africa, West Asia, and Asia and the Pacific; and four members from the country hosting the Conference.

For more information, you can visit: www.unep.org/Tunza

e-mail : children.youth@unep.org

ATMOSPHERE

The Earth's atmosphere is the gaseous layer that surrounds the planet Earth. It contains about 4/5 nitrogen and 1/5 oxygen, with a few other gases including ozone. The atmosphere protects life on Earth and it moderates the temperature between day and night.

ATOM

An atom is the smallest quantity of an element. Everything around us is made up of atoms. Atoms join together to make molecules, and the molecules join together to make compounds in specific ways to make everything we can see (materials, objects, living beings).

CALCIUM

Calcium is a substance essential to our bones and teeth. Calcium is found in milk for example.

CARBON DIOXIDE (CO₂)

Carbon dioxide is a colourless gas that contains one carbon atom and two oxygen atoms bound together (therefore it is written CO₂). It is present in the atmosphere and plants take it from the air for their own growth. We also release out carbon dioxide while breathing out.

CARBOHYDRATES

Carbohydrates are essential to all living beings. Carbohydrate molecules contain carbon dioxide (CO₂) and hydrogen (H). Plants create carbohydrates molecules with carbon dioxide they take from the air and hydrogen they take from water. Plants make carbohydrates, a kind of sugar, to stimulate their own growth.

CATARACT

Cataract is a disease of the eye and, according to the World Health Organization, the leading cause of blindness in the world. Between 12 and 15 million people become blind from eye cataracts. Cataract causes a partial or total opacity of the lens of the eye. The lens is the transparent part of the eye that regulates the amount of light we need to see clearly. Exposure to UV radiation increases the risk of eye cataract.

CHLOROFLUOROCARBON (CFC)

Chlorofluorocarbons are chemicals that contain carbon, chlorine and fluorine. The abbreviation for chlorofluorocarbons is CFCs. CFCs are used inside freezers, refrigerators, spray cans and air conditioners. When released into the atmosphere, these chemicals cause ozone layer depletion.

EQUATOR

The equator is the imaginary line drawn around the planet at equal distance from the poles, dividing the North and South hemispheres. We can see the equator line on world maps.

GRAVITATION

Gravitation is the force of attraction that bodies exert on one another: for example, it is because the Sun exerts a force of attraction on the Earth that the Earth orbits around the Sun.

HALONS

Halons are chemicals that contain bromide, fluorine and carbon. Halons are used for fire extinguishers. As CFCs, halons are responsible for the depletion of the ozone layer. When released into the atmosphere, they become dangerous to ozone molecules.

HYDROGEN (H)

Hydrogen is the lightest and most abundant element in the universe. Water and most organic compounds contain hydrogen.

IMMUNE SYSTEM

The immune system is the natural capacity of our body to fight diseases -virus for example - and to recover from them when we are sick. Exposure to UV radiation can affect our immune system.

LENS

The lens is the transparent part of the eye that regulates the amount of light we need to see clearly.

MELANIN

Melanin is a black, dark-brown or reddish pigment present in the hair, skin and eyes. When exposed to the sun, our skin naturally produces melanin to protect itself from UV radiation. Everybody's skin contains melanin, but not the same amount: dark-skin contains more melanin than light skin. However, melanin does not protect efficiently against UV rays and everybody, regardless of skin types, needs additional protection.

MESOSPHERE

The mesosphere is the region in the atmosphere above the stratosphere. It begins at an altitude of 50 kilometres (30 miles) above ground and extends approximately 80 kilometres (48 miles) above the Earth.

METHYL BROMIDE

Methyl Bromide is a gas and a widely used chemical pesticide in agricultural production. It is mainly used to kill parasites, insects for example. This gas is destroying the ozone layer 50 times faster than CFCs and is also very toxic to humans and animals.

MOLECULE

Invisible to the eyes, molecules are the simplest units of any substance that can exist. A molecule consists of two or more atoms bound together. Everything is made of molecules.

