Environmental science

Transition pack

A warm welcome!

Environmental Science is likely a completely new subject to you – but there is no need to panic! Over the course of the two years, our job is to foster your curiosity and develop the skills you need to be a practicing scientist. This long journey all begins with you reading this pack, which is designed with a few key aims:

- Introduce the structure of the course
- Spark some curiosity and interest
- Bridge the gap with GCSE

The structure of the course

This course takes a multi-disciplinary approach to learning. We look at biology, chemistry, physics, geography and maths to study the ways the planet is changing (for better or worse) and how scientists – including you! - might be able to change the course of the future.

You will have five 100 minute lessons every fortnight with two teachers, each teaching a separate topic. In total there are seven topics. These are listed below:

1. Living environment
2. Physical environment
3. Energy resources
4. Pollution
5. Biological resources
6. Sustainability
7. Research methods

The A-level is assessed with two exams. Both are worth 50% of the overall grade and are 3 hours worth 120 marks. They both comprise multiple choice questions, short answers, and extended writing. The extended writing will include 25 mark essay questions, which might sound scary, but provide a perfect opportunity to write about all the knowledge you've gained. You can find more information about the course at the QR code to the right.

To be successful on this course, you will need to understand the vocabulary and terminology of an Environmental Scientist – many of which will be completely new to you. To best prepare you for this, this pack is designed to help introduce you to some of the background, terminology and questions you will face.

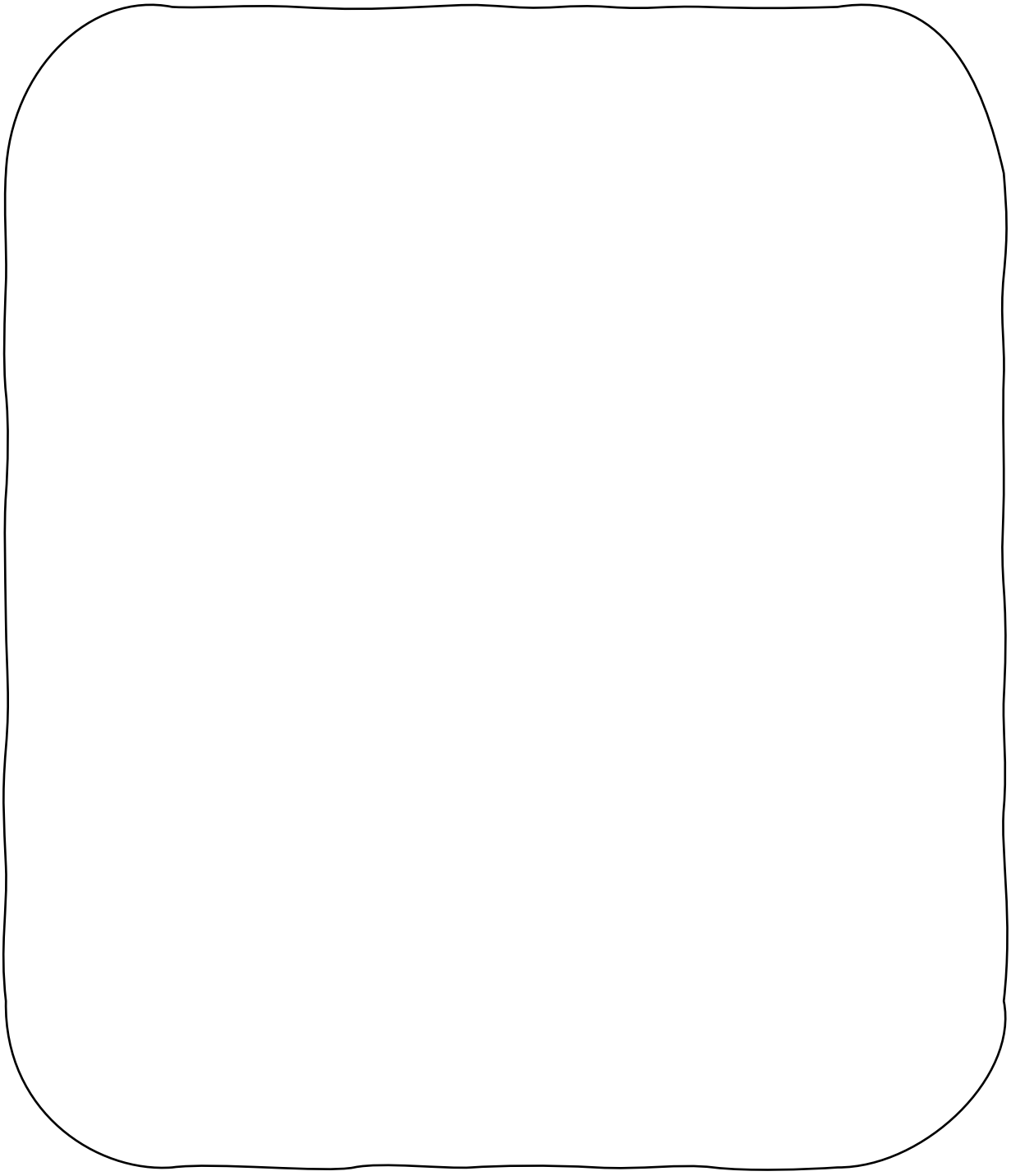
We therefore ask that you complete this booklet over the summer holiday to help introduce you to the course and give us an idea of how we can best support you. Remember that although we would expect you to complete the work that follows, it is definitely **not** intended as a test. So relax, enjoy and try your best.

