# IGCSE Co-ordinated Sciences 0654
## Unit 13: C9 Acids and Alkalis & C10 Soil, Rocks and Rates

**Recommended Prior Knowledge**
Students should be familiar with writing word and symbol equations.

**Context**
This Unit has links with topic C6 Oxidation and Reduction, and topic C7 Ions and Electrolysis.

**Outline**
The properties of acids and alkalis are studied in the context of everyday substances. The rock cycle and soil formation by weathering is studied. Reaction of acid with carbonate is used to follow change in rate of reaction with conditions used.

| AO | Learning outcomes | Suggested Teaching activities | Learning resources |
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| ABC | Know the properties of acids with regard to their reactions with metals, bases and carbonates.<br><br>. | Students may perform test tube experiments to observe the reactions listed. Students make notes on all observations, particularly any heat evolved as this is studied later on in the unit. They should perform the limewater test for carbon dioxide on the gas evolved from reaction of acid with carbonates. | *IGCSE Chemistry* by B Earl and LCR Wilford, Chapter 7.<br><br>*Teaching and Assessing Practical Skills in Science* by Dave Hayward |
| | Know the test for carbonate ions using dilute hydrochloric acid and limewater | Students should develop patterns from data obtained from these experiments. There is also an opportunity to practice writing word and symbol equations. Students can read through information on the web site to help with their notes.<br><br>Examples used should include everyday substances such as vinegar, antacids and lime. | http://www.chem4kids.com |

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| ABC | Be able to describe solutions as acidic, alkaline or neutral in terms of the pH scale. | Students can arrange solutions of varying pHs in terms of increasing acidity / basicity e.g. milk, vinegar, ammonia solution, 'bench' and 'household' chemicals. | *IGCSE Chemistry* by B Earl and LCR Wilford, Chapter 7.<br><br>Teaching and Assessing Practical Skills in Science by Dave Hayward |
| ABC | Know that salts are formed when acids are neutralised by alkalis. | Examples of neutralisation of acid by alkali can be included in the section above.<br><br>Students should gain experience of the preparative techniques of filtration, evaporation and crystallisation by making a salt. The technique of titration using simple apparatus provides an opportunity for students to learn to measure masses and volumes accurately. | *IGCSE Chemistry* by B Earl and LCR Wilford, Chapter 7.<br><br>Teaching and Assessing Practical Skills in Science by Dave Hayward |
| AB | Be able to suggest a method of making a named salt from suitable starting materials. | Students can perform a paper exercise to suggest starting materials for the preparation of a number of salts. Again there is opportunity for practice writing word and symbol equations. | *IGCSE Chemistry* by B Earl and LCR Wilford, Chapter 7. |
| ABC | Know the meaning of the term exothermic reaction and that when acids react with alkalis the temperature of the solution increases. | Reactions used above will include exothermic examples. Students should be encouraged to note which reactions result in an increase in temperature of the solution by feeling the test tube and/or using a thermometer.<br><br>Energy changes occurring on neutralisation could be measured using a suitably insulated vessel. For higher grades, the results could be calculated per mole of acid. | *IGCSE Chemistry* by B Earl and LCR Wilford, Chapter 7.<br><br>*Teaching and Assessing Practical Skills in Science* by Dave Hayward |
| AB | Understand that during neutralisation reactions, hydrogen ions combine with hydroxide ions to form water | Students aiming for higher grades should study acid-alkali neutralisation as the reaction between hydrogen and hydroxide ions. The symbol equation for this reaction should be written out and explained. | *IGCSE Chemistry* by B Earl and LCR Wilford, Chapter 7. |

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| | molecules. | | |
| AB | Be able to write simple balanced equations for salt formation and appreciate that it is possible to calculate the amount of alkali required to neutralise an acid using the mole concept. | There is opportunity for further practice in writing symbol equations.<br><br>Simple calculations of the amount of alkali required to neutralise a specific amount of acid may be performed. | *IGCSE Chemistry* by B Earl and LCR Wilford, Chapter 7. |
| A | Know the meaning of the word antacid. | Students may survey the range of antacid products available commercially, and note the active ingredient in each. | *IGCSE Chemistry* by B Earl and LCR Wilford, Chapter 7. |
| ABC | Know that lime can be used to neutralise industrial waste | Students should be given brief details of the use of lime (calcium hydroxide) to cure excess acidity of water in water treatment plants, before supply to domestic customers. | *IGCSE Chemistry* by B Earl and LCR Wilford, Chapter 8. |
| ABC | -know that rocks may be classified as sedimentary, igneous or metamorphic. | Students should study a diagram of the rock cycle.<br><br>Samples of sedimentary, igneous and metamorphic rocks should be observed in order to identify their characteristic features. Keys could be used to classify rocks and minerals. Wherever possible the samples used should be those found in the locality. | http://www.bbc.co.uk/schools/gcsebitesize/<br><br>http://www.rocksforkids.com<br><br>http://qldscienceteachers.tripod.com/<br><br>*Teaching and Assessing Practical Skills in Science* by Dave Hayward |
| AB | Know that geological time scales are very long compared to human lifetimes. | Emphasis should be placed on the very long time scales involved in rock formation. | |
| ABC | Know that weathering of rocks is the | The weathering of rocks could be developed by investigations. . | *Teaching and Assessing Practical* |

