Lesson 7 C9.7 – Global Climate Change

Connection

Q1. What is the definition of a pollutant?

Q2. What is deforestation doing to contribute to carbon dioxide levels?

Q3. What could be done as a solution to lessen the effects of deforestation?

Activation

LI: Describe how emissions of greenhouse gases could theoretically be reduced.

1. https://www.youtube.com/watch?v=1gFRHVYjsP0
2. Make a note of the title and the LI
3. Read pages 306-307
4. List three contributing factors to climate change

Demonstration

Attempt questions 1-5
In 15 mins answer as many questions as you can.
Self mark the questions you have done making any necessary corrections in blue pen

Challenge yourself to answer as many as you can:
Green questions to GCSE Level 3
Blue questions to GCSE Level 6
Purple questions to GCSE Level 9

Consolidation

Complete and self assess the relevant past paper question for this topic - From the C9 DIP file

Extension

Make a note of one thing you think you understand well and one thing that you would like to ask your teacher

Answers: C9.7 – Global climate change

Connection

1 substances that can cause damage to the environment
2 Increasing CO2 levels
3 plant more trees in urban areas

Demonstration

1 Burning fossil fuels. deforestation, increased agriculture and decomposition of rubbish.
2 Decrease in crop yields / increase in desertification / flooding / sea level rising / coastal erosion / glaciers melting / changing weather patterns such as severe storms etc.
3 Weather patterns are changes in the weather that follow cycles. Climate change is a long term change in global climate that may have a big effect on weather patterns.
4 They are a reserve of fresh water. Without this fresh water, animal, plant and human life would be in jeopardy. Also, if they melt, sea levels will rise and land will be flooded.
5 Temperature stress: Global warming is increasing Earth's average temperature. This is causing problems for people in the Arctic where glaciers are melting. Some areas will become much drier (desertification) as weather patterns change.
Water stress: Global warming will cause glaciers, which are a source of fresh water, to melt. Along with changes in rainfall patterns, this will limit the availability of fresh water.
Food production: As temperatures rise and weather patterns change (such as rainfall patterns), the capacity to grow crops may decrease.
Distribution of wildlife: As weather patterns and plant distribution change, animals will inevitably be affected. Species may die out or change their migration patterns.

Lesson 8: C9.8 – Carbon Footprint and its Reduction

Connection

Q1. State contributing factor to climate change

Q2. Give one way you could reduce the rate of climate change

Q3. Name a household item you recycle.

Activation

LI: Explain why emissions of greenhouse gases are difficult to reduce in practice.

1. https://www.youtube.com/watch?v=8q7_aV8eLUE
2. Make a note of the title and the LI
3. Read pages 308-309
4. Define 'Carbon Footprint'

Demonstration

Attempt questions 1-6
In 15 mins answer as many questions as you can.
Self mark the questions you have done making any necessary corrections in blue pen

Challenge yourself to answer as many as you can:
Green questions to GCSE Level 3
Blue questions to GCSE Level 6
Purple questions to GCSE Level 9

Consolidation

Complete and self assess the relevant past paper question for this topic - From the C9 DIP file

Extension

Make a note of one thing you think you understand well and one thing that you would like to ask your teacher

Answers: C9.8 – Carbon Footprint and its Reduction

Connection

1 Cars, Deforestation, Burning Fossil Fuels etc.
2 Walk to school, Turn electric sockets off after use etc.
3 Glass, Paper, Card

Demonstration

1 Energy is used to produce the game (offices for staff, use of computers etc.), to advertise it, to download it and/or to manufacture it. Energy is required to play it in the form of electricity for a PC, laptop, tablet or game console. All of these cause greenhouse gases to be emitted (assuming the power doesn't come from renewable energy such as solar power).

2 The majority of experts believe that global warming is a reality and the best response is to reduce it. To limit and reduce the impact of global warming, carbon footprints have to be reduced. This will limit the emission of greenhouse gases.

