

UNIVERSITY OF SWAZILAND
FACULTY OF EDUCATION
MAIN EXAMINATION PAPER 2009
B. Ed. II AND PGCE

Title of paper : Curriculum Studies: Chemistry

Course number: EDC 279

Time allowed: 3 hours

Instructions:

1. This paper contains FIVE questions.
2. Question 1 is COMPULSORY. You may then choose ANY TWO questions from questions 2, 3, 4, 5.
3. Marks for each question are indicated at the end of the question.
4. Any piece of material or work which is not intended for marking purposes should be clearly CROSSED OUT.
5. Ensure that responses to questions are NUMBERED CORRECTLY.

Special Requirements

SGCSE Physical Science syllabus 6888 (Chemistry section)

THIS PAPER SHOULD NOT BE OPENED UNTIL PERMISSION HAS BEEN GRANTED BY THE INVIGILATOR

SECTION A

QUESTION 1

This question is compulsory

For the Chemistry topic *C12.2 Water* from the Physical Science-Chemistry syllabus:

- a) Prepare an 80-minute lesson plan. Your lesson plan should **also** include the following:
- i) at least **three** appropriately stated objectives.
 - ii) an outline of the activities which would be carried out by the pupils and the teacher.
 - iii) the assessment tasks the teacher might use to assess learning. [30]
- b) What important functions can the following serve?
- i) Introduction to a lesson and [5]
 - ii) Conclusion of a lesson [5]

SECTION B

Choose and answer any two questions

QUESTION 2

The aims of education include developing pupils' affective, cognitive, physical and interpersonal abilities. Science is an integral component of the school curriculum.

With the help of examples from Chemistry (syllabus is attached) discuss the extent to which you consider the chemistry offered at senior secondary school level contributes towards the aims of education for the learner in Swaziland. [30]

QUESTION 3

For a specified chemistry content area (topic and sub-topic) of your choice (other than those used in Question 1 and Question 5), identify and discuss **fully two** teaching methods you consider suitable for teaching the specified content area. [30]

QUESTION 4

Attitude and motivation are indeed the most critically important constructs of the affective domain in science education (Koballa n.d).

Discuss motivation in relation to teaching and learning in Chemistry. [30]

QUESTION 5

The attached test for Form 4D Physical Science: Chemistry was designed by a student teacher during teaching practice. Study the test and use the syllabus assessment objectives and specification grid to perform the following tasks

- a) Construct a marking guide for the test [12]
- b) Construct a table of specification for the test [8]
- c) Comment on the test's
 - (i) content validity [6]
 - (ii) construct validity [4]

Chemical Bonding

Instructions: 1. answer all questions!
2. copying not allowed!

50 minutesQuestion 1

- (a) Explain what you understand about the following terms;
- (i) Chemical bond. [1]
 - (ii) Noble gas configuration [1]
 - (iii) Van der Waals forces [1]
- (b) What causes a substance like graphite to conduct electricity? [1]
- (c) Chemical symbols, together with their atomic number and mass number, are often written in a short hand notation. Write this notation for Lithium with atomic number 3 and mass number 7. [1]

Question 2

Name the following elements and draw their electronic configuration, using circles for shells.

- (i) ${}_{12}^{24}\text{Mg}$ (ii) ${}_{16}^{32}\text{S}$ (iii) ${}_{18}^{40}\text{Ar}$ [6]

Question 3

Draw "dot and cross" diagrams to show how the atoms share electrons in the following compounds;

- (i) Water [2]
(ii) Cl_2 [2]
(iii) CH_4 [2]

Question 4

- (a) Describe how an ionic compound forms. In your description, give an example. [4]
State three properties of ionic compounds. [3]
- (b) Describe how metallic bonds form. In your description, give an example. [4]
State two properties of the compounds resulted from this type of bonding. [2]

.....END.....