A little about you?

It is always helpful for a teacher to know a little bit about the students in front of them. In the space below, tell us a little bit about yourself. This will help us avoid those awkward icebreaker moments in the first lesson! You might want to include some of the following:

- Why did you choose to study environmental science?
- Do you have any particular plans for after Sixth Form – gap year, university, career?
- Is there any part of science that you really enjoy?
- Is there anything that you are kind of dreading?
- Bonus: what's your favourite animal?

There is no right or wrong answer, so just write whatever feels right.



Environmental science is a relevant course to the world we live in. If you keep your eyes peeled and watch the news, you will find that it really is everywhere. Every political party makes a pledge about fossil fuels or green energy, nature documentaries are all over TV, pandemics and natural disasters are a staple part of film. Below is a short list of some videos and books that you might find interesting and will provide a good background to some of the content that we cover in the course.

Videos

As this is a written document, I have provided a title to the lectures that can be found on YouTube/google as opposed to writing a long and complex hyperlink that you can't click.

The New Era of Environmental Science – Milton Muldrow – TEDxDover
Dr. Muldrow discusses evolution of environmental science from his perspective as a researcher and professor.

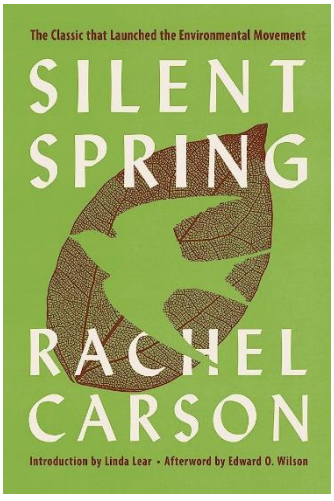
Beyond the science: Environmental Problems…Cultural solutions
Paul Doss discussed the pressing threats to our planet and looks at how science won't be the solution – but cultural changes across society.

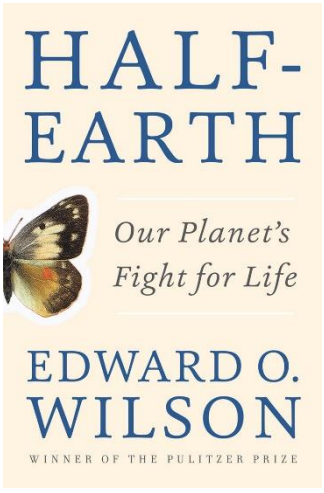
Mass extinctions and the future of life on Earth – Michael Benton – TedxThessaloniki
Michael Benton is an expert on the Permo-Triassic extinction and turnsh is attention here to if we are really on the brink of a new mass extinction.

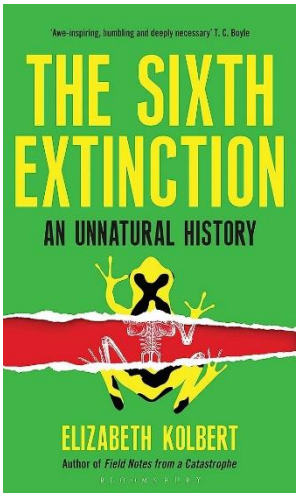
Books

As Environmental Science is a multi-disciplinary subject, almost any book on science or geography can be relevant, but that made for quite the big list. Instead, I have bullet pointed some books below that you may find interesting.

