



PHYSICAL SCIENCES

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GRADE 12



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1. What is Physical Sciences?

ONE subject that combines Physics and Chemistry. It is written as two papers and reported as a single mark on the National Senior Certificate.

THE SUBJECT AT A GLANCE

What it is	ONE subject that combines Physics and Chemistry. It is written as two papers and reported as a single mark on the National Senior Certificate.
Paper 1 (Physics)	150 marks • 3 hours
Paper 2 (Chemistry)	150 marks • 3 hours
Year mark	School-based assessment (tests, examinations, the preliminary examination and formal practical investigations) counts 25% of the final promotion mark; the two final papers count 75%.
Compulsory partner subject	Mathematics. Mathematical Literacy is not accepted for Physical Sciences.
Where it leads	Engineering, medicine and health sciences, pharmacy, actuarial and computer science, geology, mining, chemistry, physics and the applied sciences.
Entry from another system	Grade 12 entry is possible with a strong Physics and Chemistry record. A bridging programme covers the Grade 11 work that this year assumes: vectors in two dimensions, VSEPR and molecular shape, intermolecular forces, and the Grade 11 electricity topics.

CONTENT COVERED IN GRADE 12

PAPER 1 — PHYSICS (150 marks)

MECHANICS • 65 marks

Newton's laws and universal gravitation	Different kinds of forces; static and kinetic friction; free-body diagrams; the three laws applied to single objects and two-body systems on horizontal and inclined planes and in the vertical plane; apparent weight; $F = Gm_1m_2/d^2$.
Momentum and impulse	Momentum as a vector; Newton's second law in terms of momentum; impulse and the impulse-momentum theorem; conservation of linear momentum in one dimension; elastic and inelastic collisions; safety applications such as airbags and electror beds.
Vertical projectile motion in one dimension	Free fall; the equations of motion applied to objects thrown upwards, thrown downwards and bouncing; position-time, velocity-time and acceleration-time graphs.
Work, energy and power	Work done by a constant force; the work-energy theorem on horizontal, vertical and inclined planes; conservative and non-conservative forces; conservation of mechanical energy; power and average power.

WAVES, SOUND AND LIGHT • 15 marks

Doppler effect	The Doppler effect with sound and ultrasound; calculations with a moving source or a moving listener; applications in medicine; red shifts and evidence for an expanding universe.
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ELECTRICITY AND MAGNETISM • 55 marks

Electrostatics	Coulomb's law for charges in one and two dimensions; the electric field and field patterns; electric field strength at a point due to a number of point charges.
Electric circuits	Ohm's law; series and parallel networks of up to four resistors; power and energy; the cost of electricity; emf, internal resistance and series-parallel networks.
Electrodynamics	Electrical machines; the AC and DC generator and the electric motor, their components, uses and energy conversions; alternating current, rms values and average power.

MATTER AND MATERIALS • 15 marks

Optical phenomena and properties of materials	The photo-electric effect; threshold frequency and work function; $E = W_0 + E_{k(max)}$; the effect of frequency and intensity; emission and absorption spectra and how they are formed.
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PAPER 2 — CHEMISTRY (150 marks)

MATTER AND MATERIALS • 58 marks

Organic molecules	Functional groups of the alkanes, alkenes, alkynes, haloalkanes, alcohols, aldehydes, ketones, carboxylic acids and esters; IUPAC naming and structural formulae; chain, positional and functional isomers.
Physical properties and structure	The relationship between boiling point, melting point and vapour pressure and the strength of intermolecular forces, the functional group, chain length and branching.
Organic reactions	Addition, elimination and substitution reactions; hydrohalogenation, halogenation, hydration and hydrogenation; dehydrohalogenation, dehydration and cracking; electrophilic; oxidation of alcohols; reaction conditions and major products.