OXYGEN (O₂)

Oxygen is a colourless and odourless gas found into the air. Oxygen is the gas we breathe and it is essential to all forms of life on Earth.

OZONE (O₃)

Ozone is a colourless gas. It is a form of oxygen. Ozone molecules are composed of three atoms of oxygen and are therefore written O₃. Ozone is found in high concentrations in the stratosphere (upper atmosphere) and forms the ozone layer that protects us from UV radiation.

OZONE DEPLETING SUBSTANCES (ODS)

Ozone Depleting Substances (ODS) are chemicals responsible for ozone layer depletion: these ozone depleting substances are mainly chlorofluorocarbons (CFCs), halons and methyl bromide.

OZONE LAYER

The ozone layer is a thin invisible shield made of ozone gas. It protects us from the dangerous UV rays of the sun. The ozone layer stands in the stratosphere (upper atmosphere), at an altitude of 16 to 50 kilometres (10 to 30 miles) above the Earth.

OZONE LAYER DEPLETION

A number of human activities release in the air some chemicals (ODS) that destroy ozone molecules in the upper atmosphere: while ozone molecules are destroyed in the upper atmosphere, the ozone layer gets thinner and thinner. This is ozone layer depletion. The consequence for us is an increased amount of damaging UV rays reaching the surface of the Earth.

PESTICIDES

Pesticides are chemicals used in agricultural production for killing pests, especially insects.

PHOTOSYNTHESIS

Photosynthesis is the chemical process by which plants use the energy from sunlight to turn carbon dioxide (from the air) and hydrogen (from water) into their own nutrient.

POLICY

A policy is a plan of action adopted by an individual, group of individuals or an institution.

PREMATURE AGING

Premature aging of the skin is the skin being abnormally wrinkled early in life because of overexposure to the sun.

SKIN CANCER

Skin cancer is a very serious skin disease that must be treated at early stage. It starts when the skin cells, confused, behave abnormally and begin growing and multiplying. Overexposure to the sun increases the risk of skin cancer. Skin cancer must be prevented by avoiding sun exposure.

SOLAR SYSTEM

The solar system contains the Sun at its centre and the planets held in its gravitational field. The planets of our solar system are Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, Neptune and Pluto.

SUN

The Sun is the star at the centre of our solar system around which 9 planets orbit, including the Earth. It is the source of life on Earth. The Sun emits energy, especially visible light. It also emits dangerous ultraviolet radiation that are partly absorbed by the ozone layer and that we need to be protected from.

SUNBURN

Sunburn is an inflammation of the skin caused by overexposure to the sun.

SUNTAN

suntan is a brownish colouring of the skin caused by the production of melanin within the skin on exposure to the sun.

STRATOSPHERE (UPPER ATMOSPHERE)

The stratosphere is the region of the Earth's atmosphere above the troposphere and below the mesosphere. It begins at an altitude of 16 kilometres (10 miles) above ground and extends approximately 50 kilometres (30 miles) above the Earth. In the stratosphere, ozone plays a positive role as it protects us from the dangerous UV rays.

TROPOSPHERE (LOWER ATMOSPHERE)

The troposphere is the lowest layer of the atmosphere, below the stratosphere, from the ground to an altitude of 13 kilometres (8 miles). The air we breathe is in the troposphere.

In the troposphere ozone plays a negative role and becomes a very harmful pollutant. Indeed, breathing ozone can cause health problems, like shortness of breath, lung diseases, eye irritation and asthma.

ULTRAVIOLET RADIATION (UV RADIATION)

Ultraviolet radiation is a harmful component of sunlight that we cannot see or feel. Ultraviolet radiation is dangerous for us because it damages our health by penetrating deep into our skin and eyes, and by weakening our immune system. There are three categories of UV rays: UV-A, UV-B and UV-C. UV-B are the most dangerous.

UV-A

UV-A rays represent approximately 90% of UV radiation reaching the Earth's surface because the ozone layer lets them through. They are the least strong UV rays, so they may be the least dangerous.

UV-B

UV-B rays represent approximately 10% of UV radiation reaching the Earth's surface. UV-B cause the most damage to human health. The ozone layer is supposed to prevent most of UV-B from reaching us but some can go through and do serious harm, especially now that the ozone layer is depleted. Ozone layer depletion causes a significant increase of UV-B radiation reaching the Earth, which is dangerous for us, but also for plants and animals.

UV-C

UV-C rays are all blocked by the ozone layer. UV-C rays are extremely strong and dangerous.

UV INDEX

The UV Index is a tool to describe the level of solar UV radiation at the Earth's surface. It is aimed at alerting people about the need to adopt sun protective measures. The UV Index uses a range of values from zero upward. The higher the value, the greater the amount of dangerous UV rays and the potential for damage to our health.

VITAMIN D

Vitamin D is an essential substance that helps our body use calcium, needed for bones and tooth to be strong.

MORE RESOURCES

On-line resources

PEDAGOGICAL TOOLS

UNITED NATIONS ENVIRONMENT PROGRAMME

UNEP OzonAction Programme

- > Ozzy Ozone Video:
<http://www.unep.fr/ozonaction/library/video/ozzy.html>
- > Ozzy Ozone Cartoon book: *Ozzy Ozone Defender of Our Planet*
http://www.unep.fr/ozonaction/library/mmc/lib_detail.asp?r=4310
- > Ozzy Ozone website: Kids' corner : www.ozzyozone.org

WORLD HEALTH ORGANIZATION

- > *Sun Protection and Schools, How to Make a Difference:*
<http://www.who.int/uv/publications/en/sunprotschools.pdf>
- > *Sun Protection, A Primary Teaching Resource:*
<http://www.who.int/uv/publications/en/primaryteach.pdf>
- > *Evaluating School Programmes To Promote sun Protection:*
<http://www.who.int/uv/publications/en/schoolprog.pdf>
- > *Global Solar UV Index. A Practical Guide:*
<http://www.who.int/uv/publications/en/GlobalUVI.pdf>

OTHERS

- > *Let's Play Safe in the Sun! Are You Sun Savvy?*, Environment Canada:
http://www.msc-smc.ec.gc.ca/education/uvindex/sssclub/play_safe_sun/play_safe_sun_e.pdf
- > *Mission: SunWise. Activity Book*, Environmental Protection Agency (USA):
http://www.epa.gov/sunwise/doc/mission_activity.pdf
- > *Sun Safety for Kids, The sunWise School Program*, Environmental Protection Agency (USA):
<http://www.epa.gov/sunwise/doc/brochure.pdf>
- > *The Sun Safety Activity Guide*, Environmental Health Centre, Division of the National Safety Council (USA):
<http://www.nsc.org/EHC/sunwise/activity.htm#pdf>
- > *The Sun, UV and You, A Guide to SunWise Behaviour*, Environmental Protection Agency (USA):
<http://www.epa.gov/sunwise/doc/sunuvu.pdf>
- > *The UV Index, Weather and You! Activity Information Guide*, Environment Canada: http://www.msc-smc.ec.gc.ca/education/uvindex/sssclub/wx-you/index_e.html

WEB SITES

- > United Nations Environment Programme :
<http://www.unep.org/>
- > Ozone Secretariat (secretariat for the Vienna Convention for the Protection of the Ozone Layer and the Montreal Protocol on Substances that Deplete the Ozone Layer)
Web site: <http://www.unep.ch/ozone/index.asp>
- > UNESCO: <http://portal.unesco.org/en>
- > World Health Organisation:
<http://www.who.int/en/>

Publications

PEDAGOGICAL TOOLS

- > *Educator's Kit on Ozone Layer Protection*, Centre for Environment Education & Ministry of Environment and Forests (Ozone Cell), India
- > *The Sun Can Be Harmful. Be Protected*, Ministry of Trade and Industry, National Ozone Office, Namibia
- > *Vivre avec le soleil – Education à la Santé, Guide de l'Enseignant*, La main à la pâte & Sécurité Solaire, Hatier, Paris, 2005

ordering

In case you would like to get additional copies of the Education Pack, please write to us OzonAction Branch, UNEP DTIE, Tour Mirabeau, 39-43 quai André Citroën, 75739 Paris Cedex 15, France or by email: ozonaction@unep.fr or by fax at: +33 1 44 37 14 74.