**SWAZILAND GENERAL CERTIFICATE OF SECONDARY
EDUCATION
PHYSICAL SCIENCE SYLLABUS 6888**

(CHEMISTRY SECTION)

SPECIAL REQUIREMENTS FOR

**EDC 279 Curriculum Studies: Chemistry
2009 Main and Supplementary Examinations**

AND

**EDC 379 Curriculum Studies: Chemistry
2009 Main and Supplementary Examinations**

SGCSE PHYSICAL SCIENCE Syllabus 6888
November 2009 and November 2010 Examinations

CONTENTS

	Page
Swaziland General Certificate of Secondary Education	3
Introduction	4
Aims	4
Assessment Objectives	6
Specification Grid	7
Assessment	8
Scheme of Assessment	8
Weighting of Papers	9
Curriculum Content	10
Chemistry Section	10
Physics Section	19
Grade Descriptions	25
Appendix: Assessment Criteria for Practicals	26
Appendix: Symbols, Units and Definitions of Physical Quantities	28
Appendix: Notes for Use in Qualitative Analysis	29
Appendix: Data Sheet (The Periodic Table of the Elements)	30
Appendix: Mathematical Requirements	31
Appendix: Glossary of Terms	32

Developed in collaboration with the University of Cambridge International Examinations (CIE), part of the Cambridge Assessment Group. Cambridge Assessment is the brand name of University of Cambridge Local Examinations Syndicate (UCLES), which is itself a department of the University of Cambridge.

SWAZILAND GENERAL CERTIFICATE OF SECONDARY EDUCATION

Broad Guidelines

The Ministry of Education is committed, in accordance with the National Policy Statement on Education, to provide a Curriculum and Assessment System (Form 4 and Form 5) so that at the completion of secondary education, learners will

- be equipped to meet the changing needs of the Nation, and
- have attained internationally acceptable standards.

Swaziland's National Education Policy Directives

SGCSE syllabuses for studies in Form 4 and Form 5 will individually, and collectively, enable learners to develop **essential skills** and provide a broad **learning experience** which

- inculcates values and attitudes as well as knowledge and understanding,
- encourages respect for human rights and freedom of speech,
- respects the values and beliefs of others, relating to issues of gender, culture and religion,
- develops desirable attitudes and behaviour towards the environment,
- provides insight and understanding of global issues which affect quality of life in Swaziland and elsewhere, e.g., the AIDS pandemic; global warming; maldistribution of wealth; and technological advances.

The National Curriculum for Form 4 and Form 5

Learners will be given opportunities to develop **essential skills** which will overlap across the entire range of subjects studied. These skills are listed below.

- Communication and language skills
- Numeracy skills: mathematical ideas, techniques and applications
- Problem-solving skills
- Technological awareness and applications
- Critical thinking skills
- Work and study skills
- Independent learning
- Working with others

To develop these skills, learners must offer **four compulsory subjects** and at least **three elective subjects** chosen from one or more Field of Study.

Compulsory Subjects

- SiSwati – either First Language or Second Language
- English Language
- Mathematics
- Science

Fields of Study

- Agriculture Field of Study
- Business Studies Field of Study
- Home Economics Field of Study
- Social Sciences and Humanities Field of Study
- Technical Field of Study

INTRODUCTION

The Swaziland General Certificate of Secondary Education (SGCSE) syllabuses are designed as two-year courses for examination in Form 5. Physical Science is designed for learners with a wide range of abilities and relevant to those from different backgrounds and experiences. It requires a wide range of learner-centred activities which are based on practical work. This provides learners with opportunities to acquire scientific knowledge and develop skills and processes which will enable them to apply science in everyday situations. As the learners explore and interpret the physical world, emphasis will be directed to the development of innovative ideas, processes and use of scientific equipment in this advancing technological world. This syllabus serves as a basis for further studies in science.

All SGCSE syllabuses follow a general pattern. The main sections are:

Aims
Assessment Objectives
Assessment
Curriculum Content

Physical Science falls into the Science Compulsory Subjects Group which includes: Biology and Combined Science. It is also an Elective Subject in the following Field of Study Groups: Agriculture, and Home Economics. This syllabus may not be offered in the same session with SGCSE Combined Science Syllabus 6886.

AIMS

The aims of the syllabus are the same for all learners. These aims are set out below and describe the educational purposes of a course in Physical Science for the SGCSE Examination. They are not listed in order of priority.