CHEMICAL CHANGE • 92 marks

Representing chemical change	Balanced chemical equations, including the phases of reactants and products; interpreting equations in terms of the conservation of atoms and of mass.
Quantitative aspects of chemical change	The mole concept; molar mass and molar volume; concentration of solutions; volume relationships in gaseous reactions; stoichiometric calculations including limiting reagents, percentage yield and percentage purity.
Rate and extent of reaction	Reaction rate and the factors that affect it; the collision theory; measuring reaction rate; catalysts and the mechanism of catalysis; Maxwell-Boltzmann distribution curves.
Chemical equilibrium	Dynamic equilibrium; the equilibrium constant K_c and its calculation; Le Chatelier's principle applied to concentration, pressure, volume and temperature; interpreting and completing equilibrium graphs.
Acids and bases	Arrhenius and Lowry-Bronsted theories; strong and weak, concentrated and dilute; conjugate acid-base pairs; hydrolysis of salts; titrations, indicators and percentage purity; pH and K_w .
Electrochemical reactions	Oxidation and reduction; galvanic cells, their components and cell notation; standard electrode potentials and the standard hydrogen electrode; emf and spontaneity; electrolytic cells, electroplating, the refining of copper and the electrolysis of concentrated sodium chloride.



$$E = mc^2$$



Future
Scientists



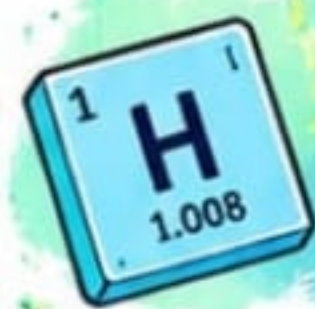
Chemistry
Change



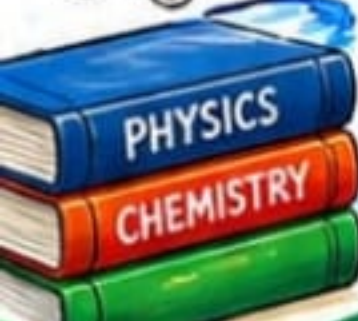
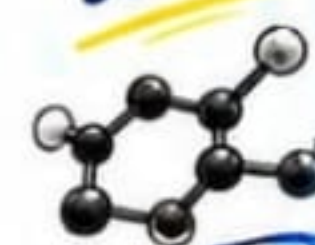
Think
Discover
Achieve



Small
steps
Biggy



Science
makes
sense



ROSEBANK PROGRESS COLLEGE
Cape Town

PHYSICAL SCIENCES

How the South African NSC compares with the Zambian and Cambridge systems

Prepared for families considering Grade 11 or Grade 12 entry

1. THE SINGLE BIGGEST DIFFERENCE

In Zambia and in the Cambridge system, Physics and Chemistry are two separate subjects, each with its own syllabus, its own examination and its own grade. In South Africa they are ONE subject, called Physical Sciences, written as two papers of 150 marks each and reported as a single mark on the National Senior Certificate.

This matters for subject choice. A learner who took Physics and Chemistry separately in Zambia will find that the two together now occupy only one of the seven subjects required for the NSC, which frees a slot for another subject. It also means a strong performance in one half cannot be recorded separately from a weaker performance in the other; the two papers are averaged into one result.