- The Diversity of Life by Edward O. Wilson
- Half-Earth: Our Planet's Fight for Life, by Edward O. Wilson
- The Sixth Extinction: An Unnatural History, by Elizabeth Kolbert
- Gaia: A New Look at Life on Earth, by James Lovelock
- Silent Spring, by Rachel Carson
- The Ecology Book: big ideas simply explained, by Tony Juniper
- Statistics without Tears: An Introduction for Non-Mathematicians, by Rowntree, D (2018)
- Small is Beautiful, by E. F. Schumacher (1973/1993).
- Sustainability: A History, by Jeremy L. Caradonna (2016)







What follows are tasks to complete that will help with the transition to A-level. This starts with exam-type questions. The questions you need to answer are always in a box. It's helpful if you can try to answer all of them – even if you're unsure.

Practical activities

Link each term on the left to the correct definition on the right.

Hypothesis	The maximum and minimum values of the independent or dependent variable
Dependent variable	A variable that is kept constant during an experiment
Independent variable	The quantity between readings, eg a set of 11 readings equally spaced over a distance of 1 metre would give an interval of 10 centimetres
Control variable	A proposal intended to explain certain facts or observations
Range	A variable that is measured as the outcome of an experiment
Interval	A variable selected by the investigator and whose values are changed during the investigation

Every measurement has a size (e.g. 2.7) and a unit (e.g. metres or kilograms). Sometimes, there are different units available for the same type of measurement. For example, milligram, gram, kilogram and tonne are all units used for mass. There is a standard system of units, called the SI units, which are used for most scientific purposes. These units have all been defined by experiment so that the size of, say, a metre in the UK is the same as a metre in China. There are seven SI base units, which are given in the table.

Physical quantity	Unit	Abbreviation
Mass	kilogram	kg
Length	metre	m
Time	second	s
Electric current	ampere	A
Temperature	kelvin	K
Amount of substance	mole	mol
luminous intensity	candela	cd

What would be the most appropriate unit to use for the following measurements?

1. The length of a leaf
2. The distance that a migratory bird travels each year
3. The diameter of a smoke particle
4. The mass of a woodlouse
5. The volume of the trunk of a large tree
6. The flow volume of a river

1.

2.

3.

4.

5.

6.

The practical skills you learnt at GCSE will be further developed through the fieldwork and practicals you undertake at A-level. Your teacher will explain in more detail the requirements for fieldwork, practical work, and the research methods. What follows are some example practicals as well as some questions about them. Once again, the questions to answer appear in a black box.

Organisms have adaptations that enable them to survive in the conditions in which they normally live.

Students wanted to investigate if the distribution of invertebrates in a habitat depends on the intensity of light.

Equipment:

- 20 Woodlice
- Choice chamber with four sectors and a transparent lid
- Bench lamp
- Translucent material, eg tracing paper (to vary light intensity)
- Stop clock

Method:

1. Place the choice chamber on the bench.
2. Cover the sectors with different numbers of layers of translucent material. Leave one sector with no cover.
3. Turn on the bench lamp so that it shines from directly above the choice chamber.
4. Put 20 woodlice into the centre of the choice chamber.
5. Immediately start a stop clock.
6. Leave the apparatus for 2 minutes.
7. Record the number of woodlice in each sector of the chamber.

1. Write a hypothesis for this investigation.

2. What do you predict will be the result of this investigation?

3. What are the independent, dependent and control variables in this investigation?

4. What is the difference between a repeatable measurement and a reproducible measurement?

1.

2.

3.

4.

GCSE Recap - Biology

What follows are GCSE questions that are also relevant to the A-level. The questions all appear on one page, but the following page is blank for your answers.

Factors affecting the rate of photosynthesis

1. Name **three** limiting factors of photosynthesis.
2. CO_2 can be added to the air in a greenhouse where tomatoes are growing. This increases the rate of photosynthesis.

   Suggest why increasing CO_2 levels to very high concentrations will no longer increase the rate photosynthesis.
3. Describe how global warming may affect the rate of photosynthesis and how this in turn by affect the greenhouse effect.