The aims are to enable learners to:

1. provide, through well designed studies of experimental and practical science, a worthwhile educational experience for all students, whether or not they go on to study science beyond this level and, in particular, to enable them to acquire sufficient understanding and knowledge to
 - 1.1 become confident citizens in a technological world, to take or develop an informed interest in matters of scientific import;
 - 1.2 recognise the usefulness, and limitations, of scientific method and to appreciate its applicability in other disciplines and in everyday life;
 - 1.3 inspire learners to seek, acquire and develop scientific explanations of natural phenomena;
 - 1.4 be suitably prepared for studies beyond the SGCSE level in pure sciences, in applied sciences or in science-dependent vocational courses.
2. develop abilities and skills that
 - 2.1 develop and enhance scientific knowledge and understanding;
 - 2.2 are useful in everyday life and applicable in domestic, environmental and industrial situations;
 - 2.3 are necessary to communicate scientific findings of practical investigations using proper technical scientific terminology;
 - 2.4 encourage efficient and safe practice;
 - 2.5 will evaluate the positive and negative impact of scientific or technological development.
3. develop attitudes relevant to Physical Science such as
 - 3.1 concern for accuracy and precision;
 - 3.2 objectivity;
 - 3.3 integrity;
 - 3.4 enquiry;
 - 3.5 initiative;
 - 3.6 inventiveness;
 - 3.7 perseverance.
4. stimulate interest in, and care for, the environment.

SGCSE PHYSICAL SCIENCE Syllabus 6888
November 2009 and November 2010 Examinations

5. promote an awareness
- 5.1 of the potential of the indigenous technologies in developing local societies;
 - 5.2 that scientific theories and methods have developed, and continue to do so, as a result of the co-operative activities of groups and individuals;
 - 5.3 that the study and practice of science is subject to social, economic, technological, ethical and cultural influences and limitations;
 - 5.4 that the applications of science may be both beneficial and detrimental to the individual, the community and the environment;
 - 5.5 that science transcends national boundaries and that the language of science, correctly and rigorously applied, is universal.

ASSESSMENT OBJECTIVES

Assessment Objectives in Physical Science are:

- A** Knowledge with Understanding
- B** Handling Information and Solving Problems
- C** Experimental Skills and Investigations

A description of each assessment objective follows.

A KNOWLEDGE WITH UNDERSTANDING

Learners should be able to demonstrate knowledge and understanding in relation to:

1. scientific phenomena, facts, laws, definitions, concepts and theories;
2. scientific vocabulary, terminology and conventions (including symbols, quantities and units);
3. scientific instruments and apparatus, including techniques of operation and aspects of safety;
4. scientific quantities and their determination;
5. scientific and technological applications with their social, economic and environmental implications.

The Curriculum Content defines the factual material that candidates may be required to recall and explain. Questions testing this will often begin with one of the following words: define, state, describe, explain (using your knowledge and understanding) or outline. (See Appendix: Glossary of Terms.)

B HANDLING INFORMATION AND SOLVING PROBLEMS

Learners should be able, in words or using other written forms of presentation (i.e., symbolic, graphical and numerical), to:

6. locate, select, organize and present information from a variety of sources;
7. translate information from one form to another;
8. manipulate numerical and other data;
9. use information to identify patterns, report trends and draw inferences;
10. present reasoned explanations for phenomena, patterns and relationships;
11. make predictions and hypotheses;
12. solve problems, including some of a quantitative nature.

These assessment objectives cannot be precisely specified in the Curriculum Content because questions testing such skills are often based on information which is unfamiliar to the candidate. In answering such questions, candidates are required to use principles and concepts that are within the syllabus and apply them in a logical, deductive manner to a novel situation. Questions testing these objectives will often begin with one of the following words: discuss, predict, suggest, calculate, explain or determine. (See Appendix: Glossary of Terms.)

C EXPERIMENTAL SKILLS AND INVESTIGATIONS

Learners should be able to:

13. use techniques, apparatus and materials (including the following of a sequence of instructions where appropriate);
14. make and record observations, measurements and estimates;
15. interpret and evaluate experimental observations and data;
16. plan and carry out investigations, evaluate methods and suggest possible improvements (including the selection of techniques, apparatus and materials).

SGCSE PHYSICAL SCIENCE Syllabus 6888
November 2009 and November 2010 Examinations

Specification Grid

The approximate weightings allocated to each of the assessment objectives in the assessment model are summarised in the table below.

Assessment Objectives	Weighting
A Knowledge with understanding	50% (not more than 25% recall)
B Handling information and solving problems	30%
C Experimental skills and investigations	20%

Teachers should take note that there is an equal weighting of 50% for skills (including handling information, solving problems, practical, experimental and investigative skills) and for knowledge and understanding. Teacher's schemes of work, and the sequence of learning activities should reflect this balance, so that the aims of the syllabus may be met, and the candidates prepared for the assessment.