2. STRUCTURE OF THE ASSESSMENT

FEATURE	SOUTH AFRICA (NSC, CAPS)	ZAMBIA (ECZ) AND CAMBRIDGE
Subject structure	One subject: Physical Sciences (Physics + Chemistry).	Zambia: Physics and Chemistry are separate ECZ subjects. Cambridge: separate IGCSE syllabuses (0625 Physics, 0620 Chemistry), and separate A Levels (9702, 9701).
Final papers	Paper 1 Physics, 150 marks, 3 hours. Paper 2 Chemistry, 150 marks, 3 hours.	Zambia: historically three papers per subject: a multiple-choice paper, a structured theory paper and a practical paper. Cambridge IGCSE: a multiple-choice paper, a theory paper and a practical or alternative-to-practical paper.
Multiple choice	No separate multiple-choice paper. Each paper opens with ten multiple-choice questions worth 20 of the 150 marks.	Both systems usually set a whole paper of multiple-choice questions.
Practical examination	No practical examination. Prescribed experiments are assessed internally.	Zambia: a practical paper has historically been written under examination conditions. Cambridge: a practical paper, or an alternative-to-practical written paper.
Continuous assessment	School-based assessment counts 25% of the promotion mark; the final papers count 75%.	Zambia's revised O-Level syllabus introduces school-based assessment at 30%, with the national examination at 70%. Cambridge IGCSE and A Level are examined entirely at the end.
Materials supplied	A data sheet with constants and formulae, a periodic table and a table of standard electrode potentials are supplied in the examination.	Both systems supply a periodic table and selected data; formulae are more often expected to be known.
Reporting	Percentage, converted to levels 1 to 7 (level 4 and above is a pass level 5 and above is usually needed for university science).	Zambia: numeric grades 1 to 9, where 1 is the strongest. Cambridge: A* to G at IGCSE and A* to E at A Level.

3. WHAT WILL FEEL FAMILIAR

A learner arriving from the Zambian or Cambridge system has already met most of the underlying physics and chemistry. The following carries across almost directly:

AREA	ALREADY COVERED ELSEWHERE
Mechanics	Forces, Newton's three laws, friction, moments, work, energy and power, and momentum all appear in the ECZ and Cambridge syllabuses. The NSC treats free-body diagrams and inclined planes more formally, and adds the work-energy theorem as a named principle.
Electricity	Ohm's law, series and parallel circuits, power and energy, and the cost of electricity are common to all three systems. Internal resistance and emf are treated more heavily in the NSC than at IGCSE level.

4. WHAT WILL BE NEW

TOPIC	WHY IT IS NEW OR DIFFERENT
Waves and light	Reflection, refraction, Snell's law, total internal reflection and diffraction are shared. The NSC covers the Doppler effect in Grade 12, which Cambridge introduces at AS Level and which ECZ treats more briefly.
Chemical calculations	The mole, molar mass, molar volume, concentration, empirical and molecular formulae, limiting reagents and percentage yield are standard in all three.
Acids, bases and redox	Neutralisation, titrations, indicators, pH, oxidation numbers and redox reactions appear in all three systems; the NSC adds hydrolysis of salts and K_{sp} calculations in Grade 12.
Organic chemistry	Homologous series, functional groups and IUPAC naming are common ground. The NSC goes further on reaction types, conditions and major products than IGCSE does, and sits close to AS Level in this area.

5. WHAT IS NOT IN THE NSC COURSE

Learners moving from the Zambian or Cambridge syllabus may be surprised that the following do not appear in NSC Physical Sciences: thermal physics and heat capacity, nuclear physics and radioactivity, electronics and logic gates, the detailed treatment of the periodic table and group chemistry, and the extraction and properties of individual metals beyond the Grade 11 mining unit. Time that would have gone to these topics is spent instead on the depth of treatment in mechanics, equilibrium, electrochemistry and organic chemistry.

6. BRIDGING SUPPORT AT ROSEBANK PROGRESS COLLEGE

Grade 11 entry	Recommended where a learner has completed Grade 9 or the equivalent. The Grade 11 year covers the vector, bonding and gas-law foundations that Grade 12 assumes.
Grade 12 entry	Possible for a learner with a strong Physics and Chemistry record. A bridging programme covers work at an intermediate level: collision and bond calculations, intermediate A-levels and the A-Level.
Examination technique	Explicit teaching of the NSC marking conventions, formula, substitution, answer and unit: the data sheet; and the standard wording required for definitions and laws.
Mathematics	Physical Sciences dogmatically taken with Mathematics. Learners are placed after a mathematics assessment.

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Learn
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Same
Subject
Different
Systems

Future
Scientists

PHYSICS

CHEMISTRY

SCIENCE

New
Challenges
Same
Goal

Science
Builds a
Brighter
Future