3 It takes energy to make solar panels so greenhouse gas emissions inevitably occur. However, once in operation, they convert sunlight into heat/electrical energy without any carbon dioxide emissions.This can then replace power stations which use fossil fuels to generate electricity, thus reducing carbon dioxide emissions.

4 Manufacturing solar panels is likely to produce greenhouse gas emissions so they have a carbon footprint. However, over the long lifetime that solar panels are used, they convert sunlight into heat/electrical energy without any carbon dioxide emissions. So when operating, they have no carbon footprint. There may be a carbon footprint when they come to the end of their life and are disposed of.

5 Cavity wall insulation: Slows heat loss through the walls so less energy used.
Double glazing: Slows heat loss through glass so less energy used.
Hot water tank with jacket on: Slows energy loss from hot water so less energy used.
Loft insulation: Slows heat loss through the roof so less energy used.
Low energy light bulbs: These consume less power than conventional light bulbs so are energy efficient.
Solar panels: These generate energy/electricity without consuming non-renewable fossil fuels and without producing greenhouse gases. They are more efficient at producing energy than conventional fossil fuel power generation.
Thermostat set low: This reduces the energy consumed. It uses the energy more efficiently than it would otherwise be if the thermostat was higher.
Appliances switched off: This prevents power consumption when on standby and therefore uses the energy more efficiently.

6 During their lifetime, trees and plants take in carbon dioxide during photosynthesis. Also, they trap the carbon dioxide by storing it as carbon in organic molecules. So they reduce the carbon footprint by reducing atmospheric carbon dioxide.

Lesson 9: C9.9 – Limitations on Carbon Footprint Reduction

Connection

Q1. What is carbon footprint?

Q2. How are solar panels beneficial to reducing Carbon Emissions?

Q3. What is the problem with having solar panels as the sole provider for electricity in the UK?

Activation

LI: Give reasons why actions to reduce the level of carbon dioxide and methane may be limited

https://www.youtube.com/watch?v=4RQv9VDgQq0

1. Make a note of the title and the LI
2. Read pages 310-311
3. Define ‘ Particulates'

Demonstration

Attempt questions 1-5
In 15 mins answer as many questions as you can.
Self mark the questions you have done making any necessary corrections in blue pen

Challenge yourself to answer as many as you can:
Green questions to GCSE Level 3
Blue questions to GCSE Level 6
Purple questions to GCSE Level 9

Consolidation

Complete and self assess the relevant past paper question for this topic - From the C9 DIP file

Extension

Make a note of one thing you think you understand well and one thing that you would like to ask your teacher

Answers: C9.9 – Limitations on Carbon Footprint

Connection

1 the total amount of carbon dioxide and other greenhouse gases emitted over the full life cycle of a product, service or event.

2 Less use of fossil fuels to provide electricity for the home
3 Not enough sunshine to cope with demand of electricity

Demonstration

1 An increase in population means that additional methane is generated because of: • More livestock farming to feed an increasing population. • More deforestation (for wood, grazing land etc.). • More rice grown to feed an increasing population. • More rubbish generated.

2 • Drive less. • Turn down thermostat for heating. • Install solar panels. • Walk/cycle more or use public transport. • Plant a tree. • Use local food. • Recycle / reuse.

3 To improve public information about global warming and carbon footprints: • Present the information and evidence more clearly. • Limit the use of technical language. • Highlight the fact that these issues are complex. • Make the point that "do nothing" is not an option. • Raise awareness of global warming and carbon footprint reduction. • Make these issues part of the national curriculum. • Avoid the use of sound bites and overly simplified science. • Encourage people to find out more about these issues.

4 The information may be biased because:
• There are companies who benefit from selling fossil fuels. They may promote arguments that fossil fuels have a limited effect on global warming.
• There is disagreement about how to manage the economic impact.
• Some companies may benefit from carbon trading.
• Politicians may not fully understand the complexities of the science behind the arguments.
• There is disagreement about the science behind global warming.

5 The sports stadium may reduce emissions by generating "green" electricity. For instance by using solar and wind turbines. However, if the CO_2 emissions of thousands of spectators driving to and from the stadium, eating cooked food etc. is taken into account, the stadium has a very large carbon footprint. The stadium might say that it is the spectators that are responsible for their greenhouse gas emissions. Therefore, there would be a disagreement over the ownership of the carbon footprint.

Lesson 10: C9.10 – Atmospheric Pollutants from Fossil Fuels

Connection

Q1. What is the relationship between population growth and carbon footprint

Q2. What is a particulate?

Q3. Name three activities that uses the burning of fossil fuels.

Activation

LI: Use a fuel's composition, and the condition in which it is used, to predict which pollutants it will release.

https://www.youtube.com/watch?v=ivdhpdqCQAA

1. Make a note of the title and the LI
2. Read pages 312-313
3. Define 'Hydrocarbon'

Demonstration

Attempt questions 1-8
In 15 mins answer as many questions as you can.
Self mark the questions you have done making any necessary corrections in blue pen

Challenge yourself to answer as many as you can:
Green questions to GCSE Level 3
Blue questions to GCSE Level 6
Purple questions to GCSE Level 9

Consolidation

Complete and self assess the relevant past paper question for this topic - From the C9 DIP file

Extension

Make a note of one thing you think you understand well and one thing that you would like to ask your teacher

Answers: C9.10 – Atmospheric Pollutants from Fossil Fuels

Connection

1 Higher Population larger carbon footprint
2 small particles in the air often caused by burning fuels
3 Flying, Driving, Cooking etc.

Demonstration

1 Sulfur dioxide / Nitrogen oxides / Carbon monoxide / Unburned hydrocarbons / Soot.
2 Insufficient oxygen to allow the fuel to react completely with oxygen. Instead of carbon dioxide, carbon monoxide (and carbon) are produced.
3 Carbon monoxide: Converted to carbon dioxide in the catalytic converter in a vehicle. Sulfur dioxide: Reacts with limestone (calcium carbonate) in power stations / removed from coal and petroleum products by chemical or other means. Oxides of nitrogen: Converted to nitrogen in the catalytic converter in a vehicle. Unburnt hydrocarbons: Converted to carbon dioxide and water in the catalytic converter in a vehicle. Soot: Trapped by filter in diesel cars.
4 Insufficient oxygen leads to incomplete oxidation of carbon in fuel.
5 $N_2 + O_2 \rightarrow 2NO$
6 Soot, tobacco smoke and smog.
7 Particles which are less than 10 micrometers can penetrate the lungs. Particles which are less than 2.5 micrometers can penetrate the small sacs in the lungs called alveoli. Particulate contaminants such as soot are produced during incomplete combustion. Diesel cars produce a lot of particulate contaminants. Soot particles have an average diameter well below 2.5 micrometers and can potentially cause damage to the lungs. Pollution from cars causes smog. Many of the particles in smog are below 2.5 micrometers and can also potentially damage lungs.
8 Use a filter to trap particulates in the exhaust. Burn the particulates after they leave the engine.

Lesson 11: C9.11 – Properties and effects of Atmospheric Pollutants

Connection

Q1. What is a pollutant?

Q2. What is a particulate?

Q3. What is pollution?

Activation

LI: Explain the environmental implications of air pollution and evaluate its role in damaging human health.

https://www.youtube.com/watch?v=2ri95j0cShg

1. Make a note of the title and the LI
2. Define key words
3. Read pages 314-315

Demonstration

Attempt questions 1-6
In 15 mins answer as many questions as you can.
Self mark the questions you have done making any necessary corrections in blue pen

Challenge yourself to answer as many as you can:
Green questions to GCSE Level 3
Blue questions to GCSE Level 6
Purple questions to GCSE Level 9

Consolidation

Complete and self assess the relevant past paper question for this topic - From the C9 DIP file

Extension

Make a note of one thing you think you understand well and one thing that you would like to ask your teacher

Answers: C9.11 – Properties and effects of Atmospheric Pollutants

Connection

1 substances that can cause damage to the environment
2 small particles in the air often caused by burning fuels
3 contamination of the environment as a result of human activities

Demonstration

1 The blood can carry less oxygen and therefore the heart (and lungs) has to work harder to get oxygen to the cells.
2 If appliances such as boilers are not maintained they can give out significant quantities of carbon monoxide. Carbon monoxide is colourless, odourless and toxic and is dangerous to humans and animals.
3 Fossil fuels often contain sulfur. When fossil fuels are burnt sulfur dioxide is formed. Also, when fossil fuels are burnt, oxides of nitrogen are formed. Both these dissolve in water to form an acidic solution - acid rain.
4 Acid rain causes respiratory problems in humans (particularly when photochemical smog forms) and plants. Acid rain also reacts with the materials in buildings (e.g. limestone) and damages them.Acid rain also changes the pH of rivers and lakes, killing fish and other aquatic wildlife.
5 Average size of settled dust particles = 10 micrometers. Average size of soot particles = 0.07 micrometers. So 10/0.07 = 143
6a Global dimming could lead to a reduction in the average global temperature since it reduces the amount of sunlight that reaches the Earth's surface. This is the opposite effect to global warming. However, global dimming could have masked some of the effect of global warming.
6b As particulate levels drop, more sunlight will reach the Earth's surface. This will reduce global dimming and may lead to a greater increase in global warming.

Revision

Connection

Q1. Why is carbon monoxide toxic?

Q2. What causes acid rain and what does it cause?

Q3. What are the problems with particulates?

Activation

LI: Create a topic summary sheet

1. Fold an A3 sheet so it is divided into 8 sections
2. Look back over you lesson and group them into 8 main headings
3. Summarise the key points into each section, use keywords and diagrams and symbols rather than sentences

Consolidation

Look though the relevant past paper questions for this topic - From the C9 DIP file – see if you can complete any additional questions

Extension

Make a note of one thing you think you understand well and one thing that you would like to ask your teacher

Demonstration

Design a climate awareness fact sheet this must include:

- Climate Change
- Pollution
- Names of Gases contributing to Climate change
- Activities that can reduce Climate Change

Answers: C9 Revision

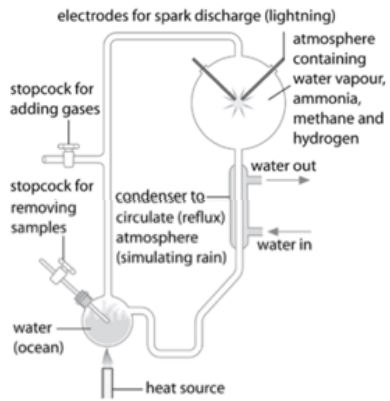
Connection

1 it binds to red blood cells and stops them carrying oxygen cause suffocation
2 sulphur dioxide is produced when burning fossil fuel. Dissolves in water to cause acid rain which is toxic to plants and aquatic animals
3 Particulates cause global dimming – block out light from the sun, affects air quality and causes lung damage, very small particles can pass into the blood and be toxic or carcinogenic

DART C9 - How life began on earth: The primordial soup experiment

Scientists do not know how life began on Earth and may never know. However, in 1953 Stanley Miller and Harold Urey published results from experiments that showed how some organic molecules, essential to life, could have been produced on Earth. They set up apparatus containing water to represent the oceans and a mixture of gases that may have been similar to the Earth's atmosphere when it was young. They included methane, ammonia and hydrogen and used an electric spark to represent lightning.

Miller and Urey analysed the chemicals produced in the water and found that many new molecules had been formed. This included organic molecules such as amino acids which are essential for life.



Organic molecules are molecules containing carbon and hydrogen and possibly some other elements. Amino acids are the molecules which make up proteins and are essential for RNA (ribonucleic acid) and DNA (deoxyribonucleic acid).