SGCSE PHYSICAL SCIENCE Syllabus 6888
November 2009 and November 2010 Examinations

ASSESSMENT

Scheme of Assessment

All candidates must enter for three papers. These will be Paper 1, one from either Paper 2 or Paper 3, and one from the practical assessment Papers 4 (Practical Test) or 5 (Alternative to Practical).

Candidates who have only studied the Core Curriculum or who are expected to achieve a Grade D or below should be entered for Paper 2. Candidates who have also studied the Extended Curriculum and who are expected to achieve a Grade C or above should be entered for Paper 3.

A description of each paper follows.

The Data Sheet (The Periodic Table of the Elements) will be included in Papers 1, 2 and 3.

Core Curriculum Grades C to G available	Extended Curriculum Grades A* to G available
<p>Paper 1 (1 hour) Compulsory short answer paper consisting of 40 marks, with questions designed to discriminate between grades C to G. The questions, targeted at the lower grades, will be based on the Core Curriculum and will test skills mainly in Assessment Objectives A and B.</p> <p>This paper will be weighted at 27% of the final total available marks.</p>	
<p>Either Paper 2 (1 hour 15 minutes) Core theory paper consisting of 80 marks of short-answer and structured questions, designed to discriminate between grades C to G.</p> <p>The questions will be based on the Core Curriculum and will test skills mainly in Assessment Objectives A and B.</p> <p>This paper will be weighted at 53% of the final total available marks.</p>	<p>Or Paper 3 (1 hour 15 minutes) Extended theory paper consisting of 80 marks of short-answer and structured questions, designed to discriminate between grades A to C.</p> <p>The questions are targeted at the higher grades and will test skills mainly in Assessment Objectives A and B. A quarter of the marks available will be targeted at the lower grades and contain Core Curriculum only material. The remainder will be targeted at higher grades and will contain material from the Extended Curriculum as well as the Core.</p> <p>This paper will be weighted at 53% of the final total available marks.</p>
<p>Practical Assessment Compulsory The purpose of this component is to test appropriate skills in Assessment Objective C. Candidates will not be required to use knowledge outside the Core Curriculum. Candidates must be entered for one of the following:</p> <p>Either Paper 4 Practical Test (1 hour 30 minutes), consisting of 30 marks, with questions covering experimental and observational skills. (See Appendix: Assessment Criteria for Practicals.)</p> <p>Or Paper 5 Alternative to Practical (1 hour 30 minutes), consisting of 60 marks. This is a written paper designed to test familiarity with laboratory based procedures. (See Appendix: Assessment Criteria for Practicals.)</p> <p>The practical assessment will be weighted at 20% of the final total available marks.</p>	

SGCSE PHYSICAL SCIENCE Syllabus 6888
November 2009 and November 2010 Examinations

Weighting of Papers

Paper	Weighting Core Curriculum candidates (Papers 1, 2 and 4 or 5 only)	Weighting Extended Curriculum candidates (Papers 1, 3 and 4 or 5 only)
1	27%	27%
2	53%	
3		53%
4 or 5	20%	20%

CURRICULUM CONTENT

Learners will follow either the Core Curriculum only, or the Extended Curriculum which includes both the Core and the Extended. The Curriculum Content that follows is divided into two (2) sections: Chemistry and Physics. Candidates entered for this subject must study both sections.

Notes:

- (i) The Curriculum Content is designed to provide guidance to teachers as to what will be assessed in the overall evaluation of the learner. It is not meant to limit, in any way, the teaching programme of any particular school.
- (ii) Due to the spiral nature of the curriculum, it is assumed that the elementary concepts of the syllabus have been covered during study at Junior Secondary level.
- (ii) The Curriculum Content is set out in topic areas within Chemistry and Physics. The main topic areas and concepts are indicated in **bold**. The left-hand column provides amplification of the Core Curriculum topics, which all learners are to study. Topics in the right-hand column are supplementary and should be studied by learners following the Extended Curriculum.
- (iv) Cross-references are provided to indicate areas of overlap or close association within the syllabus.
- (v) It is intended that, in order to avoid difficulties arising out of the use of l as the symbol for litre, use of dm³ in place of l or litre will be made.

Appropriate teaching time for the Physical Science syllabus should be equivalent to six (6) periods of forty (40) minutes each over a period of sixty (60) weeks/cycles.

