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|  **Subject Science - Year 9 Medium Term Plan/SOW** | **The Academy of St Francis of Assisi** |
| **Unit:**  | **Title: Chemistry of the atmosphere** | **Number of lessons in sequence** | **10 hours** |
| **Overarching Curricular Goals (Aims)**  | **By the end of this unit students will:** In this chapter, students have learnt about the Earth’s atmosphere. Students need to be able to describe the volcanic activity theory of the origin of the atmosphere and should be able to interpret evidence concerning other theories, and be able to evaluate them. To describe the history of the atmosphere students will have learnt a sense of the timescales involved. Along with an understanding of the origins of the atmosphere, students should also understand how it has evolved over time. This includes both how the general composition of the atmosphere has changed and how the atmosphere is currently being affect by human activity. Students should be able to describe the human activities that are thought to cause global warming, and be able to explain some of the effects this has on the climate of the Earth. Students should also be able to explain the effect of other pollutants on the Earth, including carbon monoxide, sulfur dioxide, nitrogen oxides, and particulates. Throughout this chapter, students have had many opportunities to develop their working scientifically skills, including evaluating models and interpreting and evaluating evidence for scientific theories. | **Links to National Curriculum****Links to & building upon prior learningIncluding KS2 if Yr7** | **Students at KS3 build on their knowledge and skills from KS2 by learning about:*** The structure of the Earth
* The composition of the atmosphere
* The production of carbon dioxide by human activity and the impact on climate.
* Material cycles and energy
* Energy changes and transfers