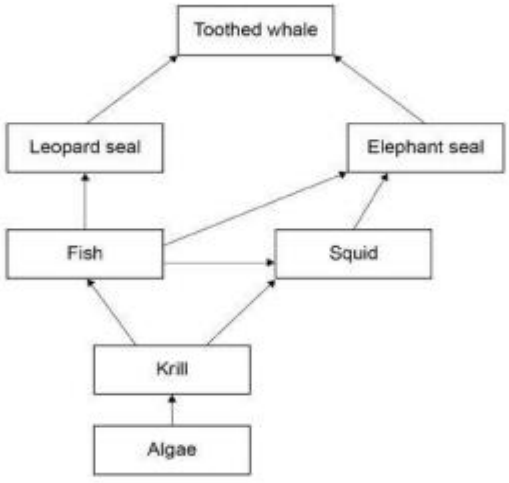
Factors affecting the rate of transpiration

4. Why do plants transpire?
5. Explain how the abiotic factors temperature, humidity and air flow affect the rate of transpiration in plants.

Selective breeding

6. State **two** characteristics that may be useful to select when breeding plants or animals for agriculture.
7. Selective breeding can reduce the gene pool. Describe **two** problems that may arise as a result of this reduction.

The diagram below shows a food web.



8. What term is used to describe all the organisms living together in an ecosystem?
9. What term is given to the place a particular species lives in?
10. What do we mean by the term population?
11. What term is used to describe the algae in this food web?
12. Toothed whales will compete with each other for food. What else might toothed whales compete for?
13. These organisms live in the ocean.

    Name **two abiotic** factors and **two biotic** factors that could affect these organisms.

Your answers here

GCSE Recap -Chemistry

What follows are GCSE questions that are also relevant to the A-level.

Acids and alkalis

1. Cross through the bold words in the sentence below that are incorrect to produce a correct statement about pH.

   The lower the pH the **lower/ higher** the content of H^+ ions and so the more **acidic / alkaline** the solution is.

2. For every decrease of 1 on the pH scale, the concentration of H^+ ions increases by a factor of 10.

   For example, an acid of pH 4 has 10 times the concentration of H^+ ions than that of an acid of pH 5.

   The pH of two soil samples was analysed.

   Soil A = pH 4
   Soil B = pH 7

   By what factor is the concentration of H^+ ions greater in soil A than soil B?

Evolution of the atmosphere

3. Complete the table below to show the Earth's atmosphere as it is today.

Gas	% volume
Nitrogen	
Oxygen	
Carbon dioxide	

   The Earth's early atmosphere had virtually no oxygen and much higher concentrations of carbon dioxide.

4. Describe **one physical** process that led to the reduction in the concentration of CO_2 in Earth's early atmosphere.

5. State the name of **one biological** process that led to the reduction of CO_2 and the increase in O_2 in the Earth's atmosphere from ~2.7 billion years onwards.

Your answers here:

GCSE Recap -Physics

What follows are GCSE questions that are also relevant to the A-level. As with the biology questions, the questions all appear on one page and there is space for your answers on the next.

Energy stores and transfers

Thermal insulation can be used to reduce rate of energy transfer.

Students investigated how effective three different thermal insulating materials were in keeping a container of water hot.

The students:

- wrapped the three different insulating materials around three containers
- added hot water to each container
- measured the temperature of the water in each container
- left the containers for 5 minutes and then measured the temperature again.

1. Identify the independent and dependent variable in this experiment.

2. Suggest three variables that should have been controlled.

3. Suggest how the experiment could be improved.

Energy efficiency

4. The more energy efficient something is, the less energy is wasted.

   What is the equation to calculate energy efficiency?

5. Energy efficiency is important in environmental science. For example, improvements in efficiency means less energy is wasted and so less fossil fuel needs to be combusted, meaning fewer greenhouse emissions.

   An electric fan is supplied with 1500 kJ of energy. 500 kJ is wasted as thermal energy.

   Calculate the % energy efficiency of the electric fan.

6. Tick the box to identify if the energy resources are renewable or non-renewable.

Energy resource	Renewable	Non-renewable
Coal		
Wind		
Gas		
Geothermal		
Solar		
Nuclear		
Wave		
Hydroelectric		
Oil		
Biofuel		
Tidal		

Your answers here:

Extended answers

Environmental science tackles big questions and so sometimes requires big answers. This means you may need to write short essays. What follows is a question that we hope will interest you and give you a chance to practice your essay writing skills. So here goes…

Should we conserve the Giant Panda or is it all a waste of resources?

The QR code below links to an article from the Guardian called ‘should Pandas be left to face extinction?’ and represents a good starting point for the question. Your job is to read around, form your own opinion based upon your research and then write a **500 word** response. This could be written (I’ve left a blank sheet for you) or typed – the choice is yours.

Should we conserve the Giant Panda or is it all a waste of resources?