CHEMISTRY SECTION	
CORE	EXTENDED
C1. Definition of chemistry and its importance in society	
All learners should be able to: - define chemistry as the study of the composition of substances and their effects upon one another. - describe the importance of chemistry to Swaziland.	
C2. Particulate nature of matter	
All learners should be able to: - describe evidence for the movement of particles in gases and liquids i.e., diffusion. - describe the states of matter in terms of the kinetic theory.	
C3. Experimental techniques	
All learners should be able to: C3.1 Measurement - name and use appropriately the burette and pipette. C3.2 Methods of purification - describe methods of purification by use of suitable solvent, filtration, evaporation, crystallisation, distillation (simple and fractional), separating funnel, sublimation (see C7.3 – Speed of reaction).	

SGCSE PHYSICAL SCIENCE Syllabus 6888
November 2009 and November 2010 Examinations

<p>C3.3 Criteria for purity</p> <ul style="list-style-type: none"> - describe paper chromatography. - interpret simple chromatograms. - describe how chromatography techniques can be applied to colourless substances by exposing chromatograms to locating agents. 	<ul style="list-style-type: none"> - identify substances and test their purity by melting point and boiling point determination and by paper chromatography.
<p>C4. Physical and chemical change</p>	
<p>All learners should be able to:</p> <ul style="list-style-type: none"> - identify and describe physical and chemical changes. 	
<p>C5. Atoms, elements and compounds</p>	
<p>All learners should be able to:</p> <p>C5.1 Basic chemistry</p> <ul style="list-style-type: none"> - define element. - name and give symbols of the first 20 elements of the Periodic Table. - define compound. - name and give formulae of simple compounds. - describe the Periodic Table as a method of classifying elements (see C9.1). - define atoms and molecules as smallest particles of elements and compounds. - describe simple structure of atoms in terms of, neutrons, protons and electrons. <p>C5.2 Atomic structure and the Periodic Table</p> <ul style="list-style-type: none"> - state relative charges and approximate relative masses of protons, neutrons and electrons. - define proton (atomic) number and nucleon number. - use proton number and simple structure of atoms to explain the basis of the Periodic Table (for the first 20 elements). - deduce information from the notation ${}^a_b X$ for an atom. - describe the build up of electrons in shells and the significance of the noble gas electronic structures and of outer electrons (The ideas of the distribution of electrons in s- and p-orbitals and in d-block elements are not required.) Note that a copy of the Periodic Table will be provided in Papers 1, 2 and 3. - define isotopes. - describe differences between elements, mixtures, compounds and between metals and non-metals. <p>C5.3 Bonding: the structure of matter</p> <ul style="list-style-type: none"> - describe alloys e.g., brass as a mixture of a metal with other elements. 	<ul style="list-style-type: none"> - explain how alloying affects the properties of metals.

<p>C5.3.1 Ions and ionic bonds - describe the formation of ions by electron loss or gain. - describe the formation of ionic bonds between the alkaline metals and the halogens.</p> <p>C5.3.2 Molecules and covalent bonds - describe the formation of single covalent bonds in H_2, Cl_2, H_2O, CH_4 and HCl as the sharing of pairs of electrons leading to the noble gas configuration. - describe the differences in volatility (including M.P. and B.P.), solubility and electrical conductivity between ionic and covalent compounds.</p> <p>C5.3.3 Macromolecules - describe the 'structure' of graphite and of diamond.</p> <p>C5.3.4 Metallic bonding</p>	<p>- describe the formation of ionic bonds between metallic and non-metallic elements.</p> <p>- describe the electron arrangement in more complex molecules such as N_2, C_2H_4, CH_3OH and CO_2</p> <p>- relate these structures to melting point, conductivity and hardness. - describe metallic bonding as a lattice of positive ions in a 'sea of electrons' and use these to describe the electrical conductivity and malleability of metals.</p>
<p>C6. Stoichiometry</p>	
<p>All learners should be able to:</p> <ul style="list-style-type: none"> - use the symbols of the elements and write the formulae of simple compounds. - deduce formulae of simple compounds from relative numbers of atoms present. - construct word equations and simple balanced chemical equations. - define relative atomic mass (A_r) and relative molecular mass (M_r) and calculate it as the sum of the relative atomic masses. 	<ul style="list-style-type: none"> - use the mole and the Avogadro constant. - use molar gas volume taken as 24 dm^3 at room temperature and pressure. - determine the formula of an ionic compound from the charges of the ions present. - deduce the balanced equation of a chemical reaction given relevant information. - calculate stoichiometric reacting masses and volumes of gases and solutions, solution concentrations expressed in mol/dm^3 or g/dm^3 (Calculations based on limiting reactants may be set. Questions on the gas laws and the conversions of gaseous volumes to different temperatures and pressures will not be set.)
<p>C7. Chemical reactions</p>	
<p>All learners should be able to:</p> <p>C7.1 Production of energy - describe and explain the use of hydrogen as a fuel e.g., in rockets. - describe radioactive isotopes such as ^{235}U as a source of energy. - describe the production of electrical energy from simple cells i.e., two electrodes in an electrolyte (this should be linked with the reactivity series). - describe the use of batteries as a convenient portable energy source.</p> <p>C7.2 Energetics of a reaction - describe, using example, exothermic and endothermic reactions.</p>	

