



THE OZONE SONG: EDUCATION PACK





WHAT THIS IS

This year marks the 30th anniversary of the Vienna Convention for the Protection of the Ozone Layer, an important milestone in the protection of the ozone layer. As part of the commemorative activities, the Ozone Secretariat is conducting the “Precious Ozone” digital campaign to celebrate the many successes achieved under the ozone protection regime over the past 30 years and highlight the importance of the ozone layer in protecting life on Earth from the harmful effects of UV radiation. As a result of concerted international efforts over the past three decades, the ozone layer is healing itself.

The Secretariat has worked with Carbon Visuals to create campaign products including a song and animation showing phytoplankton celebrating the healing of the ozone layer. The song has been commissioned from David Haines, the composer in residence at the MIT science festival since 2007. An animation has also been created so that children and adults around the world can join in the celebrations by learning and singing this song together.

Phytoplankton are the single cell marine plants that support marine life including in Antarctic coastal waters. They also moderate the global greenhouse effect by absorbing CO₂ from the atmosphere and releasing sulphur compounds to promote cloud formation. Depletion of stratospheric ozone over Antarctica during spring has increased solar ultraviolet radiation, causing a decline in phytoplankton population. But now that the ozone hole is healing the phytoplankton can celebrate with their friends in the microbial community by singing this catchy tune!

The song and animation film are released on International Day for the Preservation of the Ozone Layer, 16 September 2015. The theme for the day is, “30 years of healing the ozone together,” supported by the slogan, “Ozone: All there is between you and UV.”





A NOTE FROM THE COMPOSER

As an artist-in-residence in numerous schools and colleges both in the UK and USA, I have run many hundreds of collaborative songwriting sessions over the last 25 years. Since 2007, the greater part of my work of this nature has been in Cambridge, Massachusetts - as songwriter-in-residence with MIT's Science Festival. Over the last four or five years, nearly all of the songs have been based upon the students' science curriculum. I have co-written over two hundred science songs in this manner. In addition, I have written around one hundred science songs of my own, the great majority of which have been performed by both children and adults.

My experience has been that students - mainly ranging in age from four to thirteen - relish learning new vocabulary. The longer and more 'complicated' the word is the more they like it. This sometimes contradicts the expectations of their teachers, who are often pleasantly surprised at their students' enthusiasm to acquire words and concepts that they may have discounted as 'too difficult'.

This observation applies even to the many classes of Special English Immersion students I have worked with, where the children are generally new to the English language - having spoken it for anything between a few days to a few months. There is a special excitement in learning a word that you can be fairly sure your parents won't know.

When explaining new vocabulary, I nearly always try to give the children an idea not only of the meaning, but of the derivation of the word. This can result in beautiful moments of realisation when a children spots a link between their mother tongue and the English word and its origins. I have always found it helps me to remember the meaning of a term if I know its etymology - whether or not I'm familiar with the source language - and I'm convinced this is true for many others.

Nowadays I don't give a second thought to sprinkling supposedly 'complex' words in my science songs, whether independently- or collaboratively-written.

-DAVID HAINES





LYRICS

INTRO

Humans lie in the bright sunshine
But its rays aren't all of the friendly kind
UVA rays age the skin
UVB rays burn it but just in...
Case you thought it was all bad news
Ultraviolet light makes Vitamin D in him,
in her, in me, in you too

It isn't just humans that have to take care
Of ultraviolet traveling through space then air.
We phytoplankton living in the sea
For photosynthesis need UV
But too much bleaches out the green
And damages our DNA - yes, we've been...
Having a hard time for many years
But now let's celebrate, whoop and cheer

That big Antarctic Ozone Hole
Is healing now thanks to The Montreal Pro-tocol
Healing thanks to The Montreal Protocol
Healing thanks to The Protocol

REFRAIN

We're delightful fighting-fit, floating phyto-
plankton
Living in the big wet sea
Tiny mighty thronging thriving feisty phyto-
plankton
Dancing nature's choreography

VERSE 1 - CFCs

You naughty humans sprayed
Ozone-depleting stuff
Such as chlorofluorocarbons
Into the air, enough
To interfere with ozone
Which shields us all from UV rays
But international action

Has succeeded in reversing ozone's decay
Hooray! Hooray! Hooray!

REFRAIN

VERSE 2 - WHAT IS OZONE?

UV radiation splits
Molecules in stratosphere
O₂ (oxygen) divides
Quickly recombines, but hear!
One...
... in every half a million
ends up as ozone
O₃ the conquering hero
From UV shields our planetary home
His home, her home, my home, your home
Everybody's home

BRIDGE

We're Life's foundation food,
We phytoplankton
Down at the bottom of the food chain
And now the ozone hole is healing
We're feeling fitter, so once again, once again...

REFRAIN & CODA

We're delightful fighting-fit, floating phyto-
plankton
Living in the big wet sea
Tiny mighty thronging thriving feisty phyto-
plankton
Dancing nature's choreography
(it's twinkle toes zone)
Dancing nature's choreography
(thanks to ozone)
Dancing nature's choreography...





EXPLANATION OF TERMS

WHAT IS OZONE?

Ozone is gas. An ozone molecule is made up of three oxygen atoms and has the chemical symbol O_3 . It differs from breathable oxygen molecules which are only made up of two oxygen atoms and have the chemical symbol O_2 . Oxygen molecules and ozone molecules are known as oxygen allotropes, because they are different physical forms in which pure oxygen atoms can exist.

READ MORE: <http://ozonewatch.gsfc.nasa.gov/facts/ozone.html>

WHAT IS THE FUNCTION OF OZONE IN THE ATMOSPHERE?

Ozone is a gas which is predominantly found in the ozone layer. This layer protects us from the sun's harmful UV radiation by absorbing its energy through endothermic reactions.

READ MORE: <http://www.youtube.com/watch?v=WE3y1Gj2dec>

WHERE IS THE OZONE LAYER?

Ozone is densest at an altitude of about 26 km. About three quarters of the ozone lies in a band between 17 km and 35 km. This, roughly, is the 'ozone layer' - a fairly thick layer of the atmosphere where ozone is at its densest.

READ MORE: <http://ozone.unep.org/en/precious-ozone>

WHAT ARE CFCs AND WHAT DO THEY DO?

CFCs (chlorofluorocarbons) are man-made chemicals which are harmful to the ozone layer. They are very unreactive, which means that when they enter the atmosphere they can reach the ozone layer without decomposing. Here, UV light causes them to lose their chlorine atoms. The loose chlorine atoms react with ozone to split it up. One chlorine atom can destroy up to 100,000 ozone molecules before it is removed by some other reaction.

READ MORE: <http://www.ozone-hole.org.uk/05.php>

WHAT IS THE MONTREAL PROTOCOL?

When scientists in the '70s realised what harm was being done to the ozone layer by man-made chemicals such as CFCs, they urged nations to do something about it. The Montreal Protocol is an international treaty signed in 1987 and strengthened over the years by its parties, enabling the phase-out of 98% of ozone-depleting substances globally.

READ MORE: http://ozone.unep.org/en/montreal_protocol.php

WHAT ARE PHYTOPLANKTON?

Phytoplankton are microscopic plant-based organisms which drift in sea or freshwater and are the food for fish and other aquatic organisms. Phytoplankton rely on the sun to photosynthesise and therefore create food but too much UV radiation can be harmful to them.

READ MORE: <http://oceanservice.noaa.gov/facts/phyto.html>





WHAT EFFECT DO PHYTOPLANKTON HAVE ON OUR PLANET?

Marine phytoplankton produce a chemical called 'dimethyl sulphide' or DMS. DMS is oxidised in the air above the sea into several sulphur-containing compounds, some of which are able to act as cloud seeds. Cloud seeds are tiny solid particles on which water vapour in the atmosphere condenses to make water droplets. Water droplets suspended in the air in large groups form clouds. Therefore the more phytoplankton there are producing DMS, the more clouds form.

READ MORE: <http://www.whoi.edu/page.do?pid=110417&cid=40305&d=28372&article=45946&tid=5782>

WHAT DO CLOUDS DO TO THE EARTH?

Clouds (particularly low thick clouds) are able to reflect solar radiation back into space. Deserts and ice also reflect away solar radiation. This is known as the albedo effect and it helps to keep the planet cool.

READ MORE: <http://earthobservatory.nasa.gov/Features/Clouds/>





GLOSSARY

CFCS	CFCs (chlorofluorocarbons) are man-made chemicals which are useful as coolants in refrigerators and air-conditioning systems, among other things.
MONTREAL PROTOCOL	The Montreal Protocol on Substances that Deplete the Ozone Layer is an international treaty signed in 1987 on the phase-out of ozone-depleting substances.
OXYGEN (ATOM)	Oxygen is a chemical element with symbol O and atomic number 8.
OXYGEN (MOLECULE)	An oxygen molecule is made up of two oxygen atoms and has the molecular formula O ₂ . Oxygen is a colourless odourless gas.
OZONE	An ozone molecule is made up of three oxygen atoms and has the molecular formula O ₃ . Ozone is pale blue in colour and has a pungent smell.
OZONE HOLE	The ozone hole refers to an area of the ozone layer where there is much less ozone than normal. This 'hole' is found over Antarctica.
PHYTOPLANKTON	Phytoplankton are microscopic plant-based organisms which drift in sea or freshwater.
UVA	UVA is longwave ultraviolet light. It is emitted from the sun. This light can penetrate the ozone layer. UVA is what causes us to tan and our skin to age.
UVB	UVB is medium wave ultraviolet light. It is emitted from the sun. This light is mostly absorbed by the ozone layer. UVB is what causes sunburn.