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| | result of both physical and chemical changes and that soil is formed from both rocks and organic material. | Students should carry out or have demonstrated some experiments involving heating, cooling and abrasion, to illustrate weathering: e.g. freezing a bottle of water (inside a plastic bag), shaking 1cm cubes Plaster of Paris in a container, reaction of limestone with acids.<br><br>Students could undertake a survey of local soils using a simple soil test kit and a sedimentation test could be used to compare the composition of different soils. | http://my.ca.gov/state/portal/myca_homepage.jsp<br><br>*Skills in Science* by Dave Hayward |
| ABC | Be able to describe at least one example in each case of physical, biological and chemical weathering of rock. | Action of plant roots on cliff faces may be observed if available locally or from photographs. | |
| A | Understand the role of limestone in the extraction of iron. | This may be linked to the role of limestone in the extraction of iron covered in topic 6 Oxidation and Reduction.<br><br>Students aiming for higher grades should study the relevant symbol equations. | *IGCSE Chemistry* by B Earl and LCR Wilford, Chapter 9. |
| ABC | Know that lime can be manufactured by the decomposition of limestone and can be used to treat acidic soils. | Students may heat a limestone chip strongly for 20 minutes and then allow it to cool to form calcium oxide. They can then observe the reaction of calcium oxide when drops of water are added to make slaked lime (another example of exothermic reaction), and test the pH of the resulting solution.<br><br>Photographs and diagrams could help in discussing the manufacture of products obtained from limestone. Students should discuss the importance of lime treatment to cure the acidity of unfertile land, enabling acid intolerant crops to be grown. | *IGCSE Chemistry* by B Earl and LCR Wilford, Chapter 8.<br><br>*Teaching and Assessing Practical Skills in Science* by Dave Hayward<br><br>Notes on limestone: http://www.mineralstech.com<br><br>Uses of lime/slaked lime: http://www.answers.com/topic/calcium-oxide |
| ABC | Know that weathering of rock releases salts into the soil which plants need | The need for supply of minerals to plants may be show by growing identical plants with and without fertiliser. | |

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| | for growth. | | |
| AB | Understand the importance of controlling soil acidity. | Students should understand how the pH of soil an affect uptake of minerals, and how some plants are intolerant of soils that are too acidic or too alkaline. | |
| ABC | Understand that concentration, temperature and surface area are factors which affect the speeds of chemical reactions. | Students should carry out experiments to investigate the effect on e.g. the rate of reaction between marble chips (calcium carbonate) and hydrochloric acid of changing: concentration of acid, size of marble chips.<br><br>Students could plan their own investigations into the factors affecting speeds of reaction. The effect of a catalyst on speed of reaction could be developed by demonstrating the effect of $MnO_2$ on the decomposition of aqueous hydrogen peroxide. | *IGCSE Chemistry* by B Earl and LCR Wilford, Chapter 11.<br><br>Teaching and Assessing Practical Skills in Science by Dave Hayward |
| AB | Be able to describe tests for oxygen, hydrogen and carbon dioxide. | Tests for these gases should have been experienced by students in the activities described above, and in topic 7 Ions and Electrolysis. The ideas may be reinforced here. (Notes for use in Qualitative Analysis are reproduced in the question paper for the Practical Test.) | |
| ABC | Be able to interpret data from reaction rate experiments.<br><br>Understand the factors affecting reaction rate in terms of the frequency of reactive collision between particles. | Students aiming for higher grades should plot graphs of data obtained from their experiments, and interpret them to make conclusions. Results should be explained using collision theory, web link includes useful animations. | *IGCSE Chemistry* by B Earl and LCR Wilford, Chapter 11.<br><br>*Teaching and Assessing Practical Skills in Science* by Dave Hayward<br><br>http://www.sciencepages.co.uk/ |