<p>- describe bond breaking as an endothermic reaction and bond formation as an exothermic reaction.</p> <p>C7.3 Speed of reaction</p> <p>- define speed of a reaction.</p> <p>- describe the effect of concentration, particle size, catalysts (including enzymes) and temperature on the speed of reactions in terms of the collision theory.</p> <p>- state that organic compounds that catalyse organic reactions are called enzymes.</p> <p>- describe the application of the above factors to the danger of explosive combustion with fine powders (e.g., flour mills) and gases (e.g., mines)</p> <p>C7.4 Redox</p> <p>- define oxidation and reduction in terms of oxygen/hydrogen gain/loss.</p>	<p>- interpret data obtained from experiments concerned with speed of reaction.</p> <p>- show awareness that light can provide energy needed for certain chemical reactions by: describing the use of silver salts in photography i.e., reduction of silver ions to silver, stating that photosynthesis leads to the production of glucose from carbon dioxide and water in the presence of chlorophyll and sunlight (energy).</p> <p>- define oxidation and reduction in terms of electron transfer.</p>
<p>C8. Acids, bases and salts</p>	
<p>All learners should be able to:</p> <p>C8.1 Characteristics and properties of acids and bases</p> <p>- describe the characteristic properties of acids as reactions with metals, bases, carbonates and effect on litmus.</p> <p>- describe neutrality and relative acidity and alkalinity in terms of pH (whole numbers only) measured using Universal Indicator paper.</p> <p>- describe and explain the importance of controlling the acidity in soil.</p> <p>- prepare and use plant extracts as acid/base indicators.</p> <p>- define acids and bases in terms of proton transfer, limited to aqueous solutions.</p> <p>C8.2 Types of oxides</p> <p>- classify oxides as either basic or acidic related to metallic and non-metallic character of the element forming the oxide.</p> <p>C8.3 Preparation of salts</p> <p>- describe and prepare soluble salts from bases and ammonium salts.</p> <p>- prepare, separate and purify insoluble salts (see C3.2 – Methods of purification).</p> <p>C8.4 Identification of ions</p> <p>- describe and use the following tests to identify:</p> <p>C8.4.1 Aqueous cations</p> <p>- ammonium, calcium, copper (II), iron (II) and iron (III) zinc using aqueous sodium hydroxide and aqueous ammonia as appropriate. (Formulae of complex ions are not required).</p> <p>C8.4.2 Aqueous anions</p> <p>- carbonate (by reaction with dilute acid and then lime water), chloride (by reaction under acidic conditions with aqueous silver nitrate),</p>	<p>- use these ideas to explain specified reactions as acid/base.</p> <p>- classify other oxides as neutral or amphoteric.</p>

<p>iodide (by reaction by reaction under acidic conditions with aqueous lead (II) nitrate), nitrate (by reduction with aluminium to ammonia) and sulphate (by reaction under acidic conditions with aqueous barium ions).</p> <p>C8.5 Identification of gases</p> <ul style="list-style-type: none"> - identify carbon dioxide using limewater. - identify hydrogen using a lighted splint. - identify oxygen using a glowing splint. - identify ammonia using damp litmus paper. 	
<p>C9. The Periodic Table</p>	
<p>All learners should be able to:</p> <p>C9.1 Periodic trends</p> <ul style="list-style-type: none"> - describe the Periodic Table as a method of classifying elements and its use in predicting properties of elements. - describe the trend from metallic to non-metallic character across a Period. - identify alkali, alkaline earth metals, halogens and noble gases. <p>C9.2 Group properties</p> <ul style="list-style-type: none"> - describe the relationship between group number and the number of outer electrons. - describe lithium sodium and potassium in Group I as a collection of relatively soft metals showing a trend in melting point, density and in reaction with water. - predict the properties of other elements in the Group given data, where appropriate. - describe chlorine, bromine and iodine in Group VII as a collection of diatomic non-metals showing a trend in colour and state their reaction with other halide ions. - predict the properties of other elements in the Group given data where appropriate. - identify trends in other groups given information about the elements concerned. <p>C9.3 Transition elements</p> <ul style="list-style-type: none"> - describe the transition elements as a collection of metals having high densities, high melting points and forming coloured compound, and which, as elements and compounds, often act as catalysts. <p>C9.4 Noble gases</p> <ul style="list-style-type: none"> - describe the noble gases as being unreactive. - describe the uses of noble gases in providing an inert atmosphere, e.g., argon in lamps; helium for filling weather balloons. 	
<p>C10. Metals</p>	
<p>All learners should be able to:</p> <p>C10.1 Properties</p> <ul style="list-style-type: none"> - compare the general physical and chemical properties of metals with those of non-metals. 	