PARTNERS PRESENTATION

UNITED NATIONS EDUCATIONAL, SCIENTIFIC AND CULTURAL ORGANISATION (UNESCO)

ABOUT UNESCO

UNESCO was created in 1945 to contribute to peace and security by encouraging collaboration between countries through education, science, culture and communication.

ABOUT THE UN DECADE OF EDUCATION FOR SUSTAINABLE DEVELOPMENT

The United Nations Decade of Education for Sustainable Development (2005-2014) aims to integrate the values inherent in sustainable development into all aspects of learning to encourage changes in behaviour which will enable a more viable and fairer society for everyone.

During this decade, education for sustainable development will contribute to preparing citizens better prepared to face the challenges of the present and the future, and decision-makers who will act responsibly to create a viable world.

Five kinds of fundamental learning have been identified: learning to know, learning to do, learning to be, learning to live together, and learning to transform oneself and society.

ABOUT UNESCO ASSOCIATED SCHOOLS

Created in 1953, the UNESCO Associated Schools Project Network (ASPnet) is a worldwide network which in 2006 covers 176 countries and more than 7900 schools and colleges ranging from pre-school to secondary and teacher training institutions. ASPnet's aims are to promote UNESCO's ideal of peace and contribute to improving the quality of education.

UNESCO — the United Nations Educational, Scientific and Cultural Organization — was founded in 1945 with a mandate to contribute to peace through international cooperation within its fields of competence. The Associated Schools Project was launched as an educational pilot project based on pedagogical innovation and international cooperation. Today it is one of the largest school networks in the world working under the auspices of the United Nations towards international understanding.

WORLD HEALTH ORGANISATION (WHO)

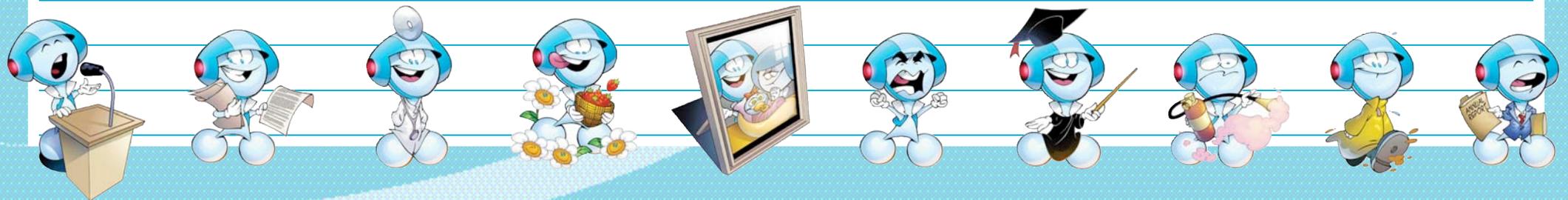
ABOUT WHO

The WHO was established in 1948 as the United Nations specialized agency for health. WHO's goal is the attainment by all peoples of the highest possible level of health, defined as a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity.

ABOUT WHO INTERSUN

The 1992 United Nations Conference on Environment and Development (UNCED) concluded that under Agenda 21 that there should be activities on the effects of UV radiation. In response, WHO in collaboration with other UN agencies and international partners set up INTERSUN, the Global UV project. INTERSUN aims at providing scientifically sound information on the health impact and environmental effects of UV exposure and at providing guidance about effective sun awareness programmes. The project encourages countries to take action to reduce UV-induced health risks.





Waza

www.unep.org

United Nations Environment Programme
P.O. Box 30552 Nairobi, Kenya
Tel.: ++254-(0)20-762 1234
Fax: ++254-(0)20-762 3927
E-mail: unepub@unep.org