**Students at KS4 build on their knowledge and skills from KS3 by learning about:*** Evidence for composition and evolution of the Earth’s atmosphere since its formation
* Evidence, and uncertainties in evidence, for additional anthropogenic causes of climate change
* Potential effects of, and mitigation of, increased levels of carbon dioxide and methane on the Earth’s climate
* Common atmospheric pollutants: sulphur dioxide, oxides of nitrogen, particulates and their sources.
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| **Outcomes/****Success Criteria** | **Knowledge** **C11.1 The history of our atmosphere**Theories about what was in the Earth’s early atmosphere and how the atmosphere was formed have changed and developed over time. Evidence for the early atmosphere is limited because of the time scale of 4.6 billion years. One theory suggests that during the first billion years of the Earth’s existence there was intense volcanic activity that released gases that formed the early atmosphere and water vapour that condensed to form the oceans. At the start of this period the Earth’s atmosphere may have been like the atmospheres of Mars and Venus today, consisting of mainly carbon dioxide with little or no oxygen gas. Volcanoes also produced nitrogen which gradually built up in the atmosphere and there may have been small proportions of methane and ammonia. When the oceans formed carbon dioxide dissolved in the water and carbonates were precipitated producing sediments, reducing the amount of carbon dioxide in the atmosphere.Algae and plants produced the oxygen that is now in the atmosphere by photosynthesis, which can be represented by the equation: 6CO2 + 6H2O C6H12O6 + 6O2 carbon dioxide + water glucose + oxygen Algae first produced oxygen about 2.7 billion years ago and soon after this oxygen appeared in the atmosphere. Over the next billion years plants evolved and the percentage of oxygen gradually increased to a level that enabled animals to evolve.**Lesson C11.2 Our evolving atmosphere**For 200 million years, the proportions of different gases in the atmosphere have been much the same as they are today: • about four-fifths (approximately 80%) nitrogen • about one-fifth (approximately 20%) oxygen • small proportions of various other gases, including carbon dioxide, water vapour, and noble gases. 9.1.2 Volcanoes also produced nitrogen which gradually built up in the atmosphere and there may have been small proportions of methane and ammonia. 9.1.4 Algae and plants decreased the percentage of carbon dioxide in the atmosphere by photosynthesis. Carbon dioxide was also decreased by the formation of sedimentary rocks and fossil fuels that contain carbon. Students should be able to: • describe the main changes in the atmosphere over time and some of the likely causes of these changes • describe and explain the formation of deposits of limestone, coal, crude oil, and natural gas.**Lesson C11.3 Greenhouse gases**Greenhouse gases in the atmosphere maintain temperatures on Earth high enough to support life. Water vapour, carbon dioxide, and methane are greenhouse gases. Some human activities increase the amounts of greenhouse gases in the atmosphere. These include carbon dioxide and methane. Based on peer-reviewed evidence, many scientists believe that human activities will cause the temperature of the Earth’s atmosphere to increase at the surface and that this will result in global climate change. However, it is difficult to model such complex systems as global climate change. This leads to simplified models, speculation, and opinions presented in the media that may be based on only parts of the evidence and which may be biased.**Lesson C11.4 Global climate change**An increase in average global temperature is a major cause of climate change. Students should be able to: • describe briefly four potential effects of global climate change • discuss the scale, risk, and environmental implications of global climate change. 9.2.4 The carbon footprint is the total amount of carbon dioxide and other greenhouse gases emitted over the full life cycle of a product, service or event. The carbon footprint can be reduced by reducing emissions of carbon dioxide and methane.**Lesson C11.5 Atmospheric pollution**The combustion of fuels is a major source of atmospheric pollutants. Most fuels, including coal, contain carbon and/or hydrogen and may also contain some sulfur. The gases released into the atmosphere when a fuel is burnt may include carbon dioxide, water vapour, carbon monoxide, sulfur dioxide, and oxides of nitrogen. Solid particles and unburnt hydrocarbons may also be released that form particulates in the atmosphere. Carbon monoxide is a toxic gas. It is colourless and odourless and so is not easily detected. Sulfur dioxide and oxides of nitrogen cause respiratory problems in humans and cause acid rain. Particulates cause global dimming and health problems for humans.**Skills** * Students should be able to, given appropriate information, interpret evidence and evaluate different theories about the Earth’s early atmosphere.
* Students should be able to describe the main changes in the atmosphere over time and some of the likely causes of these changes.
* Students should be able to describe and explain the formation of deposits of limestone, coal, crude oil and natural gas.
* Students should be able to describe the greenhouse effect in terms of the interaction of short and long wavelength radiation with matter.
* Students should be able to recall two human activities that increase the amounts of each of the greenhouse gases carbon dioxide and methane.
* Students should be able to evaluate the quality of evidence in a report about global climate change given appropriate information.
* Students should be able to describe uncertainties in the evidence base
* Students should be able to recognise the importance of peer review of results and of communicating results to a wide range of audiences.Students should be able to describe briefly four potential effects of global climate change.
* Students should be able to discuss the scale, risk and environmental implications of global climate change.
* Students should be able to describe actions to reduce emissions of carbon dioxide and methane and give reasons why actions may be limited.
* Students should be able to describe how carbon monoxide, soot (carbon particles), sulfur dioxide and oxides of nitrogen are produced by burning fuels.
* Students should be able to predict the products of combustion of a fuel given appropriate information about the composition of the fuel and the conditions in which it is used.
* Students should be able to describe and explain the problems caused by increased amounts of these pollutants in the air.
* Students should be able to use ratios, fractions and percentages.
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| **2/3 tier vocabulary.** | **Differentiation/Scaffolding/Support.** | **Stretch and challenge opportunities in class, enrichment and home learning.** | **Opportunities for wider reading/Listening/watching.** |
| **Oracy:** ACE questioning Targeted Q and ADiscussion activities  | **Knowledge Support:** * Key facts.
* Knowledge organisers.

**Reading support**:* Explicit vocabulary delivery
* Glossary of terms
* Visualizer to support whole class reading.
* Keyword discussion and annotation.

**Skills support:** * Support sheets
* Practical guidance sheets.
* Practical scaffolding.
* Demonstrations and discussions.
* Writing frames.
 | Stretch and challenge embedded into every lesson (see PowerPoints)**Home learning / enrichment** **Scholarship:** |  |

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| **Unit Title** | **Sequence of learning Lesson title, theme, big question.** |  **Key concepts/outcomes/knowledge and skills.**  | **Assessment/ including specific content/ knowledge/skills tested.** **Green=assess/Blue=improve**  | **HWK. Add** **Hyperlink****To be in books clearly marked** | **Furthering Cultural Capital.****&****Opportunities for reading** | **Recall of prior or future topics –**  | **Lesson resources including or hyperlink to supporting websites/resources/books/texts & individual lessons.** **5xT+L essentials to be included in individual lessons,** |
|  | **C11.1** **The history of our atmosphere** | **Aiming for Grade 4 LOs:*** Describe the Earth’s early atmosphere.
* Describe how oxygen was formed in the development of the atmosphere.

**Aiming for Grade 6 LOs:*** State the composition, including formulae, of the Earth’s early atmosphere.
* Describe a theory for the development of the Earth’s atmosphere.
* Explain, using word equations, how gases were formed in the atmosphere and how oceans were formed.

**Aiming for Grade 8 LOs:*** Use a theory to explain in detail how the atmosphere developed.
* Explain the limits of the theory for the development of the Earth’s atmosphere and why it has changed.
* Use balanced symbol equations to explain how gases were formed in the atmosphere and explain how oceans were formed.
 | C11.1 Exam questions Level 1, 2 and 3 | C11.1 The history of our atmosphere Student Book.C11.1 The history of our atmosphere Student Book end of spread answers |  |  | C11.1 Photosynthesis and the atmosphereC11.1 The history of our atmosphere PPTC11.1 Practical: Gases in the atmosphereExam questions C11 Self-assessment checklist: The Earth's atmosphereC11 The Earth’s atmosphere: Student Book end of spread answers |
|  | **Lesson C11.2** **Our evolving atmosphere** | **Aiming for Grade 4 LOs:** * State that the levels of carbon dioxide have decreased in the atmosphere.
* List the names and symbols of the gases in dry air.
* State where methane and ammonia in the atmosphere may have come from.

**Aiming for Grade 6 LOs:** * Describe how the proportion of carbon dioxide in the early atmosphere was reduced.
* State the composition of dry air.
* Use word equations to show how carbon dioxide can form sedimentary rocks.

**Aiming for Grade 8 LOs:** * Use a theory to explain in detail how the early atmosphere developed to form the atmosphere today.
* Explain why the composition of the Earth’s atmosphere has not changed much for 200 million years.
* Use balanced symbol equations to explain how carbon dioxide forms sedimentary rock and how methane and ammonia
 | C11 Progress quiz: The Earth's atmosphere 1 – testC11.2 Exam questions Level 1, 2 and 3 | C11.2 Our evolving atmosphere student Book.C11.2 Our evolving atmosphere end of spread answers |  |  | C11.2 Gases in dry airC11.2 Our evolving atmosphereC11.2 Practical: Shelly carbonatesC11.2 exam questionsC11 Progress quiz: The Earth's atmosphere 1 – testC11 Self-assessment checklist: The Earth's atmosphereC11 The Earth’s atmosphere: Student Book end of spread answers |
|  | **Lesson C11.3** **Greenhouse gases** | **Aiming for Grade 4 LOs:** * Describe the greenhouse effect. • Name three greenhouse gases
* State some human activities that affect the proportion of gases in the atmosphere.

**Aiming for Grade 6 LOs:** * Explain the greenhouse effect
* Explain how greenhouse gases increase the temperature of the atmosphere.
* Explain how human activity can change the proportion of gases in the atmosphere.

**Aiming for Grade 8 LOs:** * Justify why scientists, as well as the public, disagree about the cause of climate change.
* Explain the difference between global warming and the greenhouse effect.
* Evaluate evidence to suggest if global warming is man-made or natural.
 | C11.3 Exam questions Level 1, 2 and 3 | C11.3 Greenhouse gases student Book.C11.3 Greenhouse gases end of spread answers |  |  | C11.3 Greenhouse gases PPTC11.3 Climate changeC11.3 Activity: Climate change?C11.3 What is happening to Earth?C11.3 Literacy skills: Greenhouse gasesC11.3 On Your Marks: Exam skillsC11 Self-assessment checklist: The Earth's atmosphereC11.3 Exam questions Level 1, 2 and 3C11 The Earth’s atmosphere: Student Book end of spread answers |
|  | **Lesson C11.4** **Global climate change** | **Aiming for Grade 4 LOs:*** List some of the possible outcomes of climate change.
* State a definition for carbon footprint.
* List some ways to reduce a carbon footprint.