<p>C10.2 Reactivity series - place in order of reactivity: calcium, aluminium, copper, (hydrogen), iron, magnesium, potassium, sodium, zinc and gold by reference to their reactions, if any, with aqueous ions of other metals, reaction with water, steam and hydrochloric acid. - deduce an order of reactivity from a given set of experimental results.</p> <p>C10.3 Extraction of metals - describe the ease in obtaining metals from their ores by relating the elements to the reactivity series. - name metals that occur native including copper and gold. - name the main ores of aluminium, copper and iron. - describe the essential reactions in the extraction of iron.</p> <p>C10.4 Uses of metals - describe the idea of changing the properties of iron by the controlled addition of additives to form steel alloys. - name the uses of mild steel (car bodies, machinery) and stainless steel (chemical plant, cutlery) - name the uses of zinc for galvanizing and making brass. - name the uses related to copper (electrical wiring, cooking utensils) and of aluminium (aircraft food containers).</p>	<p>- account for the apparent unreactivity of aluminium in terms of the oxide layer adhering to the metal.</p> <p>- describe the environmental impact of the extraction of metals on land, plants, human beings and animals.</p>
<p>C11. Electricity and chemistry</p>	
<p>All learners should be able to:</p> <ul style="list-style-type: none"> - describe electrolysis - describe the electrode products formed in the electrolysis of copper chloride (aqueous solution) between inert electrodes (platinum or carbon). - state the general principle that metals or hydrogen are formed at the negative electrode and that oxygen or halogens are formed at the positive electrode. - describe in outline the manufacture of aluminium from pure aluminium oxide, and that chlorine and sodium hydroxide from concentrated aqueous sodium chloride (starting materials and essential conditions should be given). - describe the plating of metals. 	<ul style="list-style-type: none"> - describe the electrolysis of dilute sulphuric acid (as essentially the electrolysis of water). - describe electrolysis in terms of the ions present and reactions at the electrodes in examples given. - predict the likely products of the electrolysis of a specified binary compound in the molten state or in aqueous solution. - construct equations for the electrode reactions involved in the manufacture of aluminium, chlorine and sodium hydroxide.
<p>C12. Non-metals</p>	
<p>All learners should be able to:</p> <p>C12.1 Air - describe the variability of composition of air and common pollutants in air.</p>	

- name common pollutants in air as carbon monoxide, sulphur dioxide, oxides of nitrogen and lead compounds.
- list the sources of each of the pollutants: carbon monoxide (from incomplete combustion of carbon-containing compounds), sulphur dioxide (from the combustion of fossil fuels containing sulphur compounds leading to 'acid' rain), oxides of nitrogen and lead compounds from car exhausts.
- describe the catalytic removal of nitrogen oxides from car exhausts.
- state adverse effects of common pollutants on buildings, plants and health.

C12.2 Water

- describe and perform a chemical test for water using anhydrous copper (II) sulphate or cobalt (II) chloride.
- show understanding that hydration may be reversible e.g., by heating hydrated copper (II) sulphate or hydrated cobalt (II) chloride.
- distinguish between soft and hard water.
- distinguish between temporary hardness and permanent hardness.
- state advantages and disadvantages of hard water.
- describe how hard water can be made soft.
- describe in outline the purification of water in terms of filtration, sedimentation and chlorination.

C12.3 Hydrogen

- name the uses of hydrogen in the manufacture of ammonia, margarine (see C13 – Organic chemistry) and as a fuel in rockets.
- describe the preparation, collection and properties of hydrogen.