Similar experiments have been repeated by many scientists and similar results found. Some scientists call the mixtures of organic chemicals formed in the water a 'primordial soup', meaning a rich mixture of chemicals essential for life.

Experiments have shown that these amino acids are produced only if hydrogen is present in the mixture of gases. However, scientists are very uncertain whether there was hydrogen in the atmosphere after the oceans had formed. Experiments also show that if there is oxygen in the mixture, then the organic molecules are not produced.

This shows that once oxygen was in the Earth's atmosphere, these reactions would not form organic molecules. Miller and Urey's experiments were very significant and showed one way in which some organic molecules essential for life could have formed. However, they do not show how life on Earth could have started. (***Ref: Pearson education 2011, active teach resources)***

DART C9: The atmosphere - Questions

1a Who were the scientists that first published results of an experiment showing how organic molecules could have been produced on earth?

1b List the gases in the atmosphere that Miller and Urey used for modelling earth's early atmosphere.

1c State the meaning of the term 'primordial soup'.

2a Identify the gas, essential for the experiment to work, which may not have been in the Earth's atmosphere once the oceans had formed?

2b Describe what the electric spark represented in this experiment

2c Explain what the flask of water in the experiment represented.

3a Summarise the results of Miller and Urey's experiment.

3b Discuss the significance of this experiment.

3c Evaluate whether this experiment is a conclusive explanation of how life on Earth may have started.

DART C9: The atmosphere – Answers

1a Miller and Urey

1b. methane, ammonia and hydrogen

1c. mixtures of organic chemicals formed in the water a ‘primordial soup’, meaning a rich mixture of chemicals essential for life.

2a. hydrogen although scientists are uncertain about its existence in the early atmosphere

2b. To provide energy required for the chemical reactions the scientists used an electric spark to represent lightning.

2c. The flask contains a mixture of ammonia, water vapour, methane and hydrogen representing the ‘primordial soup’

3a. The chemical reactions in the ‘soup’ produced organic molecules such as amino acid molecules.

3b. The production of amino acid molecules is important because they are the molecules used to make proteins, RNA and DNA which contains genetic information that can be passed on or replicated.

3c. Students to use key pieces of information in the text to justify their evaluation.

Suggestion: The analysis provided some key evidence that a series of chemical reactions in the right conditions can lead to the production of organic molecules, in particular the identification of amino acids as one of the products provides support for the ‘primordial soup’ theory.

However, there were significant questions about the conclusion as there is uncertainty about the presence of hydrogen in the early atmosphere. Therefore, I think the experiment did not provide enough evidence about how life started.

Attainment Band :	C9 The Atmosphere (AQA) Knowledge and Understanding
Yellow Yellow Plus/	Explain how the balance of the gases is maintained. Evaluate different theories about the Earth's early atmosphere. Recall the equation for photosynthesis. Explain how ancient levels of carbon dioxide are measured. Explain these processes as interaction of radiation with matter. Recognise the importance of peer review of results and of communicating results to a wide range of audiences. Discuss the environmental implications of climate change. Give reasons why actions on reductions may be limited. Predict the products of combustion of a fuel knowing the conditions in which it is used.
Blue	Recall the proportions of gases. Interpret evidence about the Earth's early atmosphere. Explain the role of algae in the composition of the atmosphere. Describe some of the likely causes of these changes. Explain the greenhouse effect. Describe uncertainties in the evidence base. Discuss the risk of climate change. Describe how emissions of methane can be reduced. Predict the products of combustion of a fuel knowing the composition of the fuel.
Green	Identify the gases of the atmosphere. Describe the ideas about the Earth's early atmosphere. Identify the processes allowing oxygen levels to increase. Describe the main changes in the atmosphere over time. Describe the greenhouse gases. Evaluate the quality of evidence in a report about global climate change. Discuss the scale of global climate change. Describe how emissions of carbon dioxide can be reduced. Describe some common unwanted products of combustion.
White	Some elements of the above have been achieved