**Aiming for Grade 6 LOs:*** Explain the possible effects of global climate change and why they are difficult to predict.
* Explain possible methods to reduce greenhouse gas emissions.
* Explain some of the problems in trying to reduce greenhouse gas emissions.

**Aiming for Grade 8 LOs:*** Evaluate the scale, risk, and environmental impact of global climate change.
* Justify why reducing greenhouse gas emissions can be difficult to achieve.
* Evaluate the use of products, services, or events in terms of their carbon footprint.
 | C11.4 Exam questions Level 1, 2 and 3 | C11.4 Global climate change student Book.C11.4 Global climate change end of spread answers |  |  | C11.4 Global climate change PPTC11.4 Activity: Discussing climate changeC11.4 Interactive: Consequences list**C11 Self-assessment checklist: The Earth's atmosphere**C11.4 Exam questions**C11 The Earth’s atmosphere: Student Book end of spread answers** |
|  | **Lesson C11.5** **Atmospheric pollution** | **Aiming for Grade 4 LOs**:* List some atmospheric pollutants.
* Describe how carbon monoxide and soot (carbon) can be made from the incomplete combustion of fossil fuels.
* Complete word equations to describe how atmospheric pollutants can be made.

**Aiming for Grade 6 LOs**:* Explain how sulfur dioxide and nitrogen oxides are made when fossil fuels are combusted.
* Describe the health impacts of atmospheric pollutants.
* Use balanced symbol equations to show how atmospheric pollutants are formed.

**Aiming for Grade 8 LOs:*** Predict the products of combustion of a fuel given appropriate information about the composition of the fuel and the conditions in which it is used.
* Evaluate the negative social, economic, and environmental consequences of atmospheric pollution.
* Suggest and explain methods to reduce atmospheric pollution.
 | C11.5 Exam questions Level 1, 2 and 3C11 Progress quiz: The Earth's atmosphere 2 – test | C11.5 Atmospheric pollution student Book.C11.5 Atmospheric pollution student Book end of spread answers |  |  | C11.5 Atmospheric pollution PPTC11 Progress quiz: The Earth's atmosphere 2 – testC11.5 On Your Marks: Review (Foundation)C11.5 On Your Marks: Review (Higher)C11 Self-assessment checklist: The Earth's atmosphereC11 The Earth’s atmosphere: Student Book end of spread answers |
|  | **Lesson C11.6** **Checkpoint**  | Describe how the Earth’s atmosphere has changed from its early origins to the present day.Describe how the Earth’s atmosphere and climate may be affected by increased levels of greenhouse gases.Explain how human influence may have led to changes in the Earth’s atmosphere and climate. |  | C11 The Earth's atmosphere: Student Book summary questionsC11 The Earth's atmosphere: Student Book summary answers |  |  | C11 Checkpoint quiz: The Earth's AtmosphereC11 Checkpoint follow-up: Aiming for Grade 4, 6 and 8.C11 Self-assessment checklist: The Earth's atmosphereC11 The Earth's atmosphere: Student Book summary questionsC11 The Earth's atmosphere: Student Book summary answers |
|  | **Lesson C11.7** **Revision**  |  | 30 question exam booklet Level 1, 2 and 3.  | C11 The Earth's atmosphere: Student Book practice questionsC11 The Earth's atmosphere: Student Book Practice answers |  |  | C11 Podcast: The Earth's atmosphere (Foundation)C11 Podcast: The Earth's atmosphere (Higher)C11 Self-assessment checklist: The Earth's atmosphereC11 The Earth's atmosphere: Student Book practice questionsC11 The Earth's atmosphere: Student Book Practice answers |
|  | **Lesson C11.8** **Assessment**  |  |  |  |  |  | C11 The Earth's atmosphere: Exam-style questions (Higher)C11 The Earth's atmosphere: Exam-style questions (Foundation)C11 The Earth's atmosphere: Exam-style question answers (Higher)C11 The Earth's atmosphere: Exam-style question answers (Foundation) |