C12.4 Oxygen

- describe combustion of elements e.g., magnesium.
- state the uses of oxygen including use in oxygen tents, hospitals and with acetylene welding.
- describe, in simple terms, respiration, combustion and rusting.
- describe methods of rust prevention: paint and other coatings e.g., galvanizing to exclude oxygen.

C12.5 Carbon dioxide

- describe formation of carbon dioxide from: the complete combustion of carbon containing

- describe in simple terms the role of carbon dioxide and other polyatomic molecules in global warming.
- describe the roles of ozone in absorbing UV radiation and a low level pollutant.
- show understanding that CFCs can lead to the depletion of the ozone layer (limited to the idea that electromagnetic absorption by CFCs leads to decomposition of ozone, i.e., free-radical mechanism not required).

- describe formation of hydrogen as a product of electrolysis of water (see C11 – Electricity and chemistry).

<p>substances, as a product of respiration, as a product of the reaction between an acid and a carbonate.</p> <p>C12.6 Nitrogen - describe the need for nitrogen, phosphorus and potassium compounds in plant life. - name the uses of nitrogen in the manufacture of ammonia. - name the uses of ammonia in the manufacture of fertilisers e.g., ammonium sulphate, ammonium nitrate and in the manufacture of household detergents.</p> <p>C12.7 Carbon and carbonates - define allotropy as an existence of an element in two or more forms in the same physical state. - name the allotropes of carbon as graphite and diamond. - relate their structures to the use of graphite as a lubricant and in diamond cutting. - describe the manufacture of calcium oxide (quick lime) from calcium carbonate (limestone) in terms of the chemical reaction involved. - state some uses of lime and slaked lime in treating acidic soil and neutralising acidic industrial waste products. - state the uses of calcium carbonate in the manufacture of iron, glass and cement.</p>	<p>- describe the essential conditions for the manufacture of ammonia by the Haber process.</p>
<p>C13. Organic chemistry</p>	
<p>All learners should be able to:</p> <p>C13.1 Name of compounds - name, and draw the structure of methane, ethane, ethanol, ethanoic acid and the products of the reactions stated in C13.5 -C13.8 below. - state the type of compound present given a chemical name, ending in <i>-ane</i>, <i>-ene</i>, <i>-ol</i> or <i>-oic acid</i> or a molecular structure.</p> <p>C13.2 Fuels - name as fuels coal, natural gas and petroleum. - name methane as the main constituent of natural gas. - describe petroleum as a mixture of hydrocarbons and its separation into useful fractions by fractional distillation.</p> <p>C13.3 Uses of petroleum fractions - name the uses of the fractions: petrol in petrol engines, the paraffin fraction in oil stoves and aircraft fuel, the diesel fraction for fuel in diesel engines, the lubricating fraction for lubricants and making waxes and polishes, bitumen for making roads.</p> <p>C13.4 Homologous series - describe the homologous series as a 'family' of similar compounds with similar properties due to the presence of the same functional</p>	

SGCSE PHYSICAL SCIENCE Syllabus 6888
November 2009 and November 2010 Examinations

group.

- describe the general characteristics of a homologous series.

C13.5 Alkanes

- describe the properties of alkanes (exemplified by methane) as being generally unreactive, except in terms of burning.

C13.6 Alkenes

- describe the properties of alkenes in terms of addition reactions with bromine, hydrogen and steam.

- distinguish between saturated and unsaturated hydrocarbons from molecular structures and by simple chemical tests.

- describe the formation of poly(ethene) as an example of addition polymerisation of monomer units.

C13.7 Alcohols

- describe the formation of ethanol (and carbon dioxide) by fermentation and its importance to the wine and brewing industry.

- name the uses of ethanol as:

a solvent,

a fuel,

a constituent of wine and beer e.g., locally brewed beverages,

for sterilization.

C13.8 Acids

C13.9 Natural polymers

- describe the pollution problems caused by non-biodegradable plastics.

- describe the formation of ethanoic acid by the oxidation of ethanol, by the action of atmospheric oxygen.

- describe the reaction of ethanoic acid with ethanol to give an ester (ethyl ethanoate), a sweet-smelling compound.

- name proteins, (fats) and carbohydrates as the main constituents of food.

- describe proteins as possessing the same (amide linkages) as nylon, but with different units.

- describe the hydrolysis of proteins to amino acids (structures and names not required).

- describe the carbohydrate starch, as a macromolecule represented as:

